May 6, 1952 M. E. DUCKOFF 2,595,778

FABRIC WEAVING WITH GROUPS OF ELASTIC AND RELATIVELY INELASTIC WARPS

Filed Sept. 8, 1950 2 SHEETS—SHEET 1

Fig. 1.

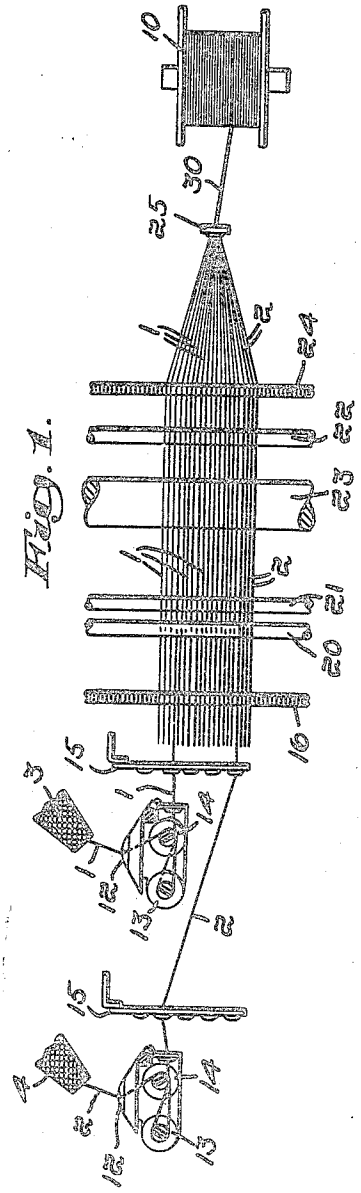
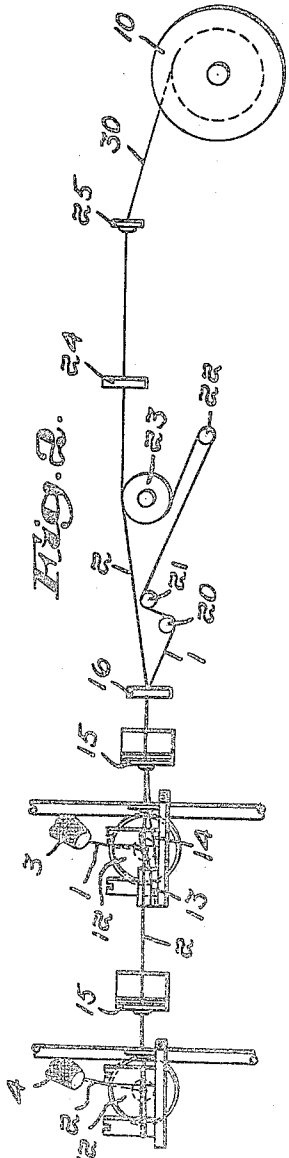


Fig. 2.



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2 SHEETS—SHEET 2

Fig. 3.

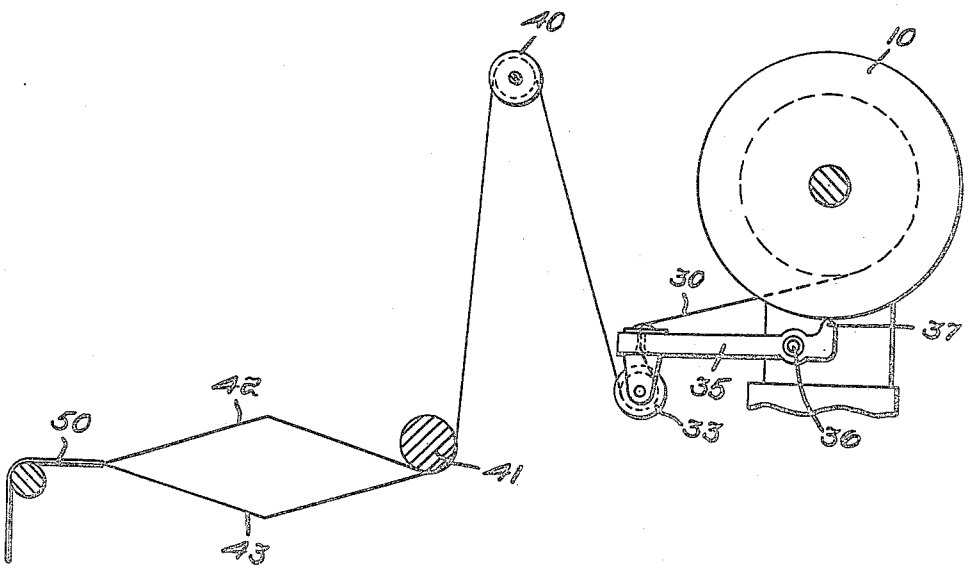
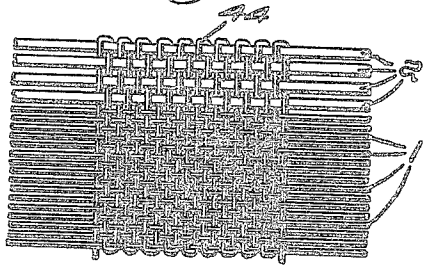


