July 2, 1968 S. F. BRAND 3,390,549

WARP KNITTED ELASTIC FABRIC AND METHOD OF MANUFACTURE

Filed July 11, 1966 2 Sheets-Sheet 1

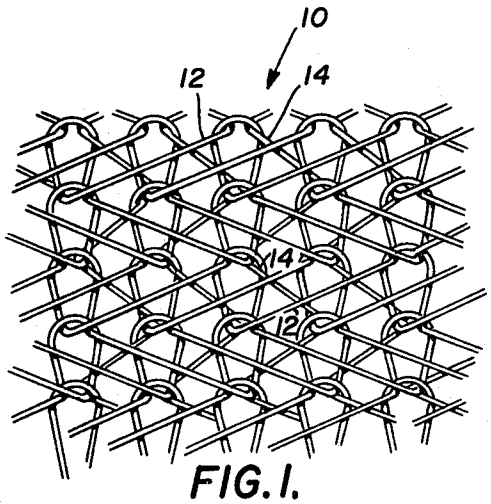

FIG. 1.

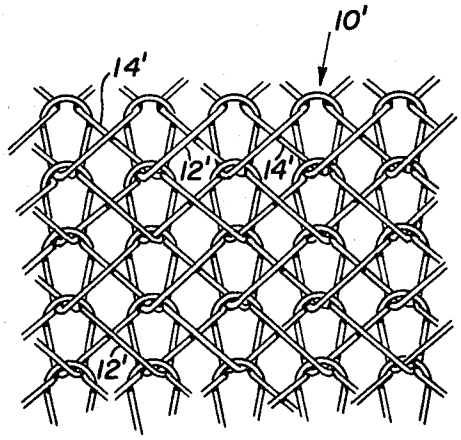

FIG. 2.

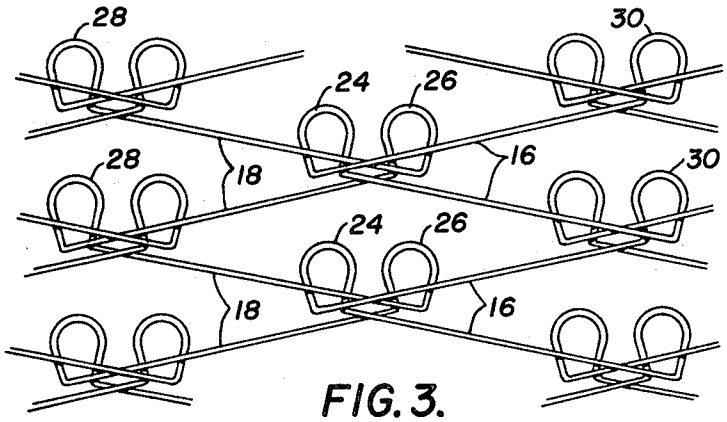

FIG. 3.

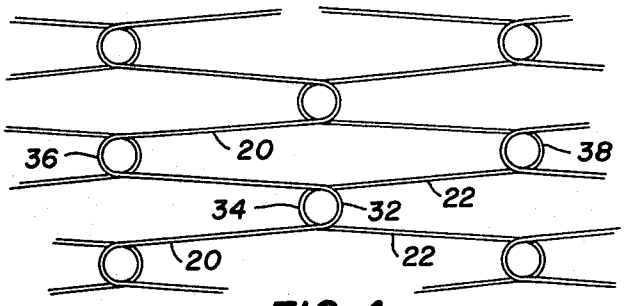

FIG. 4.

