March 3, 1936. C. E. DRUMHELLER 2,033,096

PLAIN KNITTED FABRIC CONTAINING RUBBER-LIKE STRANDS

Filed Jan. 19, 1934 4 Sheets-Sheet 1

Fig. 1.

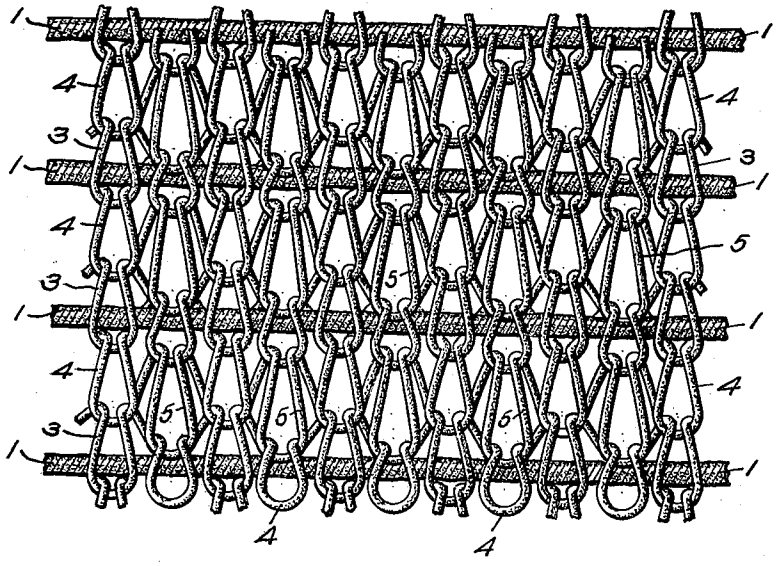
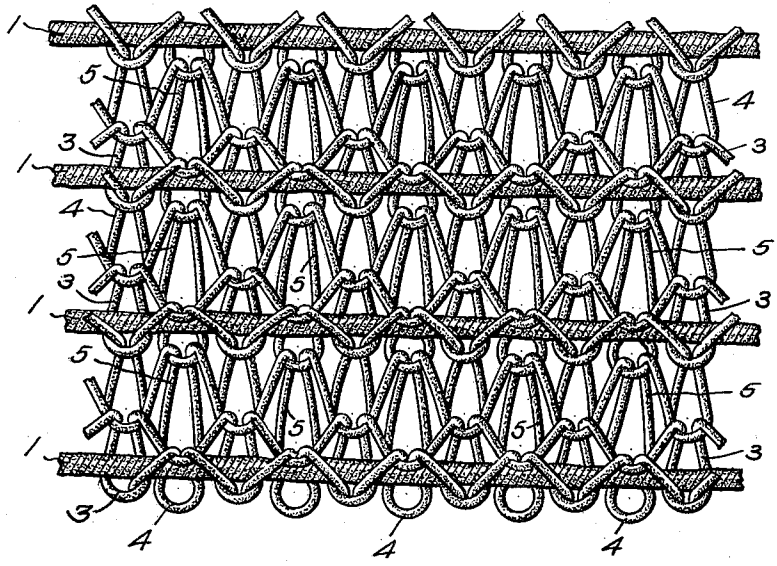


Fig. 2.



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Filed Jan. 19, 1934 4 Sheets-Sheet 2

Fig. 3.

