United States Patent

Simpson

[15] **3,672,187**

[45] **June 27, 1972**

[54] **FABRIC**

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[22] Filed: **May 19, 1967**

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[52] **U.S. Cl.** **66/192**

[51] **Int. Cl.** **D04b 23/10**

[58] **Field of Search** ..... 66/192, 193, 85 A, 84

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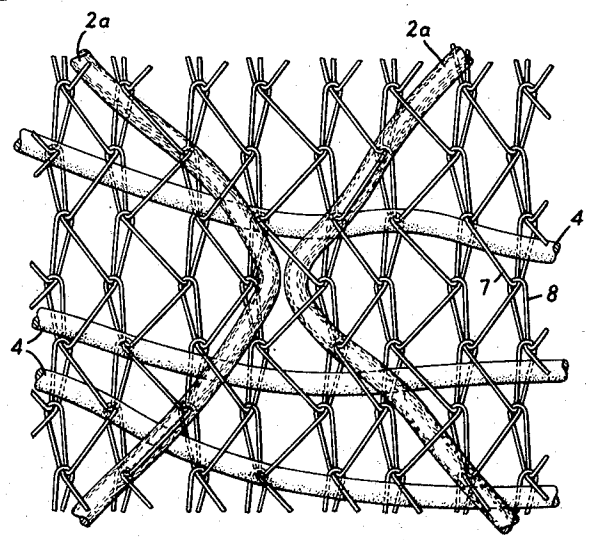
[57] **ABSTRACT**

A fabric having a layer of substantially spaced apart design elements which are laid on a cloth substrate, in the warp direction. along nonlinear paths is disclosed. The design elements are affixed to the substrate and other optional components of the fabric by knit-stitching with parallel rows of stitches forming a series of loop chains.

14 Claims, 8 Drawing Figures



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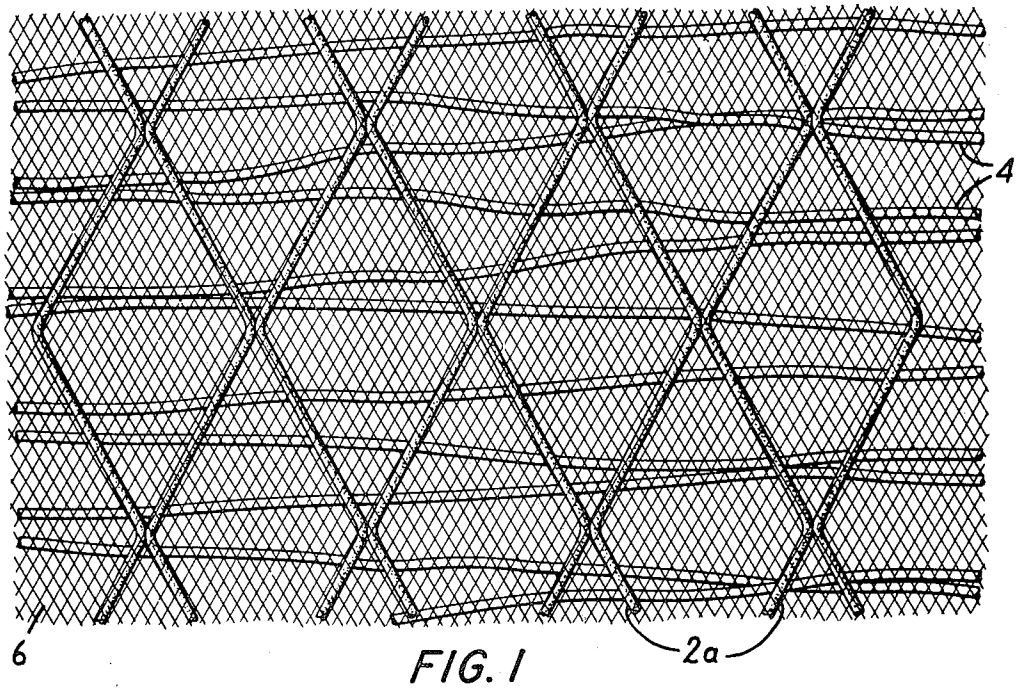

