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C. A. CRIMMINS

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ELASTIC RIB KNITTED FABRIC

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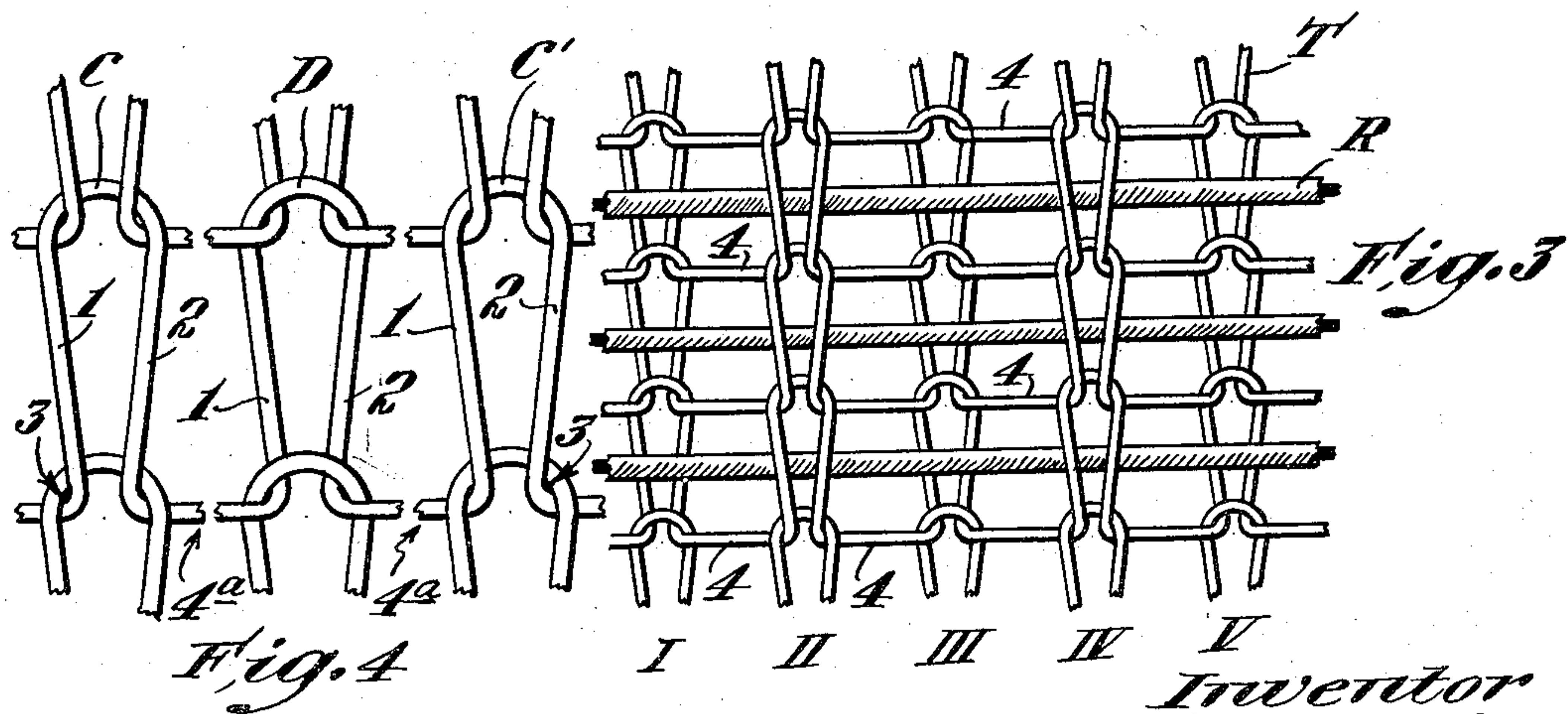
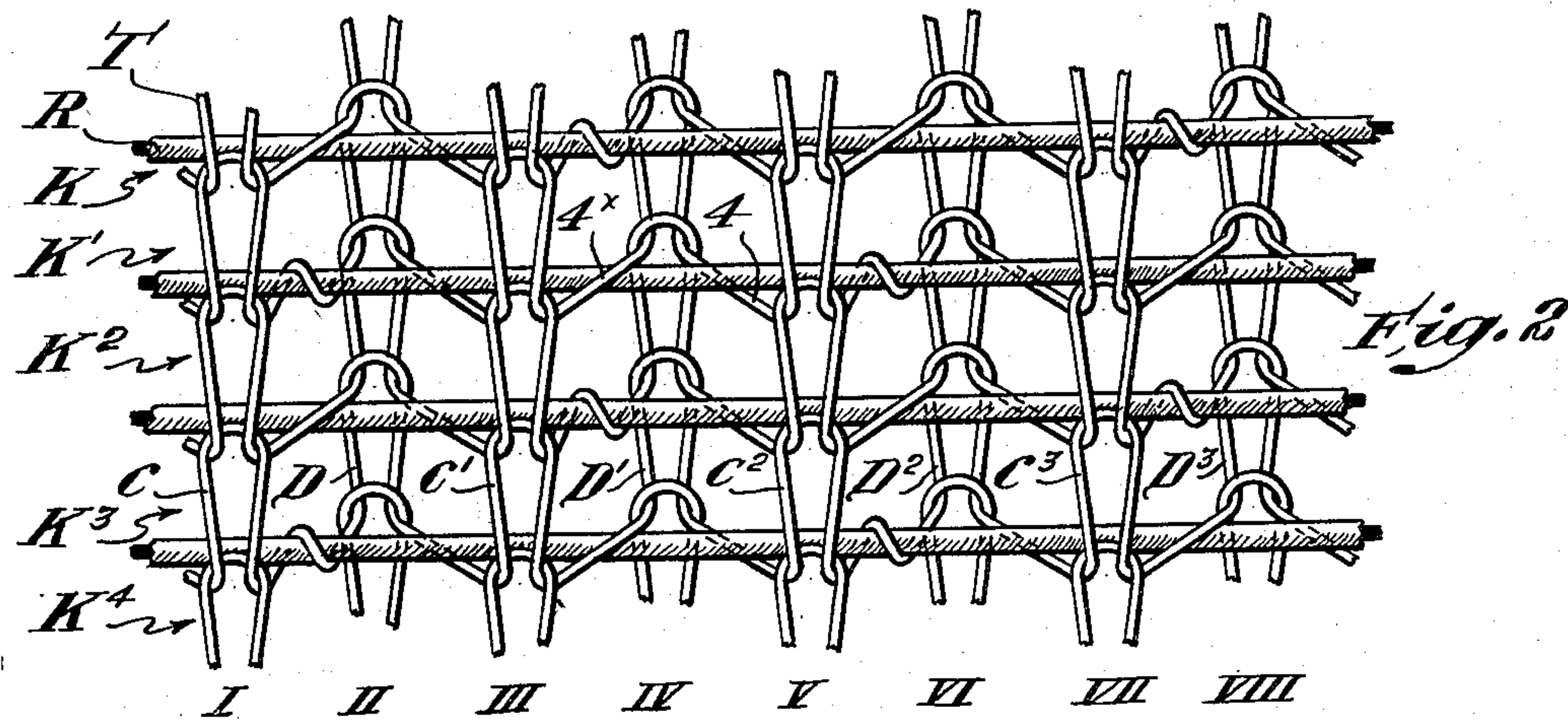
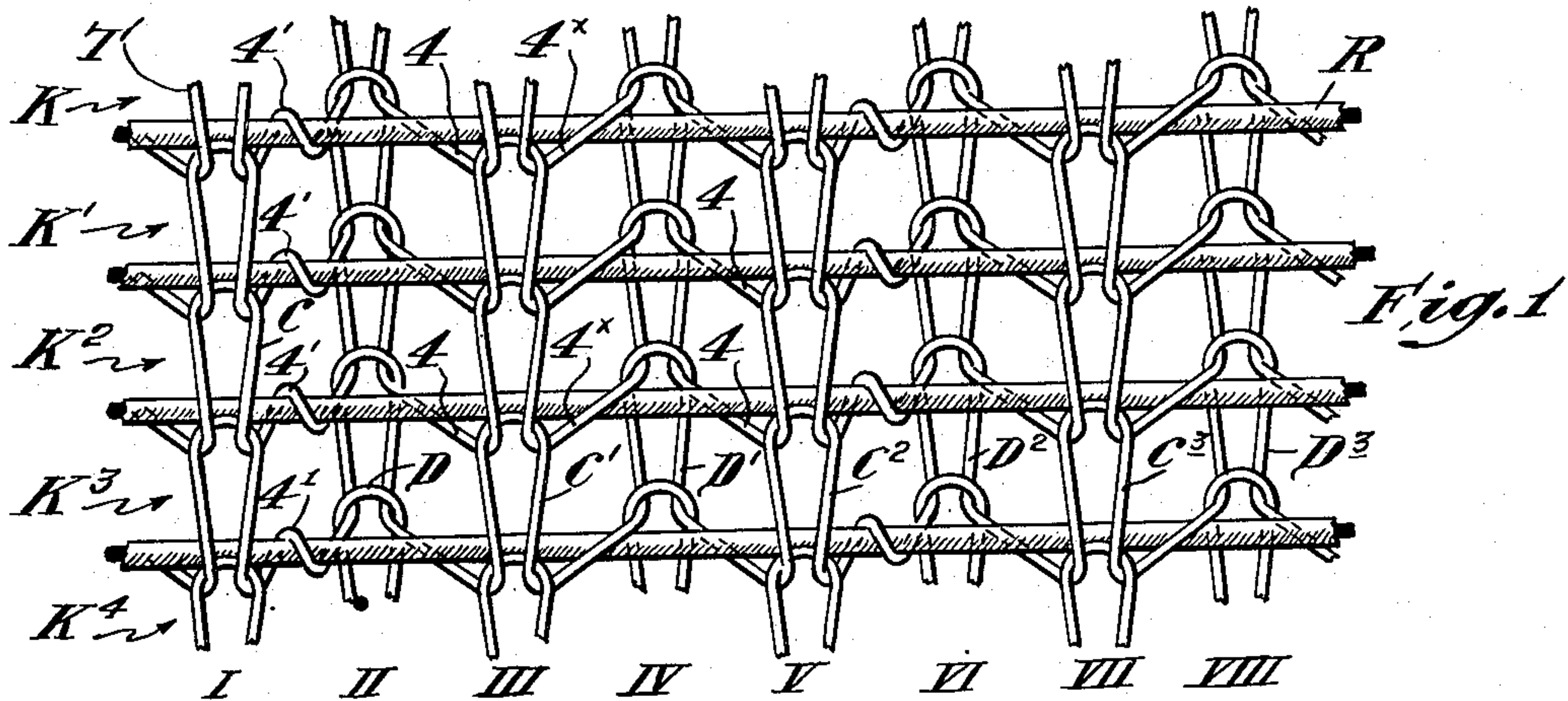