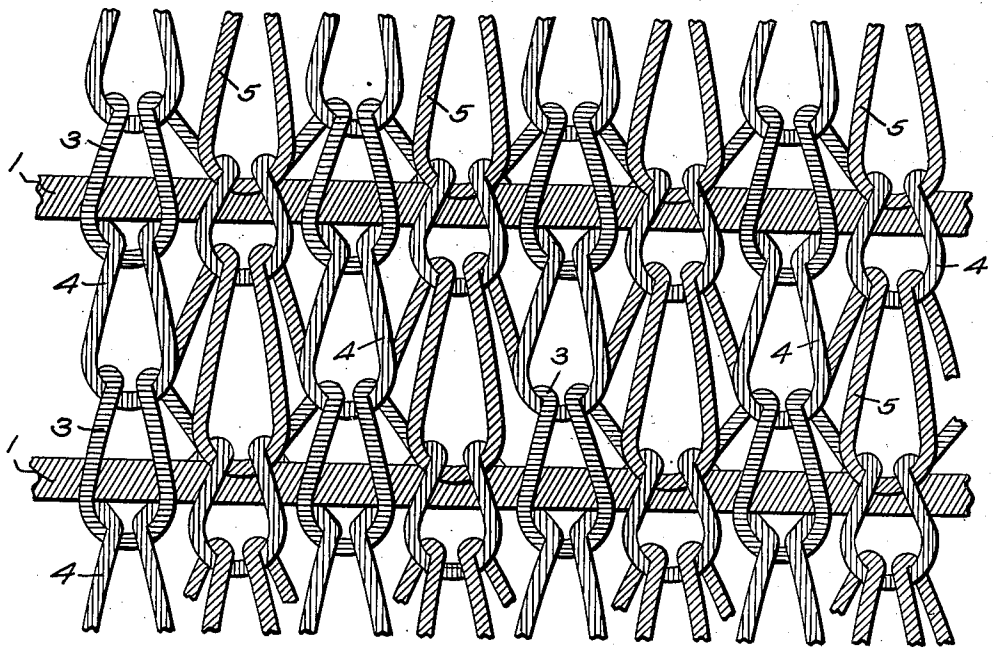


Fig. 4.

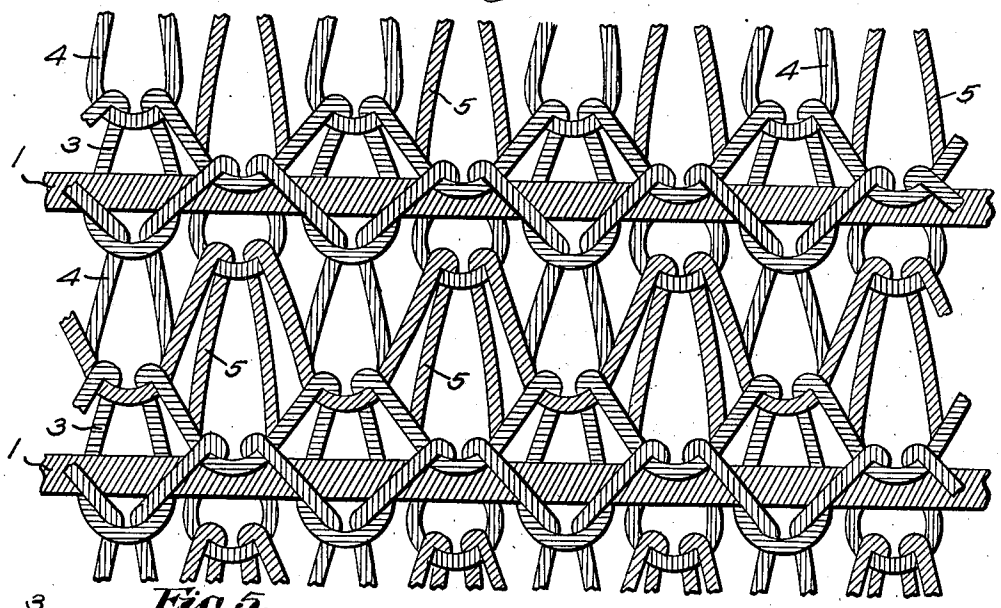
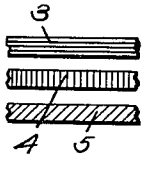


Fig. 5.