INVENTOR.
SIEGFRIED F. BRAND

BY George P Chandler
ATTORNEY

July 2, 1968 S. F. BRAND 3,390,549

WARP KNITTED ELASTIC FABRIC AND METHOD OF MANUFACTURE

Filed July 11, 1966 2 Sheets-Sheet 2

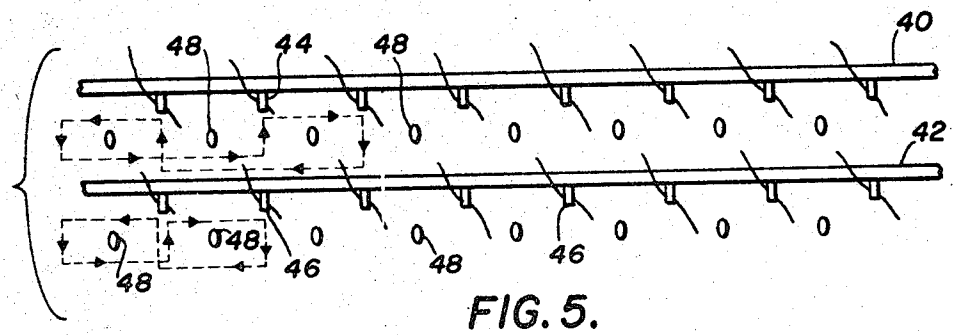

FIG. 5.

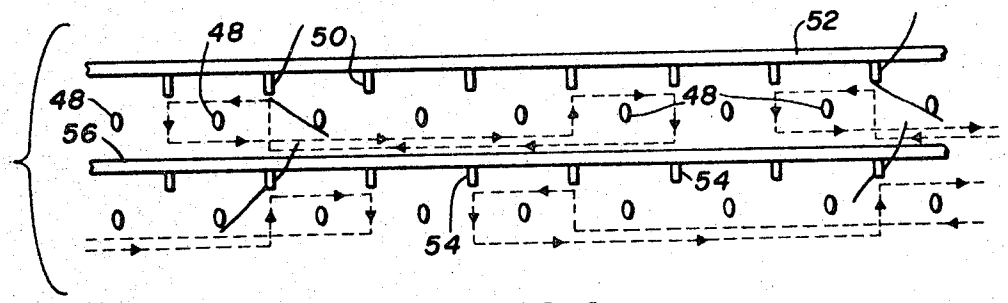

FIG. 6.

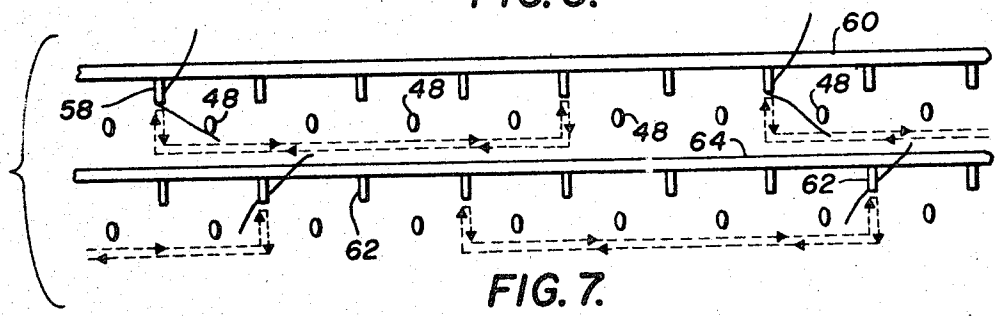

FIG. 7.

INVENTOR.
SIEGFRIED F. BRAND

BY George P Chandler
ATTORNEY

United States Patent Office 3,390,549 Patented July 2, 1968

3,390,549

WARP KNITTED ELASTIC FABRIC AND METHOD OF MANUFACTURE

Siegfried F. Brand, Yorktown Heights, N.Y., assignor to Monsanto Company, St. Louis, Mo., a corporation of Delaware

Filed July 11, 1966, Ser. No. 564,204
19 Claims. (Cl. 66—86)

This invention relates to knitted fabrics. More particularly, this invention relates to an improved fine-gauge warp knitted fabric into which elastomeric yarns have been introduced to obtain a two-way power stretch and to a method for the manufacture of such a fabric.