Fig. 4.



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FABRIC WEAVING WITH GROUPS OF ELASTIC AND RELATIVELY INELASTIC WARPS

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3 Claims. (Cl. 28—72.5)

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My present invention is directed to the manufacture of woven fabric wherein one or more portions are formed with elastic warp threads, and one or more of inelastic warp threads, and includes also the improved novel article thus made.

While the invention is broadly directed to fabric weaving, it is of special importance in the manufacture of so-called narrow fabric wherein tapes, trimmings, bindings, laces, and the like material of relatively narrow width is made.

An important object of the invention is to provide such fabric with one or more elastic portions, particularly an edge portion which will permit the fabric to be applied around curves or contours while maintaining the same flat and permitting the edge with the elastic warp threads to stretch around the outside diameter of the radius of the curve to which the tape binding or strip is applied. This feature is of particular importance in connection with the attachment of such strips to boots and shoes, especially in the uppers, wherein such binding tape is necessarily fitted around curved portions of the shoe upper materials, as shown in my prior Patent No. 2,500,668.

My invention is equally applicable to the use of elastic warp threads whether of bare rubber, covered rubber, or a combination of both, as a part of the widthwise portion or area of the fabric, and in conjunction with the remaining part of the fabric, which may be of cotton, rayon, silk, or any other material for the inelastic warp threads.

Heretofore it has been customary to weave such narrow fabric either of all-elastic warp threads or of all-inelastic warp threads, and with each set wound on separate spools. But it has been found to be extremely difficult to effect a satisfactory weaving of part-elastic and part-inelastic warp threads. Prior to my present invention, the elastic and inelastic warp threads were wound on separate reels, spools, or beams, as was customary, and then led directly into the loom to be woven with the filler into fabric.

All such warp threads were necessarily under some degree of tension while going thru the weaving operations, and all efforts, prior to my present invention, to synchronize the tension on the elastic warp portion and that of the inelastic warp portion widthwise of the fabric during the weaving has resulted in an unsatisfactory product. The warp threads necessarily would retract or shrink after being thus woven as a portion widthwise of the fabric, which was particularly difficult also in weaving a narrow fabric such as shoe bindings or tape material, to which the present invention is primarily directed.

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The most skillful efforts to effect a uniform result in the ordinary weaving methods where a series of elastic warp threads were fed into the weaving looms, side by side with a set of inelastic warp threads, have been unsuccessful in the production of a satisfactory narrow fabric of uniform quality.

Thus, in a standard type of narrow fabric for use on shoes, a proportion of warp threads widthwise of the fabric utilizing rayon as the material has been found to be 44 in number; and the proportionate elastic warp threads has been found to be 12 in number, thus producing a fabric with an elastic edge portion of approximately one-third the width of the tape, which has been found to be suitable for fitting around ordinary curved contours in the usual range of boot and shoe designs.

I have discovered a novel method of so proportioning and synchronizing the sets of rubber warp threads and the sets of relatively inelastic warp threads so that they can be woven with a filler of any desired suitable material which will produce a fabric having, in combination, a relatively elastic portion and a relatively inelastic portion, or portions, widthwise of the fabric in a uniform, expeditious, and efficient manner.

