May 22, 1928. 1,670,366

A. LAURAIN

ELASTIC WOVEN FABRIC AND METHOD OF WEAVING IT

Filed June 14, 1926

Fig. 1



Fig. 2

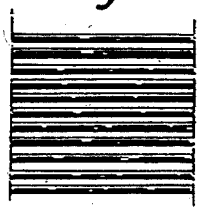


Fig. 3

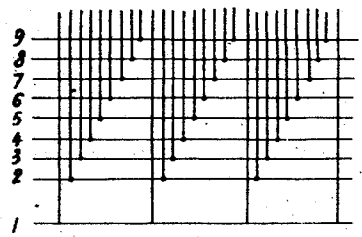


Fig. 4

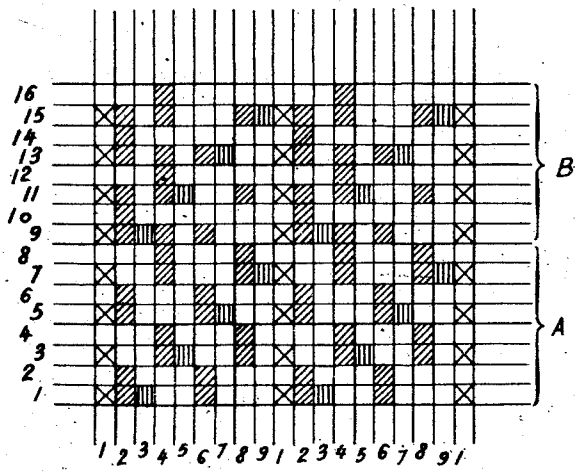
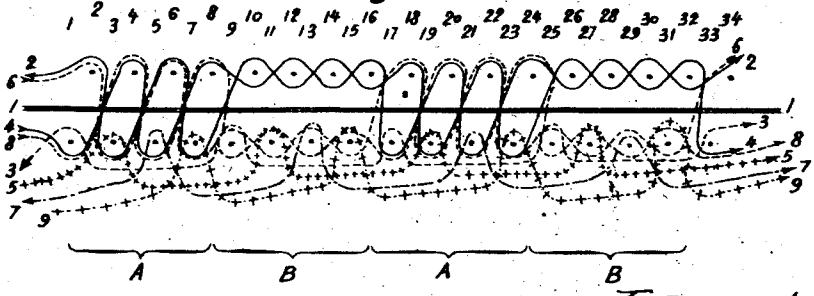


Fig. 5



Inventor
A. Laurain
by
Langner Parry Card & Langner
Atty's

Patented May 22, 1928. 1,670,366

UNITED STATES PATENT OFFICE.

ALFRED LAURAIN, OF PARIS, FRANCE, ASSIGNOR TO SOCIETE DU CAOUTCHOUC MANUFACTURE, OF PARIS, FRANCE.

ELASTIC WOVEN FABRIC AND METHOD OF WEAVING IT.

Application filed June 14, 1926, Serial No. 116,021, and in France September 16, 1925.

This invention has reference to new and useful improvements in elastic woven fabrics having a high extensibility appertaining to the class of ribbed fabrics such for example as those described in the prior United States Patents Nos. 1,545,146 and 1,546,738 i. e. to the class of like-sided fabrics wherein the weave is characterized by an uninterrupted sequence of plain sections composed of interwoven rubber warp threads, textile warp-threads and textile weft threads and of transverse parallel ribs or series of ribs protruding above and under the fabric with respect to said plain sections, said ribs comprising textile warp threads and textile weft threads whilst said rubber warp threads are bound in each rib neither with the said textile warp threads nor with the last named textile weft threads.

The primary object of the invention is to provide an improved elastic fabric of the class referred to produced by a new weaving diagram and having greater properties of resistance, durability and smartness than the above-cited fabrics.

A further object of the invention is to provide an improved elastic fabric of the class referred to having its back or "wrong" side of a colour or tint different from its front or "right" side and more particularly of a white, whitish or extremely light colour or tint adapted to æsthetically contrast with the darker arbitrary colour of its said front side.