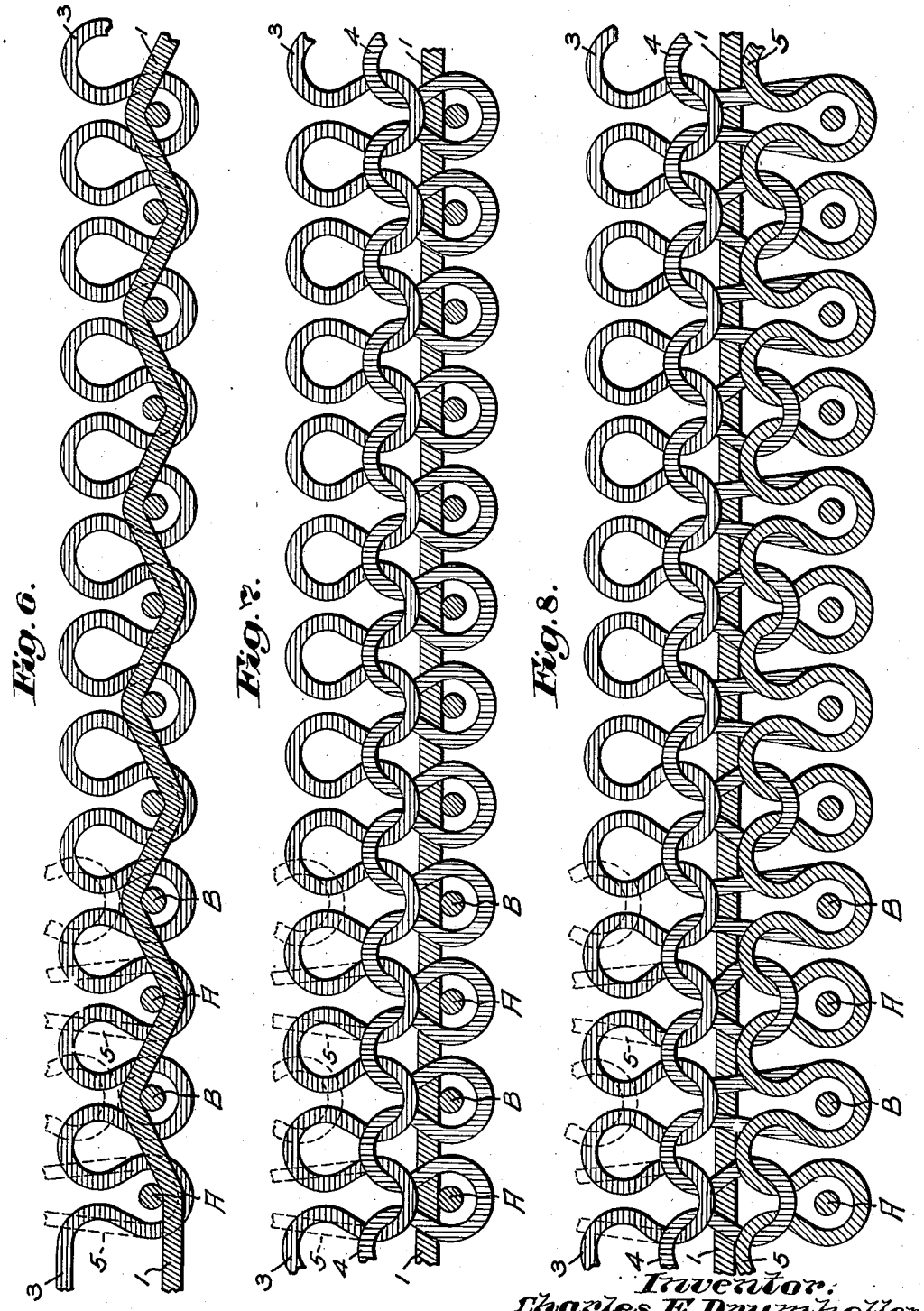
YARN-1ST. FEED.
YARN-2ND. FEED.
YARN-3RD. FEED.

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PLAIN KNITTED FABRIC CONTAINING RUBBER-LIKE STRANDS

Filed Jan. 19, 1934 4 Sheets-Sheet 3



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Filed Jan. 19, 1934 4 Sheets-Sheet 4

Fig. 9.