Thus, by my novel process I am enabled to produce a new and uniform fabric with these widthwise portions of distinctly differing characteristics and in an expeditious manner; whereas, heretofore, it was commercially impractical to effect a uniform structure with such distinct and different widthwise portions resulting from the combination of a set of elastic warp threads adjacent to and in combination with a set of inelastic warp threads.

In carrying out my invention I have discovered that by first winding both the set of inelastic warp threads and the desired set of elastic warp threads under a predetermined varying tension on the same spool or reel, I can thereafter unwind the combined elastic and inelastic warps from the same reel into the loom, and wherein the inelastic threads do all the pulling or tensioning from the unwinding action during the weaving operation.

I have discovered, also, that in order to wind on a spool or reel, both the elastic and inelastic threads which are to be used for the warp of the resultant fabric that a variation in tension during such winding operations is most critical. While such variation in the tension during winding or "warping" will vary with the material employed, diameter of warp threads, plurality required for the particular fabric to be woven, and

similar exigencies that, for example, in utilizing a narrow fabric particularly for shoe upper use, wherein 44 inelastic warp threads constitute the body of the resultant tape and 12 elastic threads are to be woven into the yielding and stretchable edge portion, that a suitable tension on the inelastic warps would be 45 grains to 90 grains during this winding action. Similarly and simultaneously, a suitable tension on the elastic threads during such winding may be approximately four grains, viz., just enough to keep the same in proper alignment and without undue stretching.

Therefore, under such suitable tensions the elastic and inelastic threads are wound together on the same reel or spool and are subsequently unwound into the weaving loom with the unwinding tension all exerted on the inelastic threads. Thus, I am enabled to produce a satisfactory uniform and commercially desirable fabric having widthwise combinations of elastic warp threads and inelastic warp threads.

I may also weave into the fabric a distinctive warp thread arranged between the elastic and inelastic portions, which intermediate thread, if desired, may be utilized as a distinguishing mark—in the nature of a trade-mark—and of added strength to still further insure the line of demarcation, and still further limiting the stretch of the elastic portion as it is fitted around the outer part of the curved contour of the material to which the tape is applied, thereby also tending to hold the tape flat and unwrinkled in its attached position.

Referring to the attached drawings wherein I have shown in diagrammatic form an illustrative example of my present invention:

Fig. 1 is a plan view of the warping operation, viz., where a plurality of elastic warp threads and a plurality of inelastic warp threads are conducted under varying tensions to and wound upon the warp spool or reel simultaneously, for subsequent unwinding during the weaving operation;

Fig. 2 is a corresponding diagrammatic side view;

Fig. 3 is a diagrammatic view on an enlarged scale of the weaving operation, and

Fig. 4 is a fragmentary view of the resultant fabric also on an enlarged scale.

It will be appreciated that I may utilize any desired number of elastic or rubber threads for the marginal portion, and a corresponding desired number of inelastic threads for the body portion of the fabric, and while I have designed and intended the invention to be utilized in the making of narrow fabric for trimming on boots and shoes and, hence, around curves, my invention can be utilized for other purposes. Also different sets or portions of elastic warp threads can be employed widthwise of the resultant fabric, as at opposite edges, along an intermediate portion, or the like, as above explained.

Referring to Figs. 1 and 2, I have designated a series of inelastic threads, outlining one of the same for clarity in the drawings which I have indicated as **1**, and a set of elastic threads also showing the line of travel of one of the same, as indicated at **2**, the inelastic thread **1** being fed off a cop **3**, and the elastic thread from a cop **4**, being arranged in proximity and with a cop for each of the series of warp threads in adjacent alignment, all to be conducted to and wound on the warp spool **10**.

Following the line of travel of each warp thread, the same would be first conducted around

the usual center guide **12** and thence around rolls **13** and **14**, thru eyelets in frames **15—15**, and thru openings in guide frames **16**, this being a usual and standard construction. From then on, however, I conduct the inelastic series of warp threads **1** around tension bars **20**, **21**, **22**, and **23**, and thence thru a guide frame **24** and an eyelet **25** to and onto the warp spool **10**, which is being rotated at appropriate speed, drawing all the warp threads together.