Warp knitted fabrics having elastomeric spandex type yarn have heretofore been used in limited quantities in the underwear and foundation field as well as swimwear and outerwear, but have failed to gain industry wide acceptance because of economic and technical problems. Generally, such fabrics are made on two-bar tricot knitting machines with a fully threaded back bar of spandex type yarn covered by a fully threaded front bar of a relatively non-elastic yarn, usually nylon. The stitch constructions used are mostly 1–0, 1–2 on the spandex bar, and either 1–2, 1–0 or 2–3, 1–0 for the non-elastic yarn.

The disadvantage of such an arrangement is that the proportional spandex content of the resultant fabric must be relatively high (generally in excess of 20 percent) depending on stitch and denier of the component yarns. Since the spandex yarn is much more expensive than the non-elastic yarn, the fabrics thus produced are costly. To lower this cost, fine denier spandex yarns are used to reduce the spandex content relative to the non-elastic fiber, but the much greater cost and lower strength of the finer yarn has a tendency to diminish or eliminate this disadvantage. The high cost tends to confine the use of these fabrics to the luxury rather than the utility trade, and thus severely limits their employment in underwear and foundation garment end uses, while keeping them almost entirely out of other applications where garments are cut from larger panels of fabric.

In addition, there are technical problems which arise with the use of spandex type yarns. These yarns have a tendency to turn dark after exposure to light and chemicals, thereby discoloring the fabrics in which they are present. The larger the content of spandex in the fabric the less it is covered by the non-elastic yarns, and the more noticeable the discoloration. Conversely, spandex yarns are difficult to dye to the same shade or intensity of the companion fiber, again causing a problem which can be alleviated by reducing the spandex content of such fabrics.

Another serious difficulty with two-bar elastic fabrics employing a full bar of spandex yarns is their tendency to edge-curling which is most apparent and awkward when the fabric has been cut into sections to be sewn into garments. These small pieces immediately tend to "scroll" up and have to be carefully unfurled just before they are fed into the sewing machine, causing a considerable loss in time, and an increase in waste and defective garments. Operators have to be specially trained for this; and, since sewing it is piece-rate operation, better paid to do it.

According to this invention a significant reduction in elastomeric yarn content without a proportional loss in modulus is accomplished by utilizing a four-bar tricot warp-knitting machine in which two bars, preferably those forming the face and back of the fabric and containing the yarns of the top beams, are made to knit a ground fabric using non-elastic yarns. Such constructions are generally knitted with fully threaded bars and may run 1–0, 2–3 in front and 1–2, 1–0 in back, or any other basic, high-stretch stitch.

The two other bars contain the elastomer ends and should be threaded only partially. The fewer the number of ends used, the lower the elastomer content will be and the higher the potential modulus. Threadings of one in three out, one in four out, one in five out, one in six out, one in seven out, one in eight out, one in nine out, and one in ten out; or variations and combinations of the above may be used. These threadings are used in both back bars, and the bars are moved in opposite directions while knitting, so as to deposit loops on the same or adjacent needles. Since only a fraction of a possible total number of power ends are present these must be moved until they meet or overlap; and in this manner elastomer ends are stretched between points to form a power lace-work which is structurally reduced to a minimum while functioning with maximum efficiency. Such efficiency is inherent in the relationship between the threading and stitch construction. The fewer the elastomer ends in the bars, the further they must be moved to meet or overlap, thus building up increased tension in the power loop which will, when relaxed, tend to contract the resulting fabric investing it with maximum modulus with a minimum of elastomer. Depending on threading and stitch relationship on one hand, and the relationship of deniers between stretch and non-elastic yarns on the other, the elastomer content of fabrics manufacured in accordance with this invention can drop below 10 percent while at the same time contributing to keeping the fabric light and powerful.

Accordingly, it is an object of this invention to produce a two-way stretch fabric having maximum power or modulus accomplished with a minimum utilization of elastomeric yarns.

Another object of this invention is to produce a stretch fabric having maximum power developed by overlapping elastomeric yarns in such a manner as to produce a plurality of opposite acting spring-like constructions incorporated in the fabric to take maximum advantage of the power of the elastomeric yarns.

Still another object of this invention is to form a fabric on a four bar tricot knitting machine having a plurality of elastomeric yarns incorporated therein with a number of said yarns omitted from the guide bars which operate in opposite directions to accomplish a fabric having a maximum modulus or power with a minimum spandex content.