Fig. 4

Inventor
Cornelius A. Crimmings
by Robert C. Cushman & Cramer
Att'ys.

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ELASTIC RIB KNITTED FABRIC

Cornelius A. Crimmins, Stoughton, Mass.

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10 Claims. (Cl. 66—190)

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This invention pertains to rib knitted fabric of the kind in which rubber yarn is incorporated with relatively inextensible textile yarn to enhance the contractile elasticity of the material; specifically to fabric of the kind in which the principal effect of the rubber yarn is to contract the material transversely after it has been stretched widthwise, that is to say, in a direction perpendicular to the ribs, such fabric being referred to as "one-way stretch" fabric as contrasted with knitted fabric in which elastic yarn is incorporated in the knitted loops.

When herein reference is made to rubber yarn it is to be understood that the term "rubber" is employed merely for convenience and is to be regarded as inclusive of yarn, whether of natural or artificial rubber, synthetic resin or the like, which possesses elastic stretch and contractile characteristics generally similar to those of natural rubber and as contrasted with the relatively limited stretch inherent in customary textile yarns of wool, cotton, silk or the like.

Elastically stretchable knitted fabric is widely employed in the manufacture of garments, particularly constrictive garments such as corsets, girdles, bathing suits, hosiery tops, etc. Rubber yarn, both bare and covered, is used in making such fabrics, the knitting being carried out upon conventional knitting machines such as straight machines of the Burson type or on circular dial or rib machines.

Elastic fabric is usually made according to one or the other of two general methods. According to one method the rubber yarn does not form an essential element of the loop structure of the fabric, the latter consisting wholly of the textile yarn while the rubber yarn lies between the front and rear rib wales of the fabric in substantially straight runs extending transversely of the fabric, resulting in a one-way stretch. In such a fabric the breakage of the rubber yarn does not result in the formation of runs. On the other hand, the rubber yarn does tend to draw back if broken, as when the material is cut in the formation, for example, of gores, or the like, in the manufacture of a garment, or when it is broken by the action of the needle in sewing a seam. When the rubber yarn thus draws back the appearance of the material is changed, the fabric becoming more open from the withdrawal of the rubber yarn, while the contractile effect (due to the rubber) is substantially lost at this point. Furthermore the cut or broken end of the rubber yarn tends to protrude at one face of the material, producing a ragged, unsightly effect.

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In accordance with the other method, the rubber yarn is drawn into loops by the knitting needles and is cast off like the textile yarn to form stitches of the completed fabric; in such a fabric the rubber yarn forms a portion of the loop structure in the completed fabric. Such a fabric is elastic both transversely and longitudinally and is known as "two-way stretch" fabric. Since the rubber yarn forms knitted stitches, breakage of this yarn may result in the formation of runs.

Covered rubber yarn contains a rubber core thread (either of cut rubber or extruded latex) encased (and under some normal tension) in helical wrappings of fine textile yarn. Necessarily, for a given amount of rubber, the outside diameter of such a yarn is substantially greater than that of a bare rubber yarn capable of exerting the same contractile force. Thus the employment of covered rubber may result in a fabric which is unduly bulky and dense, especially when the covered rubber yarn is knitted in so as to form a part of the loop structure of the fabric. For this reason, and also because of its greater extensibility, bare rubber yarn is sometimes preferred. However, covered rubber yarn has certain advantages as compared with bare rubber yarn, for example, it is able to take dye to match the color of the associated textile yarns, and its close resemblance to ordinary textile yarn in surface appearance and feel, and the greater ease of handling it during knitting, result in its general use in spite of its undesirable bulk and stiffness.

In circular knit seamless garments, for example hosiery tops, the chance of breakage of rubber yarn during the wear of the garment is relatively slight, and thus in the manufacture of such seamless garments the mere laying of the rubber yarn (whether covered or bare) between the front and rear rib wales results in a product which is acceptable to the trade. However, when the knitted material must be cut and sewed, as in the manufacture of garments in which the knitted material forms only a part or parts, the tendency of the cut or broken rubber yarn to pull back and protrude, as above suggested, is a source of much trouble to the manufacturer as well as to the wearer of the garment.

The garment trade desires a thinner and more elastic fabric than has heretofore been obtainable; some of the desired characteristics are found in the Leno woven elastic materials, but these materials are expensive, lack the desired kick-back, and require heavy starching to secure a smooth finish.

In accordance with the present invention, and as the result of long extended experiment, it is possible to provide a thin but firm, transversely stretchable elastic fabric of pleasing appearance which is acceptable to the trade for use in garment manufacture, and wherein the elastic yarn, although it may be much smaller than the textile yarn, is so firmly bound to the textile yarn that it can not pull back to any substantial degree when the fabric is cut or broken.