The elastic or rubber-covered series of warp threads **2** are led to the spool **10** without conducting them around tension bars but also thru the gathering eyelet **25**, which thus assembles the entire series of warp threads, as indicated at **30**, winding the same onto the warp spool **10**.

In the diagrammatic views of Figs. 1 and 2, I have illustrated only a portion of the elastic and inelastic threads, the series of elastic or rubber-coated threads being indicated as the lowermost six outlined in Fig. 1, in accordance with the suggested example of twelve elastic threads and forty-four inelastic threads for the suitable weaving of the narrow fabric, six of such elastic threads being subsequently fed thru one set of harnesses, and the other six thru a corresponding harness during the weaving operation, as indicated roughly in Fig. 3, and the cooperating forty-four threads of inelastic warp members being similarly divided between the weaving harnesses.

As thus explained and illustrated, the winding of the warp spool **10** winds the set of inelastic threads **1** under the tension accorded by leading the same around several tension bars **20**, **21**, **22**, and **23**; whereas the elastic series of warp threads **2** are conducted to the spool **10** substantially without any restraining friction other than the drawing tension thru the guide rolls, eyelet frames, and finally through the gathering eyelet **25**.

In the case of heavier elastic threads, it is, of course, feasible and within the contemplation of my invention to conduct the same with a predetermined tension on same, but in any event, the different series or sets of warp threads having different characteristics are thus led and conducted thru varying degrees of tension or friction appropriate to each set and assembled and wound together simultaneously upon the warp spool, to be subsequently separated and unwound during the weaving operation.

The showing in Fig. 3 is illustrative of a typical line of travel of the warp threads during the weaving, drawing the same from the warp spool **10**, showing same as an assembled mass **30**, thence over a roll **33** mounted on a pivoted friction member **35**, which latter is pivoted at **36** to a frame portion, with a bearing **37** controlling the unwinding of the spool **10**, these several series of warp threads being then led over individual conducting rolls **40** and **41** to and thru the set of harnesses, which spread the warp threads as indicated at **42** and **43** to receive the filling cross-threads **44** and to be woven into the fabric as shown at **50**.

The resultant fabric is indicated in Fig. 4, wherein the typical fabric structure is disclosed but without the full number of elastic and inelastic threads being shown, a reduced number being for clarity in the drawing.

Thus the strain and tension during both the warping operation and the weaving operation is effectually taken by the inelastic warp threads, leaving the elastic threads to be woven at al-

most the complete rest and without being stretched. This complete, or substantially complete, condition of rest of the elastic threads is obtained without any "binders" or "gut threads" and, hence, the elastic warps exerted no shrinking, contracting, or wrinkling tendency on the complete fabric, as would be the case if the elastic warp threads were also under stretch or tension.

This feature is one of the important characteristics of my present process and the resultant article constituting my invention.

I claim:

1. The improvement in the art of weaving, comprising first assembling groups of warp threads having different elastic characteristics in each group, then winding both groups on the same reel, spool, beam, or the like under differing tensions for each group, and thereafter completing the weaving operation, unwinding said groups during weaving, with all the unwinding tension for both groups on the group having the lesser elastic characteristics.

2. The improvement in the art of weaving, which consists in assembling a plurality of relatively inelastic warp threads, and a plurality of elastic warp threads arranged in widthwise groups on the same reel, spool, beam, or the like under different tensions for said groups, and thereafter completing the weaving operation, unwinding said groups during weaving with the entire tension of the unwinding on the inelastic warp threads.

3. The improvement in the art of weaving different groups of warp threads with the same weft, one group having a large plurality of relatively inelastic warp threads, and an adjacent group of a lesser plurality of elastic warp threads, which consists in first winding both of said groups on the same reel, spool, beam, or the like under proportionally different tensions, with the least tension on the elastic warp threads, and thereafter weaving said groups into fabric with the unreeling tension exerted on the inelastic threads of the larger group.

MAXWELL E. DUCKOFF.

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