A still further object of this invention is to produce a two-way stretch fabric on a four bar tricot warp knitting machine having elastomeric yarns fed into two bars with certain of said elastomeric ends omitted from the guides thereof and operated so as to produce an overlapping lace-like structure to produce maximum modulus with minimum elastomer content.

These and other objects and advantages of this invention will be more apparent upon reference to the following specification, appended claims and drawing wherein:

FIGURE 1 shows one example of a ground fabric which may be utilized in the instant invention;

FIGURE 2 shows a second example of a ground fabric which may be utilized with the instant invention;

FIGURE 3 illustrates one pattern of a pair of overlapping elastomeric yarns knit into the ground fabric;

FIGURE 4 illustrates a pattern in which the elastomeric yarns are laid into the ground fabric in overlapping relationship;

FIGURE 5 is a diagrammatic illustration showing the relationship between the bars and needles of a knitting machine in producing the fabric pattern illustrated in FIGURE 1;

FIGURE 6 is a diagrammatic illustration similar to FIGURE 5 illustrating the relationships between the bars and needles in producing the pattern of FIGURE 3; and

FIGURE 7 is a view similar to FIGURE 6 but showing the relationship required to produce the pattern illustrated in FIGURE 4.

The nomenclature, manner of designing tricot fabric, and methods of manufacturing them are well known to those skilled in the art. In this regard reference is made to the following books. "Tricot Fabric Design" by Thomas H. Johnson, first edition published in 1946 by McGraw-Hill Book Company, Inc.; "Warp Knit Engineering" by A. Reisfeld, published by National Knitted Outerwear Association, 51 Madison Avenue, New York, N.Y., 10010, May 1966; "Warp Knitting Technology" by D. F. Paling, published by Columbine Press, Old Colony House, South King Street, Manchester #2, England. It is, therefore, believed to be unnecessary to undertake a detailed explanation of the complicated subject of warp knitting tricot fabrics.

Examples of ground fabrics **10** and **10'** formed of relatively non-elastic yarns or warps are shown in FIGURES 1 and 2. These fabrics are formed on two bars of a four bar machine, preferably forming the front and back faces of the fabric. For purposes of clarity the elastomeric ends have been omitted from these views. The pattern in FIGURE 1 is produced on fully threaded bars and is 2–3, 1–0, with non-elastic yarn **12**; and 1–0, 1–2, with the non-elastic yarn **14**. The pattern of FIGURE 2 is also produced on fully threaded bars with a pattern of 1–2, 1–0 with non-elastic yarn **12**; a pattern of 1–0, 1–2 with non-elastic yarn **14'**. Many variations and combinations of the above-described patterns and other patterns may be utilized to produce ground fabric. These variations will be obvious to one skilled in the art depending on such factors as fabric density desired, end use, denier of yarns, and so forth. The major factor to be considered in designing the ground fabric pattern is that it be capable of producing a high-stretch fabric.

Two examples of the manner in which the elastomeric yarns are incorporated into the ground fabric are shown in FIGURES 3 and 4. These elastomeric yarns are incorporated into the ground fabric between the front and back faces; but, for purposes of clarity, the ground fabric has been omitted from these views. As shown in FIGURE 3, the elastomeric yarns **16** and **18** have been threaded into the other two bars of a four-bar knitting machine with both bars threaded one in and five out. The pattern of FIGURE 3 is 1–0, 4–5 on one end **16** and 4–5, 1–0 on the other end **18**. FIGURE 4 shows an example of a power inlay, again with both bars threaded one in and five out and a pattern of 0–0, 4–4 on one end **20** and a pattern of 4–4, 0–0 on the other end **22**.