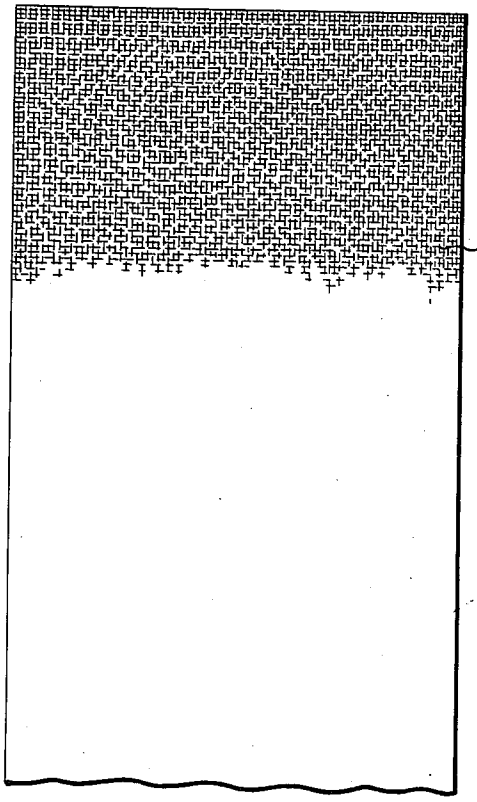


Fig. 10.

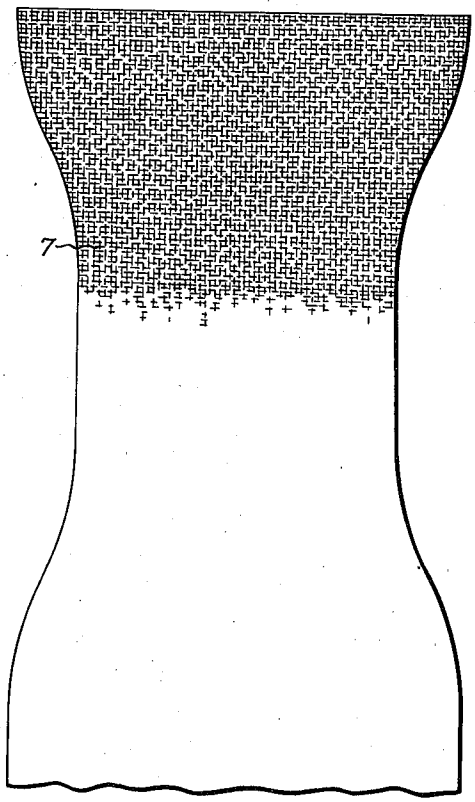
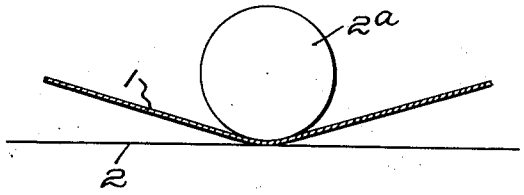


Fig. 11.



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UNITED STATES PATENT OFFICE

2,033,096

PLAIN KNITTED FABRIC CONTAINING RUBBER-LIKE STRANDS

Charles E. Drumheller, Springfield, Mass., assignor to The William Carter Company, Needham Heights, Mass., a corporation of Massachusetts

Application January 19, 1934, Serial No. 707,262½

4 Claims. (Cl. 66—190)

This invention relates to plain knitted fabrics containing rubber-like strands, being for the fabric the machine for making which is disclosed and claimed in my co-pending application Ser. No. 707,261. In order that the principle of the invention may be readily understood I have disclosed in the accompanying drawings one form or embodiment of the fabric of my invention.

In said drawings,—

Fig. 1 is an inside or front face elevation of a completed portion of the fabric much enlarged, namely, a view of the fabric after it has passed the first, second and third feeds a series of times;

Fig. 2 is a similar view of the opposite face of the fabric;

Figs. 3 and 4 are views corresponding to Figs. 1 and 2 respectively but enlarged thereover and wherein the yarn or thread at each of the first, second and third feeds and the rubber-like strand are all contrastingly designated or hatched;

Fig. 5 is a chart indicating the contrasting yarns or threads at the first, second and third feeds;

Figs. 6, 7, and 8 are somewhat diagrammatic representations of the yarns or threads and the rubber-like strand of the first, the second and the third feeds respectively;

Fig. 9 is a diagrammatic representation of the fabric of my invention when knitted as a tube of uniform diameter;

Fig. 10 is a similar view of the fabric of my invention when knitted as a tube of varying diameter, the tube being shaped by controlling the tension of the rubber-like strand; and

Fig. 11 is a diagrammatic detail to indicate the act of tensioning the rubber-like strand.