A still further object of the invention is to provide an elastic fabric of the class referred to having a back side woven with such warp threads as to have a white, whitish or extremely light colour or tint whereby such side being substantially free of any tinctorial material can not soil the underlying part such as a shirt or another garment in the event of said fabric being for instance used in braces or sock suspenders.

A still further object of the invention is to provide an elastic fabric of the class referred to wherein the "white" back side is integrally interwoven with the body of the fabric whereby it can be produced in the same weaving operation by means of one shuttle or one set of shuttles only and on the same ordinary loom and the whole of the fabric forms an integral textile unit.

A still further object of the invention is to provide an elastic fabric of the class referred to wherein the white or very light-coloured back side is produced exclusively with textile white warp threads to the exclusion of any white weft threads or of any rubber threads and wherein moreover such textile white warp threads are so closely interwoven with the other textile (coloured) threads combined with the rubber strands or threads as to substantially fill up the depressions between the transverse ribs extending on the "back" side of the ribbed body of said fabric whereby a resulting white-backed integral textile unit is obtained which is transversely ribbed and thoroughly coloured on its front side and substantially plain, smooth and colourless on its back side.

A still further object of the invention is to provide an improved method for weaving this new fabric whereby it is possible to produce it in large quantities on ordinary looms with one shuttle or one set of shuttles only without changing their structure or operation.

With the foregoing objects in view and such others as will incidentally appear hereinafter, the invention considered in its broadest aspect may be said to first comprise a two-ply elastic woven fabric involving a like-sided body presenting a sequence of plain sections and transverse ribs or series of transverse ribs extending from edge to edge (preferably without any selvages) substantially at right angles thereto and produced by the ordinary weaving diagrams as above cited and a back side or face produced by white textile warp threads combined with the coloured textile weft threads shot by one shuttle or one set of shuttles only and thus associated with the coloured textile warp threads of the body, said combination being made according to such plain fundamental weaves as are used in the art for producing plain fabrics such as twills, shalloons, satins or the like, the white warp threads forming the back side being, although autonomously arranged, so interwoven with the coloured warp and weft threads of the body of the fabric as to cause the said white back side to be invariably and intimately united with the said ribbed body whilst providing a back

side of white character and smooth surface without the use of any binding thread or threads between said body and said back side.

As above stated, the invention also comprises the weaving method for producing said improved elastic fabric, said method being characterized by the conjugated work, on the one hand, of a front side warp of arbitrary colour which produces on the coloured front side of the fabric and under its white back side sequences of plain sections and of "tubular" or transversely ribbed sections, all of varying length and, on the other hand, of an additional white warp which over the underlying ribbed surface produces a continuous plain or smooth coating which forms the white back side above referred to, said additional warp being entirely white and so interwoven with the first-named coloured warp as to intimately connect the said coating or back side of plain texture to the ribbed body of the fabric whilst remaining entirely free from the rubber warp threads whereby the latter remain completely free from any parasitic friction and thus keep their full retractability and extensibility.

According to the simplest embodiment of the invention, the improved elastic fabric is produced on ordinary looms by means of four textile warp threads of suitably selected colour (hereinafter called the front warp threads), four white textile warp threads (hereinafter called the back warp threads) and one rubber thread or strand. The number of textile warp threads may evidently be increased without changing the general appearance or the characteristic properties of the fabric and without either requiring any modification of the weave. Similarly, whilst the weave generally comprises sixteen shots of weft, it will be appreciated that such number may vary according to the relative size to be respectively given to the plain and ribbed sections on the front side of the fabric. Said shots of weft are delivered by one shuttle or one set of shuttles only and the back side warp is interwoven with every other shot of weft.

For the manufacture of this improved elastic fabric, nine healds are used, namely one heald for the rubber thread or strand, four healds for the front warp threads and four healds for the back warp threads, the first-named four healds being adapted for producing the transverse ribs on either side of the rubber lap whereas the last-named four healds are adapted for producing the back side of plain texture of the fabric and thus to completely cover those of the said ribs protruding adjacent and underneath the back side.