One object of the present invention is to provide elastic rib knitted material of the one-way stretch type wherein the laid-in rubber yarn, whether covered or bare, is so anchored in place, without substantial detriment to its elastic properties, that it does not draw back to any appreciable extent when cut or broken, so that when the fabric is cut it does not disintegrate, and any slight imperfection due to cutting the rubber will be perceptible only on careful examination and the wearing quality of the material will be unimpaired thereby. A further object is to provide a rib knitted fabric having the above characteristics and which may be knitted upon a conventional knitting machine. A further object is to provide a rib knitted elastic fabric wherein the rubber yarn extends (although with slight undulations; but no knitted loops are formed) in substantially straight, transverse runs between the front and rear faces of the fabric and is confined by wrappings of the sinker bights of the associated textile yarn so that the rubber yarn can not contact substantially when cut or broken. A further object is to provide an elastic fabric which may be of a fine gauge and a degree of firmness comparable to non-elastic fabrics of nylon or the like employed in the garment trade. Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings wherein:

Fig. 1 is a fragmentary plan view of rib knitted material according to one embodiment of the invention, the material being drawn to large scale and with the rubber yarn magnified in diameter as compared with the textile yarn, for ease in illustration, the fabric being shown transversely stretched to indicate the internal construction;

Fig. 2 is a view similar to Fig. 1 but illustrating another embodiment of the invention;

Fig. 3 is a similar view but illustrating rib knitted elastic material of prior conventional type; and

Fig. 4 is a fragmentary plan view showing a few stitches of conventional rib fabric drawn to very large scale.

Referring to Fig. 1, the fabric illustrated as a one-and-one rib knitted material, the portion shown comprising five transversely extending successive courses K, K¹, K², K³ and K⁴, of knitted loops or stitches. The corresponding loops in successive courses form longitudinally extending chains or wales, the odd numbered wales I, III, V and VII being knitted by the cylinder needles and the intervening even numbered wales II, IV, VI and VIII being knitted by the dial needles. This is on the assumption that the fabric is seamless and knit upon a circular machine. It will be understood by those skilled in the art that the fabric may be knitted upon rib machines of other types. If a circular machine be employed, it will have two or a multiple of two feeds with corresponding sets of needle-actuating cams. When herein the rib stitches and wales are referred to as at the back of the fab-

ric and the plain or cylinder needle stitches or loops as at the front, this is merely for convenience in description and without limiting intent.

Assuming that the machine is a two-feed machine, the textile yarn T will form all of the constituent stitch loops, whether the loops be knitted on the cylinder or dial needles. This textile yarn T may be a single ply yarn or it may be a plied yarn, or a multiple yarn comprising a plurality of parallel (untwisted) ends, as desired, and may be of any of the usual textile materials. The elastic yarn R is here illustrated by way of example as a covered rubber yarn (a rubber or latex core encased in helical windings of fine textile yarn). As illustrated merely for clearness in following the course of the yarns, the yarn R is much too large as compared with the yarn T.

In Fig. 4 a few stitches of ordinary rib knit fabric are shown, comprising a single dial loop D intervening between two cylinder loops C and C' in the same course. Each loop comprises the converging legs 1 and 2. For convenience in description the narrow portion 3 of any given loop, where the legs 1 and 2 most nearly contact, is herein referred to as the "neck" of the loop. Those bights 4^a of the yarn which connect the respective legs of any given loop with the adjacent legs of the next loops, to the right and left respectively, in the same course, are herein referred to as "sinker bights," whether these bights are substantially straight runs; simple U-bends; or whether they follow a more or less intricate course, for example, a helical or spiral course.

Referring to Fig. 1, and considering, for example, the loops D which form a rib wale II, all of the bights 4 which connect the necks of the loops D to the necks of the loops C' forming the cylinder wale III, first pass downwardly and behind the elastic yarn R and then forwardly to the neck of the loop C', making approximately one-half turn about the elastic yarn R. However, the bights 4' which connect the necks of the loops D in the rib wale II to the necks of the next adjacent loops C forming the cylinder wale I, first pass downwardly behind the rubber elastic yarn R, then upwardly and forwardly about the rubber yarn and then down behind the rubber yarn and then again forwardly to the neck of the loop C, thus making approximately one and one-half turns or wraps about the rubber yarn. Thus the sinker bights extending from necks of the dial loops D forming the rib wale II differ from each other, those which extend to the right forming half turns about the rubber yarns, while those which extend to the left form one and one-half turns about the rubber yarn. As shown in Fig. 1, the wrappings 4' occur at alternate rib wales in every course. Examination of the dial loops D' which form the rib wale IV will show that, whereas the right-hand sinker bights 4 are exactly like the bights 4, above described, leading from the necks of the dial loops in wale II, the sinker bights 4^x extending to the left from the dial loops D' to the necks of the adjacent cylinder loops C' extend forwardly of the rubber yarn R, forming approximately one-half turn about the rubber yarn; thus at the wale IV the sinker bights 4 and 4^x extend to the rear and to the front of the rubber yarn respectively.