The fabric of my invention is a plain knit fabric as contrasted with a rib fabric. By "plain" fabric I mean one knitted by a single series or set of needles. While said fabric may be knitted either as a straight or as a tubular fabric, I prefer to knit the same as a tubular or circular fabric and preferably upon a machine having spring beard needles.

An important purpose of my invention is to introduce a rubber-like strand into a plain knitted fabric so that the same is incorporated thereinto at all the stitches of the fabric and does not lie loosely upon the surface of the fabric anywhere. While my invention is not restricted to the introduction of any particular rubber-like strand, I have obtained the best results by employing a rubber-like strand known commercially as "Lastex" and which consists of a core of unvulcanized material, such, for example, as rubber juice suitably coagulated in water and then wrapped with a very fine covering of silk or other suitable material, the composite strand being of very fine diameter.

The fabric of my invention may be knitted upon a circular knitting machine having a plurality of feeds but modified so as to enable the machine to receive the rubber-like strand and to knit the same into the fabric in such a manner as to incorporate it in the very substance of the fabric, so that said strand does not lie upon the surface anywhere. The fabric is thereby rendered expansible both transversely and lengthwise, though not to the same extent lengthwise as is the fabric disclosed in my co-pending application Ser. No. 707,260.

I prefer to knit the fabric upon a circular machine of the general Wildman type but modified as disclosed in my co-pending application Ser. No. 707,261.

An important feature of my invention is the varying of the stitch structure as, for example, by employing tuck stitches persistently and as herein shown in alternate courses on one group of needles and in the intervening courses on the other group of needles, it being observed that alternate needles, which I will term the A needles, constitute one of said groups and that the remaining needles, which I will term the B needles, constitute the other group. By employing tuck stitches for stitch variation I am enabled to incorporate the rubber-like strands into the very substance of the plain knit fabric, and in such a way that it does not lie upon the surface thereof anywhere.

The said rubber-like strand is laid in the fabric in a straight condition and not in corrugated or wavy condition, as disclosed in my co-pending application Ser. No. 707,259. Assuming that the machine is provided with three feeds, the rubber-like strand is introduced at the first of said feeds only. Said strand is introduced under constant tension control so that the article may be shaped as desired during the knitting operation. Thus the tubular fabric may be either of uniform diameter throughout or of a tapering character, or the fabric may be irregularly shaped with contrasted and enlarged zones wherever desired.

I use the term "tuck stitches" in the broadest sense warranted by the prior art.

The rubber-like strand is indicated generally at 1, it being understood that the same is preferably "Lastex", consisting of a core and a covering, but my invention is not limited thereto. As said strand is introduced to the needles of the

machine at the first feed thereof, it is subjected to a constant tension which may be varied at any and all times during the feeding operation. This may be done by the mechanism shown in my said co-pending application Ser. No. 707,261. I have in Fig. 11 sufficiently indicated a constantly driven disk 2 and a roller 2a which may be moved toward and from the axis of rotation of said disk so as to vary the rate of feed and the tension upon the rubber-like strand 1 fed therebetween. In order to cause the A and B needles to function as two groups, I provide them with butts of different lengths, preferably providing the A needles with short butts and the B needles with long butts. I also provide individual pressers for the needles, so that at each and every needle I may form a plain stitch or a tuck stitch, according to the action of the pressers upon the needles. The differentiated construction of the pressers is disclosed in my said copending application Ser. No. 707,261, and reference may be made to that application for a full disclosure of the means for knitting the fabric.

The non-rubber threads are equal in number to the number of feeds of the machine which in the present example of my invention are three. The said three yarns, which are introduced at the first, the second and the third feeds respectively, are represented at 3, 4, 5 in the several figures, including the chart Fig. 5. In Figs. 3 and 4 they are shown as differentially hatched and the same is true of the diagrammatic illustrations in Figs. 6, 7, 8. The said non-rubber threads may be of silk or other suitable material, as, for example, cotton or rayon.