As set forth above, an example of elastomeric yarns which are knitted into the fabric is shown in FIGURE 3. The pattern is arranged so that one of the elastomeric ends **16** is formed into what is generally termed a closed stitch **24** preferably corresponding to a stitch in the ground fabric while the other yarn **18** is formed into a stitch **26** preferably corresponding to an adjacent stitch in the ground fabric. The two bars containing the elastic ends are then moved in opposite directions behind and across the three needles before being formed into other stitches **28** and **30** on fourth needles. Thus, these particular ends each span 5 wales total of the ground fabric shown in FIGURES 1 and 2 counting the stitches on which the elastomeric yarn stitches are formed and assuming that a ground fabric stitch is formed on each needle of the knitting machine. Thus, these two ends **16** and **18** overlap between stitches **24** and **26**, and, as the pattern is repeated, a plurality of oppositely acting tension springs are formed in the fabric producing the requisite power or modulus as hereinbefore described.

Again many variations of the pattern shown in FIGURE 3 may be utilized to produce the desired result. For example, the bars may be threaded one in-four out, one in-five out, one in-six out, one in-seven out, one in-eight-out, one in-nine out, one in-ten out with stitches such as 1–0, 3–4; 1–0, 4–5; 1–0, 5–6; 1–0, 6–7; 1–0, 7–8; or other variations thereof such as 0–1, 4–3; 0–1, 5–4; 0–1, 6–5; 0–1, 7–6; 0–1, 8–7; and the like, in opposite directions. The preferred limits, for economic reasons and to produce the required modulus, appear to be a pattern which would have each elastic yarn spanning at least two but not more than six wales of a ground fabric. It is important that the elastomeric ends overlap either between adjacent stitches or somewhere between laterally spaced wale forming stitches.

The power inlay illustrated in FIGURE 4 is formed merely by incorporating both ends into the loop components of a ground fabric stitch. These ends, therefore, overlap on the same wale forming stitch of the ground fabric. This pattern is accomplished again, by threading two bars of a four bar knitting machine one in and five out. The pattern is 0–0, 4–4, on one end **20** and 4–4, 0–0 on the other end **22** is achieved by moving the bars in opposite directions before again feeding the ends into other stitches of the ground fabric. Overlapping loops **32** and **34** are formed in one stitch whereupon the bars are moved behind and across three needles in opposite directions before the ends are incorporated into other, spaced stitches. In this manner the yarn **20** forming loop **32** forms another loop **36**, and the yarn **22** forms another loop **38**, each yarn **20** and **22** spanning four total wales of the ground fabric shown in FIGURES 1 and 2. By repeating this pattern with other elastomeric yarns threaded in the above described manner to the two bars, a plurality of oppositely reacting tension springs are formed in the ground fabric.

Again, variations of this pattern may be utilized to accomplish the desired end result. The two bars may be threaded one in-four out, one in-five out, one in-six out, one in-seven out, one in-eight out, one in-nine out, one in-ten out, with inlays such as 0–0, 4–4; 0–0, 5–5; 0–0, 6–6; 0–0, 7–7; and so forth. The preferred practical range again appears to be a pattern such that not less than two wales nor more than six wales of the ground fabric are spanned by the elastomeric ends.

In no one illustration has the assembled fabric been represented. This is due to the fact that such would be more confusing than helpful. In each of the fabrics described above there are four distinct knitted layers. It would be extremely difficult to follow the course of individual ends through such a fabric. It is believed that the four illustrations accompanying this description are sufficient to picture this invention to one conversant in the art.

The type of non-elastic yarn and elastomeric yarn utilized can vary widely depending on the results desired. This is also true of choice of deniers and other yarn properties. Satisfactory results have been obtained utilizing a ground fabric of 40 denier nylon and an elastomeric portion formed with 70 denier Blue C spandex, a segmented polyurethane fiber produced by the Chemstrand Division of the Monsanto Company .

Using the pattern shown in FIGURES 1 and 4, the fabric was found to have a spandex content of 10 percent. Knitting spandex yarns into the pattern show in FIGURE 1 with the two spandex bars threaded one in-five out and a pattern of 1–0, 5–6 on one bar and 5–6, 1–0 on the other, the spandex content of the fabric was found to be 13 percent by weight.