In wale VI the arrangement of the sinker bights is the same as in wale II, and in wale VIII the arrangement of the sinker bights is the same as in wale IV. Thus at every second dial wale, transversely of the fabric, one of the sinker bights makes a half turn about the rubber yarn

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and the other bight makes one and one-half turns, while at every intervening dial wale the sinker bights pass to the rear and to the front, respectively, of the rubber yarn, each making but a half turn about the latter.

In Fig. 2 a modified construction is illustrated. In the fabric shown in this figure course K^1 is identical, for example, with course K^1 of Fig. 1. However, although the stitch structure in each of the individual courses K and K^2 (preceding and following course K^1) is the same as that of course K^1 , the sinker bights $4'$, which make one and one-half turns or wraps about the rubber yarn, do not register vertically with those in course K^1 , but are offset horizontally or staggered with respect to those in course K^1 , so that whereas in course K^1 the wrappings $4'$ connect the neck of a dial loop D in wale II with the neck of a cylinder loop C in wale I—in courses K and K^2 these special wrappings or sinker bights $4'$, which form one and one-half turns about the rubber yarn, occur in wale IV rather than in wale II, and connect the necks of the dial loops D' to the necks of the cylinder loops C' . This staggered arrangement of the wrapping bights $4'$ occurs throughout the fabric, producing a somewhat more uniform texture than that of Fig. 1, but whether one or the other of these arrangements is employed, the rubber yarn is bound in with substantially the same effectiveness.

In Fig. 3 conventional elastic rib knit fabric is illustrated by way of comparison. In this material the textile yarn T is shown as forming the cylinder and dial wales I and II, etc., while the rubber elastic yarn R lies within the thickness of the material, between the cylinder and dial wales, and forms substantially straight transverse runs. In this customary material the sinker bights 4 are all substantially alike, being substantially straight runs of yarn connecting the necks of the loops forming the respective courses. The sinker bights 4 do not wrap the rubber elastic yarns at all, in fact, as illustrated, they do not even touch the rubber elastic yarns, and retraction of the rubber elastic yarns, if the fabric is cut, is only resisted by the friction of the loops themselves, and this is insufficient to prevent retraction of the rubber elastic yarns and resultant protrusion of the end of the rubber from the face of the fabric, if the fabric is cut.

I am aware that it has been proposed to wrap sinker bights of a rib knitted fabric about an elastic yarn to bind the latter in, but, so far as I am aware, all of the sinker bights in such prior fabrics wrap the elastic yarn in the same direction. In accordance with the present invention the sinker bights 4 and 4^* , as above described, wrap the rubber yarn in opposite directions, so that the rubber yarn is adequately confined. At the same time the wrappings $4'$ (although distributed with sufficient spacing between them to avoid imparting an undesirable surface appearance to the fabric) embrace and firmly grip the elastic yarn.

In making the fabric of Fig. 1 on a circular rib knitting machine having two feeds, for example, all of the needles (dial and cylinder) approach the feed point with the cotton loops in their hooks. Just before reaching the feed, alternate dial and cylinder needles are moved out to the tuck position and the rubber thread is laid on the cheeks of these needles. The rubber thread is held in place while all of the dial and cylinder needles are advanced to take a new cotton thread. In so advancing, the latches of the needles

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are cleared from the rubber thread. The rubber thread is held during this movement of the needles by a narrow guard element which engages the sinker bights of the rubber. All of the needles are now retracted to draw the new loop of cotton thread, at the same time casting off the old loop of cotton thread together with the rubber. However, the rubber does not form a knitted loop of the fabric but straightens out when it is cast off.