In order that it may be understood how the fabric is knitted, it is pointed out that at the first feed of the machine where the non-rubber yarn or thread 3 and the rubber-like strand 1 are both introduced, the A needles remain elevated and the B needles are drawn down in customary manner. Said thread 3 is therefore engaged only by the beards of the B needles, said thread being taken at about the usual point in the descent of the said B needles. The beard of each B needle as it is descending is closed before the point of the beards reaches the rubber-like strand 1. The strand of the non-rubber or silk thread 3 is later cast off (namely, at feed No. II) without the said rubber-like strand 1 being knitted into the loops or stitches of the said silk thread 3. The sinkers of the machine, however, indent, kink or corrugate both said threads 1 and 3 at all the needles and thereby very exactly measure the loops that are to be formed. Such action upon the rubber-like strands 1 is not such as to cause the said strands to lie in loops or corrugations in the completed fabric but merely enough to cause said strands to lie respectively at the back or shank side of the B needles and the front or hook side of the A needles in the knitting operation. In the completed fabric the strands 1 lie straight as shown in Figs. 1 and 2. No rubber-like strand is introduced at feed No. II but both the A and the B needles are drawn down together and therefore they all knit at said second feed Desirably the stitches formed or partly formed at the first feed are cast off at the second feed; those formed or partly formed at the second feed are cast off at the third feed; and those formed or partly formed at the third feed are cast off at the first feed.

As already stated, at the first feed all the B needles take a loop of thread 3 but the rubber-like strand 1 lies at the back or shank side of the said B needles. Neither the regular knitting thread 3 nor the rubber-like strand 1 is taken into the hooks of the A needles at the first feed but both threads 1 and 3 are properly measured at all the needles.

At the second feed, both the A and the B needles are pressed off because all the needles are drawn down at the second feed. At the first feed, the rubber-like strand 1 lies outside all the A needles (namely, at the side of said needles next the observer), as clearly shown in the diagram, Fig. 6, and said rubber-like strand 1 lies at the back of all the B needles at the said first feed, as shown by said diagram.

What occurs at feed No. II is repeated at feed No. III, excepting that at feed No. II the beards of both the A and B needles are pressed, whereas at feed No. III only the A needles are pressed.

Referring next to the diagrammatic Figures 6, 7, 8, the silk or other usual non-rubber thread is represented at 3 and the rubber-like strand at 1, and the hatching there employed is the same as that used in Figs. 3 and 4. In said diagram, Fig. 6, are represented twelve consecutive needles beginning at the left with an A needle, following by a B needle, etc. It will be understood that there is only a single rubber-like strand 1 introduced in a total or three feeds, whereas there are three silk or other non-rubber threads 3, 4, 5, introduced in a total of said three feeds.

In Fig. 6, the hook side of the needles is toward the observer and this is true of Figs. 7 and 8. In dotted lines in Fig. 6 is shown a previous part of the structure of the fabric, and the same is true of Figs. 7 and 8. In each of Figs. 6, 7, and 8, I have designated the silk or other non-rubber threads which are introduced at feeds No. I, No. II and No. III. In Fig. 7, I have designated the silk or other non-rubber thread introduced at feed No. II as 4, and in Fig. 8 I have designated the silk or other non-rubber thread introduced at the third feed as 5.

In the disclosure in my previous application Ser. No. 707,259, tuck stitches are formed at the A needles. In the operation of the machine by which the fabric shown in this application is made, tuck stitches are formed on all the A needles in every third course only, or, in other words, on the first of each group of three courses, and tuck stitches are formed on the B needles in every third course only, being a course which is the second course following that in which the tuck stitches are formed on the A needles. However, my invention is not limited to this particular arrangement or effect. This effect is brought about by the arrangement of the particular pressers and their action at the three feeds. Reference to Fig. 8 discloses the formation of tuck stitches at feed No. III on the B needles and a reference to the dotted lines in Fig. 6 discloses the formation of tuck stitches on the A needles. The tuck stitch formation of the completed fabric is clearly illustrated in Figs. 1, 2, 3, and 4.