All textile threads used for weaving this improved elastic fabric may be made of any suitable material such as cotton or silk and will have the size selected for giving the resulting fabric the required resistance properties. Moreover it must be understood that the words "white" or "whitish" as applied to the back side of said fabric and to the threads composing its texture are not strictly limited to an absolute meaning and that they also include very light colours or tints substantially producing the same results and aspects.

In order that the invention may be better understood and more readily carried into practice, it will now be described with reference to the accompanying drawing wherein is shown the appearance and the designing of the new elastic fabric.

Figure 1 is a diagrammatic edge view of the two-ply fabric, the two undulated lines roughly representing the respective courses of the coloured warp threads whereas the straight line roughly represents the course of the white warp threads, the rubber threads or strands being omitted for the sake of clearness.

Figure 2 is a diagrammatic illustration of the front side of the fabric showing its sequence of plain sections and transverse ribs.

Figure 3 illustrates the threading of the fabric, the horizontal lines diagrammatically representing the healds whereas the vertical lines represent the warp threads respectively attached thereto. Line 1 represents the heald to which is attached the rubber thread or stand, lines 2, 4, 6 and 8 represent the healds to which are attached the textile warp threads forming the ribbed front side, and lines 3, 5, 7 and 9 represent the healds to which are attached the textile warp threads forming the plain back side.

Figure 4 shows the point paper design or weave diagram of this fabric. As clearly indicated by the brackets A and B, the weave is divided into two parts: part A corresponding to the first eight shots of weft numbered from 1 to 8 whereas part B corresponds to the next eight shots of weft numbered from 9 to 16, it being understood that, as above stated, said parts might optionally comprise a different number of shots of weft according to the appearance sought.

Figure 5 diagrammatically shows on a very large scale the interweaving in the longitudinal direction of the front and back warp threads with respect to the weft threads represented by mere points, the double line 1 representing the rubber thread or strand the brackets A and B clearly setting forth the two parts of the weave.

For manufacturing this improved two-ply integral elastic woven fabric, all that is necessary is to exactly follow the weav-

ing indications as given in the point paper design shown in Figure 4 wherein the diagonalled squares represent the rubber threads whilst the squares having oblique hatchings represent the front textile warp threads and the squares having vertical hatchings represent the back textile warp threads.

The order of the weave is as follows:—

At the first pick, the healds 1, 2, 3 and 6 are raised and the healds 4, 5, 7, 8 and 9 are lowered.

At the second pick, the healds 2 and 6 are raised and the healds 1, 3, 4, 5, 7, 8 and 9 are lowered.

At the third pick, the healds 1, 4, 5 and 8 are raised and the healds 2, 3, 6, 7 and 9 are lowered.

At the fourth pick, the healds 4 and 8 are raised and the healds 1, 2, 3, 5, 6, 7 and 9 are lowered.

At the fifth pick, the healds 1, 2, 6 and 7 are raised and the healds 3, 4, 5, 8 and 9 are lowered.

At the sixth pick, the healds 2 and 6 are raised and the healds 1, 3, 4, 5, 7, 8 and 9 are lowered.

At the seventh pick, the healds 1, 4, 8 and 9 are raised and the healds 2, 3, 5, 6 and 7 are lowered.

At the eighth pick, the healds 4 and 8 are raised and the healds 1, 2, 3, 5, 6, 7 and 9 are lowered.

At the ninth pick, the healds 1, 2, 3, 4 and 6 are raised and the healds 5, 7, 8 and 9 are lowered.

At the tenth pick, the healds 2 are raised and the healds 1, 3, 4, 5, 6, 7, 8 and 9 are lowered.

At the eleventh pick, the healds 1, 2, 4, 5 and 8 are raised and the healds 3, 6, 7 and 9 are lowered.

At the twelfth pick, the healds 4 are raised and the healds 1, 2, 3, 5, 6, 7, 8 and 9 are lowered.

At the thirteenth pick, the healds 1, 2, 4, 6 and 7 are raised and the healds 3, 5, 8 and 9 are lowered.

At the fourteenth pick, the healds 2 are raised and the healds 1, 3, 4, 5, 6, 7, 8 and 9 are lowered.