In making the modified fabric of Fig. 2 the same operations as above described take place at the first feed point, but at the next feed, although the same sequence of operations is performed, those needles which intervene between the needles which tuck the rubber at the first feed are moved to the tuck position to receive the rubber.

While the elastic yarn R here illustrated is a covered rubber yarn, it is obvious that fabric of the same structure may be made in which uncovered rubber yarn is employed. Moreover, the same fabric structure has certain advantages even though the yarn R be of inelastic or relatively inelastic yarn, for example, a slippery yarn such as silk, rayon or nylon.

While desirable embodiments of the invention have been described by way of example, it is to be understood that the invention is inclusive of such further modifications as fall within the terms of the appended claims.

I claim:

1. A rib knitted one-way stretch elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the respective legs of each rib stitch to the adjacent legs of the plain stitches to the right and left respectively of said rib stitch in the same course, and elastic yarn extending in substantially straight runs transversely of the fabric and located in front of the rib stitches and behind the plain stitches, the sinker bights which extend from the respective legs of each alternate rib stitch in a given course wrapping the elastic yarn, one of said bights passing down behind the elastic yarn and then forwardly and up about the elastic yarn to its junction with the adjacent leg of the next plain stitch and the other of said bights passing downwardly behind the elastic yarn, then upwardly and forwardly about the elastic yarn, then down behind the elastic yarn and then forwardly to its junction with the adjacent leg of the next plain stitch.

2. A rib knitted one-way stretch elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the respective legs of each rib stitch to the adjacent legs of the plain stitches to the right and left respectively of said rib stitch in the same course, and elastic yarn extending in substantially straight runs transversely of the fabric and located in front of the rib stitches and behind the plain stitches, the sinker bights which extend from the respective legs of each alternate rib stitch in any given course passing downwardly in front of and downwardly to the rear, respectively, of the elastic yarn.

3. A rib-knitted one-way stretch elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the respective legs of each rib stitch to the adjacent legs of the plain stitches to the right and left respectively of said rib stitch in the same course, and elastic yarn extending in substantially straight runs transversely of the fabric and located in

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front of the rib stitches and behind the plain stitches, the sinker bights which extend from the respective legs of each alternate rib stitch in a given course crossing the elastic yarn, one of said bights passing down behind the elastic yarn and then forwardly and up about the elastic yarn to its junction with the adjacent leg of the next plain stitch and the other of said bights passing downwardly behind the elastic yarn, then upwardly and forwardly about the elastic yarn, then down behind the elastic yarn and then forwardly to its junction with the adjacent leg of the next plain stitch.

4. A rib knitted one-way stretch elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the respective legs of each rib stitch to the adjacent legs of the plain stitches to the right and left respectively of said rib stitch in the same course, and elastic yarn extending in substantially straight runs transversely of the fabric and located in front of the rib stitches and behind the plain stitches, the sinker bight which connects one of the legs of every second rib stitch in a given course with the adjacent leg of the next plain stitch to one side of said rib stitch passing down behind the elastic yarn and then forwardly and up about the elastic yarn to its junction with the adjacent leg of the next plain stitch and the sinker bight which connects the other leg of said rib stitch with the adjacent leg of the next plain stitch to the other side of said rib stitch passing downwardly behind the elastic yarn, then upwardly and forwardly about the elastic yarn and then downwardly behind the elastic yarn and forwardly to its junction with the adjacent leg of said next plain stitch.

5. A rib knitted one-way stretch elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the respective legs of each rib stitch to the adjacent legs of the plain stitches to the right and left respectively of said rib stitch in the same course, and elastic yarn extending in substantially straight runs transversely of the fabric and located in front of the rib stitches and behind the plain stitches, one of the sinker bights which extends from the neck of each second rib stitch in any given course passing down behind the elastic yarn and then forwardly and up about the elastic yarn to its junction with the adjacent leg of the next plain stitch and the other sinker bight from the same rib stitch passing downwardly behind the elastic yarn then upwardly and forwardly about the elastic yarn then down behind the elastic yarn and then forwardly to its junction with the adjacent leg of the next plain stitch.