While the elastic ends have been described as spanning five wales of the ground fabric utilizing the construction illustrated in FIGURE 3 and four wales of the ground fabric construction illustrated in FIGURE 4, it is obvious that if the pattern of the ground fabric differs from those shown in FIGURES 1 and 2 it is possible that the span, although of the same length, may cross fewer wales. For example, if both bars producing the ground

fabric are threaded so that one complete wale is omitted only four will be spanned by the construction shown in FIGURE 3 and only three by the construction illustrated in FIGURE 4. Thus, while the ground fabric pattern may vary considerably according to the desired end result, the modulus of power added by the elastic yarns will not be significantly affected.

The method by which the ground fabric of FIGURE 1 and the elastic structure of FIGURES 3 and 4 are produced is illustrated diagrammatically in FIGURES 5 through 7. In each of these figures two bars are shown as well as two sets of needles, but in reality the needles are common to each of the figures since, generally speaking, in warp knitting there is only one row of needles regardless of the number of guide bars utilized.

The fabric pattern shown in FIGURE 2 is produced by moving the bars **40** and **42** relative to one another in the manner indicated by the broken lines and arrows which trace the movement of the bar guides **44** and **46** on bars **40** and **42** respectively. It is seen that beginning at the point shown in FIGURE 5 the guide **44** moves in front of a needle **48**, between this needle and an adjacent needle, behind two needles, between adjacent pairs of needles, in front of another needle **48**, between adjacent pairs of needles, and returns to the starting point by passing behind two needles and between another adjacent pair of needles to form the stitch pattern. While this is occurring bar guide **46** moves in front of a needle **48**, between adjacent pairs of needles, behind a needle **48**, between adjacent pairs of needles, in front of a needle **48**, and returns to the starting point by moving between adjacent pairs of needles, behind one needle, and again between adjacent pairs of needles. This movement produces the stitch pattern 1–0, 1–2. Thus, as bars **40** and **42** perform their movements simultaneously the stitch pattern illustrated in FIGURE 1 is produced. In a like manner, the stitch pattern illustrated in FIGURE 2 is achieved by moving bars **40** and **42** in a similar manner. As is known in the art, the bar movements shown in FIGURE 5 will produce what are generally termed as closed stitches. It will also be obvious to one skilled in the art that this is merely a diagram and movement of the bar **40**, for example, will not produce stitches in the same course of the fabric but rather in adjacent courses. This latter statement is also true of FIGURE 6.

The manner in which the stitch pattern illustrated in FIGURE 3 is produced is indicated diagrammatically in FIGURE 6. There it is seen that guide **50** on one bar **52** participates in forming a stitch on one needle **48** whereupon it is moved behind three needles before forming a second stitch on another needle **48** before passing behind three needles to the starting point to enable a repetition of the pattern. While this is occurring bar guide **54** on bar **56** is participating in forming stitches adjacent to those formed by guide **50**. The pattern produced by the movements of bar **56** and the bar guide **54** is similar to that produced by guide **50** and bar **52** but it is being moved in the opposite direction to form the overlapping effect clearly indicated in FIGURE 3.

In FIGURE 7 the manner in which elastomeric ends **20** and **22** are inlaid in the ground fabric is illustrated. As clearly shown in this illustration the ends are merely moved through the ground fabric and entrapped therein under the influence of the movements of bar guide **58** on bar **60** and bar guide **62** on bar **64**. Again, bars **60** and **64** are moved in opposite directions and are arranged so that the elastic ends are incorporated into the same wale forming stitch. As explained before in conjunction with FIGURES 5 and 6, FIGURE 7 is a diagrammatic view and the loops formed individually by bars **50** and **64** are in adjacent courses rather than in the same course.

It will be apparent that by following the teaching of this invention a warp knitted fabric having high modulus or power with a minimum elastomeric yarn content may be produced. This result is accomplished by knitting in or laying in the spandex or other elastomeric type yarns in a manner such that they overlap and cross and are formed into a plurality of oppositely reacting tension springs incorporated into the fabric. Thus, throughout the fabric the elastic properties of the elastomeric yarn are utilized to their fullest extent.

This invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

I claim:

1. A knitted fabric comprising:
(a) a warp knitted ground fabric formed of relatively non-elastic yarn;
(b) at least two elastomeric ends separately incorporated in said ground fabric;
(c) said elastomeric ends partly overlapping one another and each spanning at least two of spaced wales of the ground fabric forming oppositely reacting tension springs thereby resulting in an elastic fabric having high power produced with a minimum percentage of elastomeric yarn.

2. A knitted fabric according to claim **1** wherein said elastomeric ends are inlaid in said ground fabric and overlap on the same wale forming stitch of said ground fabric.

3. A knitted fabric according to claim **2** wherein each of said elastomeric ends spans at least four distinct wales of said ground fabric.

4. A knitted fabric according to claim **3** wherein said ground fabric is tricot and is knit in a two bar pattern with ends fed to every needle from every guide.

5. A knitted fabric according to claim **1** wherein said elastomeric ends are knitted into said ground fabric.

6. A knitted fabric according to claim **5** wherein said elastomeric ends overlap between and are knitted in adjacent wale forming stitches of said ground fabric.

7. A knitted fabric according to claim **5** wherein each of said elastomeric ends spans at least five distinct wales of said ground fabric.

8. A knitted fabric according to claim **7** wherein said ground fabric is tricot and is knit in a two bar pattern with ends fed to every needle from every guide.

9. A knitted fabric comprising:
(a) a tricot warp knitted fabric formed in a two bar pattern with relatively non-elastic ends fed to every needle and forming fabric front and back faces;
(b) at least two elastomeric ends separately laid into said ground fabric between said front and back faces in a two bar pattern with said bars threaded one in and five out;
(c) each of said elastomeric yarns spanning four wales of said ground fabrics and overlapping on the same stitch of said ground fabric thereby forming oppositely reacting tension springs and resulting in an elastic fabric having high power produced with a minimum percentage of elastomeric.

10. A knitted fabric comprising:
(a) a tricot warp knitted fabric formed in a two bar pattern with relatively non-elastic ends fed to every needle and forming fabric front and back faces;
(b) at least two elastomeric ends separately knitted into said ground fabric between said front and back faces in a two bar pattern with said ends threaded one in and five out on both of said bars;
(c) each of said elastomeric ends spanning five distinct wales of said ground fabric and overlapping between and knit in adjacent wale stitches of said ground fabric thereby forming oppositely reacting tension springs and resulting in an elastic fabric hav-

ing high power produced with a minimum percentage of elastomeric yarn.

11. The method of manufacturing a knitted fabric comprising the steps of:

(a) feeding relatively non-elastic ends to a plurality of needles on a multi-bar warp knitting machine.

(b) forming said non-elastic ends into a warp knitted ground fabric;

(c) feeding elastomeric ends to spaced guides of at least two bars of said multi-bar warp knitting machine;

(d) feeding said elastomeric ends from each of said bars to spaced needles of said knitting machine, and incorporating said ends into said ground fabric with ends from separate of said bars overlapping at a first point on said ground fabric;

(e) moving said bars to which said elastomeric ends are fed in opposite directions passing said ends across a plurality of said needles of said knitting machine to spaced, second points on said ground fabric; and

(f) incorporating said elastomeric ends into said ground fabric at said second points on said ground fabric thereby forming oppositely reacting tensioning springs in said ground fabric resulting in an elastic fabric having high power produced with a minimum percent by weight of elastomeric yarn.

12. The method of forming a knitted fabric according to claim 11 wherein said ground fabric is knit in a two bar pattern forming front and back faces and said elastomeric ends are incorporated into said ground fabric between said faces.