At the fifteenth pick, the healds 1, 2, 4, 8 and 9 are raised and the healds 3, 5, 6 and 7 are lowered.

At the sixteenth pick, the healds 4 are raised and the healds 1, 2, 3, 5, 6, 7, 8 and 9 are lowered.

The diagram shown in Figure 5 although of a very conventional nature will facilitate the understanding of the novel weave by which is produced the improved fabric having the above-mentioned characteristics. By merely examining said figure, it is in fact possible to conceive the operation of the taut rubber thread or strand 1, of the front textile warp threads 2, 4, 6, 8 and of the back textile warp threads 3, 5, 7, 9. The shots of weft are illustrated above and under the rubber thread 1 by a series of staggered points numbered from 1 to 34 although each weave unit only comprises 16 shots of weft, this illustration being therefore adapted for clearly bringing out how the next weave unit is begun on the loom after the 16th shot of weft. In the part of the weave unit corresponding to the brackets B it will be seen that despite the additional operation of the back textile warp threads 3, 5, 7, 9 the lap of rubber threads or strands 1 is entirely free i. e. not submitted to the friction of any textile warp whatever whereas in the other part of said weave unit corresponding to the brackets A said lap of rubber threads or strands is interwoven with said textile warp and thus submitted to their friction. It will be appreciated that in view of this wherever the rubber lap undergoes the friction of the textile warp it merely possesses the usual extensibility of ordinary elastic woven fabrics whilst in the other "free" or "tubular" parts marked by the brackets B, said rubber lap preserves its maximum extensibility and retractability which imparts to the fabric its extreme pliancy and elasticity as above stated, said elasticity substantially equalling about 300% of its normal or retracted length. In this respect it may well be said that each part designated by a bracket B throughout the length of the fabric contains a free lap of rubber threads so that as the total of such parts amounts up to half the total length of the fabric the rubber threads or strands are "free" i. e. keep their maximum extensibility and retractability to the same extent.

Also by examining Figure 5 it will be readily understood in what way the back side of white, whitish or very light colour of the fabric is integrally interwoven with its body without interfering with the function of the rubber threads in the "tubular" parts. Thus, owing to the novel weave, no binding thread or threads are required for connecting the back side to the ribbed body of the fabric, which greatly differentiates the latter from the elastic fabrics having a separately woven (by means of a separate shuttle or set of shuttles) back side as manufactured hitherto.

Although it has been stated in the foregoing that the white back side is plain, a feature which is inherent to its being woven according to the twill weave, it is obvious that upon the continuous surface of said back side may be practically felt and perceived very slight protuberances corresponding to the underlying ribs so that said back side is not perfectly smooth whereby it partakes of the advantages of the ribbed fabrics

whilst possessing its own qualities of resistance, durability, cleanliness and smartness as above stated.

It will be understood that whilst the back side has throughout this description been referred to as being "white", this term must be construed in a general way as also including "whitish" or "very light-coloured" back sides.

It will be further understood that whereas the weaving of the white back side has been described and illustrated by way of example as effected by means of such a fundamental weave as for example, the Florentine twill weave, there is no limitation of the invention in this since it also includes the use of another fundamental weave (such for example as the "satin" weave) for producing a similarly characterized two-ply elastic fabric constituting an integral textile unit and presenting the above-cited advantages, such modifications merely involving slight changes in the point paper design and being included in the scope of the appended claims.

What I claim and desire to secure by Letters Patent is:—

1. An elastic woven fabric comprising, in combination, a like-sided body presenting a sequence of alternated plain sections and transverse ribs extending from edge to edge substantially at right angles to the length of the fabric and including interwoven rubber threads and coloured textile warp and weft textile threads, and a plain white backing produced by white textile warp threads associated with the above cited coloured warp and weft threads so as to integrally connect said white backing with said body without requiring the use of any additional binding threads.

2. An elastic woven fabric comprising, in combination, a body representing on both sides a sequence of alternated plain sections and transverse ribs extending from edge to edge and substantially at right angle to the length of the fabric and including interwoven rubber threads and coloured warp and weft textile threads, the interweaving being such as to bind all rubber and textile threads in said plain sections while exclusively binding the textile threads in said ribs in order to leave the rubber threads free in the ribs, and a plain white backing produced by white textile warp threads associated with the above cited coloured warp and weft threads so as to integrally bind said white backing with said body while concealing said coloured threads without requiring the use of any additional binding threads whereby the fabric constitutes an integral weave unit.