6. A rib knitted one-way stretch elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the respective legs of each rib stitch to the adjacent legs of the plain stitches to the right and left respectively of said rib stitch in the same course, and elastic yarn extending in substantially straight runs transversely of the fabric and located in front of the rib stitches and behind the plain stitches, one of the sinker bights which extends from the neck of each second rib stitch in a given course passing down behind the elastic yarn and then forwardly and up about the elastic yarn to its junction with the adjacent leg of the next plain stitch, the other sinker bight from the same rib stitch passing downwardly behind the elastic yarn then upwardly and forwardly about the elastic yarn, then down behind the elastic

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yarn and then forwardly to its junction with the adjacent leg of the next plain stitch, one of the sinker bights which extends from the neck of each intervening rib stitch in the same course passing in front of and the other behind the elastic yarn.

7. A rib knitted one-way stretch elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the respective legs of each rib stitch to the adjacent legs of the plain stitches to the right and left respectively of said rib stitch in the same course, and elastic yarn extending in substantially straight runs transversely of the fabric and located in front of the rib stitches and behind the plain stitches, the sinker bight which connects one of the legs of every second rib stitch in alternate courses with the adjacent leg of the next plain stitch to one side of said rib stitch passing down behind the elastic yarn and then forwardly and up about the elastic yarn to its junction with the adjacent leg of the next plain stitch, and the sinker bight which connects the other leg of said rib stitch with the adjacent leg of the next plain stitch to the other side of the rib stitch passing downwardly behind the elastic yarn, then upwardly and forwardly about the elastic yarn, then down behind the elastic yarn and then forwardly to its junction with the adjacent leg of the next plain stitch, the last-named sinker bights being offset horizontally in alternate courses.

8. A rib knitted one-way stretch elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the respective legs of each rib stitch to the adjacent legs of the plain stitches to the right and left respectively of said rib stitch in the same course, and elastic yarn extending in substantially straight runs transversely of the fabric and located in front of the rib stitches and behind the plain stitches, the sinker bight which connects one of the legs of every second rib stitch in alternate courses with the adjacent leg of the next plain stitch to one side of said rib stitch in the same course passing down behind the elastic yarn and then forwardly and up about the elastic yarn to its junction with the adjacent leg of the next plain stitch, and the sinker bight which connects the other leg of said rib stitch with the adjacent leg of the next plain stitch to the other side of the rib stitch in the same course passing downwardly behind the elastic yarn, then upwardly and forwardly about the elastic yarn, then down behind the elastic yarn and then forwardly to its junction with the adjacent leg of the next plain stitch, the last-named sinker bights extending from the necks of every second rib stitch in each course.

9. A rib knitted one-and-one one-way stretch, elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the neck of each rib stitch to the necks of adjacent plain stitches in the same course and elastic yarn extending in substantially straight runs transversely of the fabric, and located in front of the rib stitches and behind the plain stitches, one of the sinker bights which extends from the neck of each rib stitch, in every second rib wale, to the necks of adjacent plain stitches in the same course passing downwardly behind the elastic yarn, then upwardly and forwardly about the elastic yarn, then down behind the elastic yarn and then forwardly to its junction with the adjacent leg of the next plain stitch, and the other

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sinker bight from each rib stitch in every second rib wale in the same course wrapping the elastic yarn to form less than a complete turn about the latter.

10. A rib knitted one-way stretch elastic fabric comprising courses formed of rib stitches and plain stitches, sinker bights uniting the neck of each rib stitch to the neck of adjacent plain stitches in the same course and elastic yarn extending in substantially straight runs transversely of the fabric, and located in front of the rib stitches and behind the plain stitches, one of the two sinker bights which extend from each of regularly recurrent rib stitches in any selected course passing downwardly behind the elastic yarn, then upwardly and forwardly about the

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elastic yarn, then down behind the elastic yarn and then forwardly to its junction with the adjacent leg of the next plain stitch, and the other of said two sinker bights passing down behind the elastic yarn and then forwardly and up about the elastic yarn to its junction with the adjacent leg of the next plain stitch.

CORNELIUS A. CRIMMINS.

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