13. The method of manufacturing a knitted fabric comprising the steps of:

(a) feeding relatively non-elastic ends to a plurality of needles on a multi-bar warp knitting machine;

(b) forming said non-elastic ends into a warp knitted ground fabric;

(c) feeding elastomeric ends to spaced guides of at least two bars of said multi-bar warp knitting machine;

(d) feeding said elastomeric ends from each of said bars to spaced needles of said knitting machine and knitting said elastomeric ends into said ground fabric with ends from separate bars overlapping at a first point on said ground fabric;

(e) moving said bars to which said elastomeric ends are fed in opposite directions passing said ends across a plurality of said needles of said knitting machine to spaced second points on said ground fabric; and

(f) knitting said elastomeric ends into said ground fabric at said second points on said ground fabric thereby forming oppositely reacting tension springs in said ground fabric resulting in an elastic fabric having high power produced with a minimum percent by weight of elastomeric yarn.

14. The method of manufacturing a knitted fabric according to claim 13 wherein:

(a) said elastomeric ends are incorporated into said fabric by feeding said ends from separate bars to adjacent needles of said knitting machine and forming said ends into closed stitches;

(b) overlapping said elastomeric ends between said closed stitches formed on said adjacent needles.

15. The method of manufacturing a knitted fabric according to claim 14 wherein:

(a) said non-elastic ends are fed to each of a plurality of immediately adjacent guides on two bars of said multi-bar warp knitting machine; and

(b) said non-elastic ends are fed from said guides of said bars to the needles of said knitting machine so that each of a plurality of immediately adjacent needles of said knitting machine is producing a wale forming closed stitch with yarn fed from at least one

of said bars thereby forming the front and back faces of said fabric.

16. The method of manufacturing a knitted fabric according to claim 15 wherein:

(a) said elastomeric ends are knit into said fabric between said fabric front and back faces; and

(b) said elastomeric ends are fed to guides on each of said bar seperated from one another by a plurality of guides to which no ends are fed; and

(c) said ends from individual bars are fed to needles of said knitting machine separated from one another by a plurality of needles.

17. The method of manufacturing a knitted fabric comprising the steps of:

(a) feeding relatively non-elastic ends to a plurality of needles of a multi-bar warp knitting machine;

(b) fashioning said non-elastic ends into a plurality of stitches forming a warp knitted ground fabric;

(c) feeding elastomeric ends to spaced guides of each of at least two bars of said multi-bar warp knitting machine;

(d) feeding said elastomeric ends from said bars into a first selected ground fabric stitch and incorporating said elastomeric ends into said fabric by entrapping them in said stitch in overlapping relationship;

(e) moving said bars to which said elastomeric yarns are fed in opposite directions to pass said yarns across a plurality of said knitting machine needles; and

(f) feeding said elastomeric ends into second, selected ground fabric stitches spaced from said first stitch by entrapping said ends therein resulting in oppositely reacting tension springs in said ground fabric and producing an elastomeric fabric having high power with a minimum percent by weight of elastomeric yarn.

18. The method of manufacturing knitted fabric according to claim 17 wherein:

(a) said non-elastic ends are fed to each of a plurality of immediately adjacent guides on two bars of said multi-bar warp knitting machines; and

(b) said non-elastic ends are fed from said guides on said bars to the needles of said knitting machine to form the front and back faces of said fabric so that each of a plurality of immediately adjacent needles of said knitting machine is producing a wale forming closed stitch with ends fed from at least one of said bars.

19. The method of manufacturing a knitted fabric according to claim 18 wherein:

(a) said elastomeric ends are inlaid into said fabric between said fabric front and back faces; and

(b) said elastomeric ends are fed to guides on each of said bars separated from one another by a plurality of guides to which no ends are fed; and

(c) said ends from individual bars are fed to needles of said knitting machine separated from one another by a plurality of needles.

References Cited

UNITED STATES PATENTS

2,029,880	2/1936	Lindley	66—192
2,149,031	2/1939	Schonfeld	66—192 XR
2,149,032	2/1939	Schonfeld	66—192 XR
2,153,645	4/1939	Schonfeld	66—192
2,652,705	9/1953	Weinberg	66—193
2,996,906	8/1961	Ichibe	65—195
3,069,885	12/1962	Cooper et al.	66—195

MERVIN STEIN, *Primary Examiner.*

R. FELDBAUM, *Assistant Examiner.*