3. An elastic woven fabric comprising, in combination, a coloured body presenting on both sides a sequence of alternated plain sections and transverse ribs extending from edge to edge and substantially at right angle to the length of the fabric, said sequences corresponding from one side to the other side of the body and including interwoven rubber threads and coloured warp and weft textile threads, the interweaving being such as to bind all rubber and textile threads in said plain sections while exclusively binding the textile threads in the ribs in order to leave a lap of rubber threads free and frictionless in said ribs, and a plain backing produced by additional warp threads substantially free of tinctorial substance and intercrossed with the above cited coloured warp and weft threads so as to integrally bind said backing with said body while concealing said coloured threads on the back side of the body without requiring the use of additional binding threads.

4. The method of weaving a two-ply elastic fabric constituted by the combination of a coloured body presenting on both sides sequences of plain sections and intervening transverse ribs and of a plain white back side formed by an additional white warp integrally connected to the coloured warp and weft of said body without any binding threads consisting to so interweave taut rubber threads and coloured textile warp and weft threads as to cause all said threads to be bound together in each of said plain sections whilst causing the said textile threads to be exclusively bound together in each of said ribs so as to leave the rubber threads free therein and simultaneously to so interweave additional white textile warp threads with the coloured textile warp threads and the undershots of the coloured weft as to intimately connect said additional white warp and said coloured warp and weft for producing in one and the same weaving operation an integral textile unit.

5. The method of weaving a two-ply elastic fabric constituted by the combination of a coloured body presenting on both sides corresponding sequences of plain sections and intervening transverse ribs and of a plain smooth white back side formed by an additional white warp integrally connected to the coloured warp and weft of said body consisting to so interweave taut rubber threads and coloured textile warp and weft threads as to cause all said threads to be firmly bound together in each of said plain sections whilst causing the textile threads exclusively to be bound together in each of said ribs thus leaving the rubber free therein and simultaneously without using an additional shuttle to so interweave additional white textile warp threads with the coloured textile warp threads and with every other undershot coloured weft as to intimately connect said white warp and said coloured warp and weft for producing in one

operation on the same loom an integral textile unit comprising no binding threads.

6. The method of weaving a two-ply integral elastic fabric presenting differentiated faces respectively appertaining to a coloured body having on both sides corresponding sequences of plain sections and intervening transverse ribs produced by interwoven coloured warp and weft and to a plain white backing produced by an additional colourless warp integrally connected to the coloured warp and weft, consisting to use nine healds: one heald for the rubber thread, four healds for the coloured front warp and four healds for the white back warp and to uninterruptedly carry on the weaving in successive units produced by sixteen shots of weft out of which eight shots form the plain sections of the body by binding all rubber and textile threads and eight shots form the ribs of said body by exclusively binding the textile threads, the undershots of coloured weft being alternately interwoven with the additional white warp for integrally connecting same to the coloured body.

7. The method of weaving on ordinary looms a two-ply integral elastic fabric constituted by the combination of a coloured body presenting on both sides corresponding sequences of plain sections and intervening transverse ribs and of a plain smooth white back side formed by an additional white warp integrally connected to the coloured warp and weft of said body consisting to use nine healds: one heald for the rubber thread, four healds for the coloured front warp and four healds for the colourless back warp and to uninterruptedly carry on the weaving by means of one shuttle only in successive units each produced by sixteen shots of weft alternatingly picked over and under the lap of rubber threads, eight shots forming the plain sections of the body by binding all rubber and textile threads and the other eight shots forming the ribs of said body by exclusively binding the textile threads, the eight undershots of coloured weft being alternately interwoven with the additional white warp for integrally connecting same to the coloured body without requiring any binding threads and thus for producing in one and the same weaving operation an integral textile unit having great extensibility and retractability.

In testimony whereof I affix my signature.

ALFRED LAURAIN.