The rubber-like strand 1 is not, as in my application Ser. No. 707,259, laid in a sinuous path but is laid in an entirely straight path constituting a spiral around the fabric. Owing to the persistent formation of tuck stitch variations herein shown as tuck stitches, the rubber-like strand 1 is incorporated into the structure of the plain knit fabric, so that the silk or other like non-rubber threads lie as to portions of their loops, at both faces of the fabric, and the rubber-like strand 1 does not anywhere lie at the outer face of the fabric, nor is it anywhere floated.

The fabric herein disclosed is a plain knit fabric having non-rubber knitted threads and rubber-like strands and is more expansible in directions transverse to the wales than a knitted fabric devoid of rubber-like strands; each needle wale of the fabric has stitch variations occurring persistently therein throughout the fabric; each needle wale has normal loops between the stitch variations of that wale; the said fabric has one or more rubber-like strands positioned coursewise thereof and entirely incorporated into the substance of the fabric throughout at each wale; bights of loops of needle wales lie wholly at one side of said strands and bights of the sinker loops lie wholly at the other side of said strands in those courses wherein said strands are incorporated into the fabric.

The completed fabric, knitted with an unvarying tension, is shown at 6 in Fig. 9 and the completed fabric knitted by a varying tension is shown at 7 in Fig. 10. The shape of the fabric may be varied as desired, by varying the tension upon the rubber-like strand 1.

Having thus described one illustrative embodiment of my invention, it is to be understood that although specific terms are employed, they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims:

I claim:

1. A plain-knit fabric having non-rubber knitted threads and rubber-like strands and being more expansible in directions transverse to the wales than a knitted fabric devoid of rubber-like strands, each needle wale of the fabric having stitch variations occurring persistently therein throughout the fabric, each needle wale having normal loops between the stitch variations of that wale, said fabric having one or more rubber-like strands positioned course-wise thereof, and entirely incorporated into the substance of the fabric throughout at each wale, bights of, loops of needle wales lying wholly at one side of said strands and bights of sinker loops lying wholly at the other side of said strands, in those courses wherein said strands are incorporated into the fabric.

2. A plain-knit fabric having non-rubber knitted threads and rubber-like strands and being more expansible in directions transverse to the wales than a knitted fabric devoid of rubber-like strands, each needle wale of the fabric having tuck stitches occurring persistently therein throughout the fabric, each needle wale having normal loops between the tuck stitches of that wale, said fabric having one or more rubber-like strands positioned course-wise thereof, and entirely incorporated into the substance of the fabric throughout at each wale, bights of, loops of needle wales lying wholly at one side of said strands and bights of sinker loops lying wholly at the other side of said strands, in those courses wherein said strands are incorporated into the fabric.

3. A plain-knit fabric having non-rubber knitted threads and rubber-like strands and being more expansible in directions transverse to the wales than a knitted fabric devoid of rubber-like strands, each needle wale of the fabric having stitch variations occurring persistently therein throughout the fabric, each needle wale having normal loops between the stitch variations of that wale, said fabric having one or more rubber-like strands positioned course-wise thereof, and entirely incorporated into the substance of the fabric throughout at each wale, bights of, loops of needle wales lying wholly at one side of said strands and bights of sinker loops lying wholly at the other side of said strands, in those courses wherein said strands are incorporated into the fabric, said rubber-like strands being under differentiated tension at different portions thereof, whereby said fabric is shaped.

4. A plain-knit fabric having non-rubber knitted threads and rubber-like strands and being more expansible in directions transverse to the wales than a knitted fabric devoid of rubber-like strands, each needle wale of the fabric having tuck stitches occurring persistently therein throughout the fabric, each needle wale having normal loops between the tuck stitches of that wale, said fabric having one or more rubber-like strands positioned course-wise thereof, and entirely incorporated into the substance of the fabric throughout at each wale, bights of, loops of needle wales lying wholly at one side of said strands and bights of sinker loops lying wholly at the other side of the said strands, in those courses wherein said strands are incorporated into the fabric, said rubber-like strands being under differentiated tension at different portions thereof, whereby said fabric is shaped.

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