FIG. 1

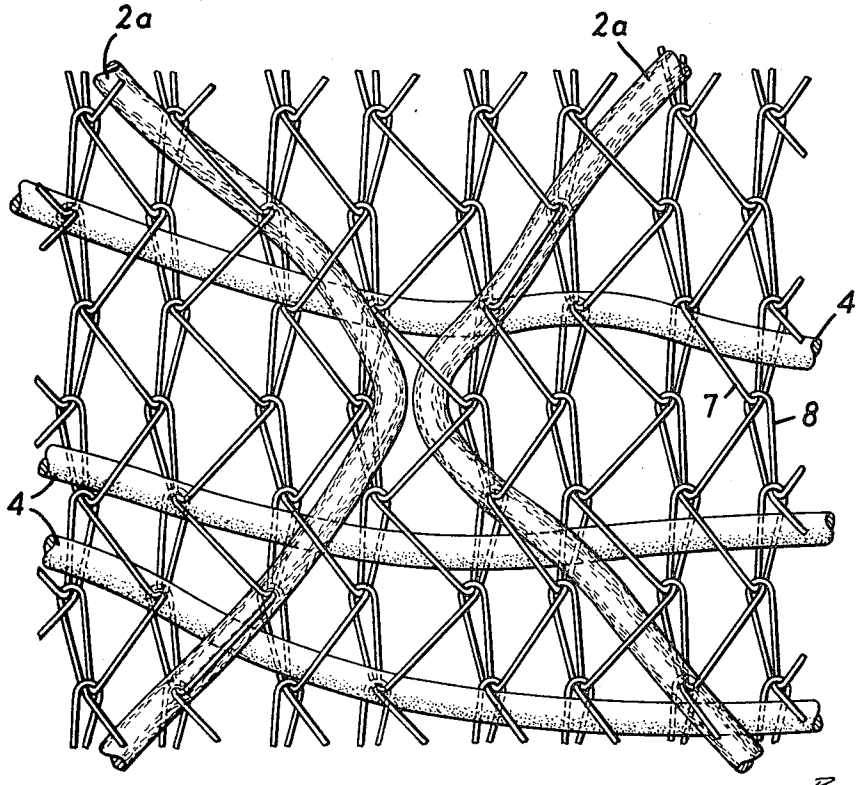

FIG. 2

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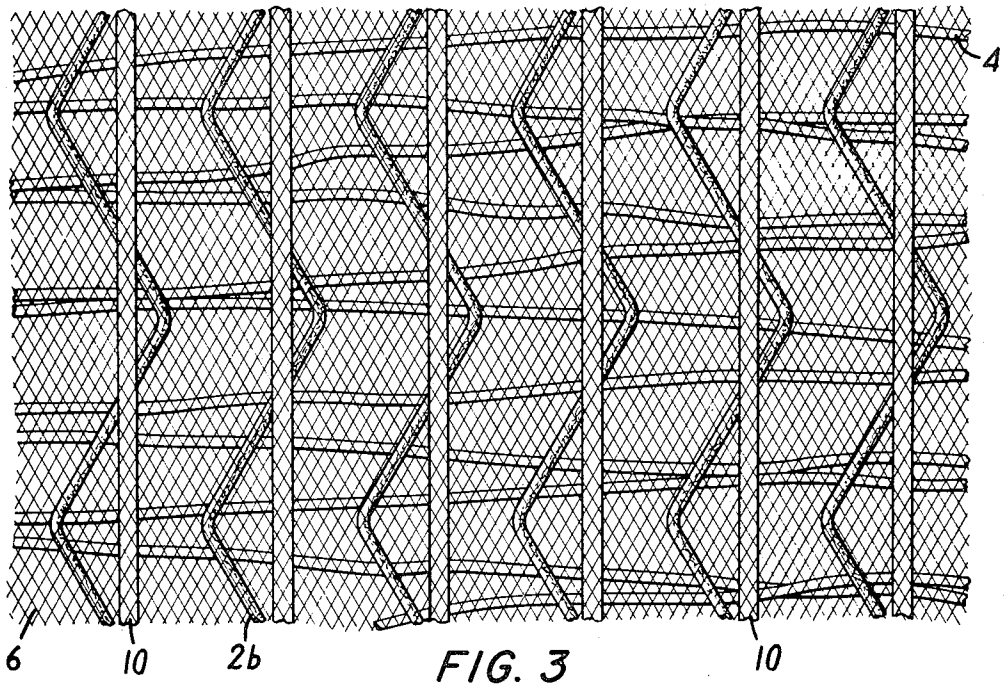

FIG. 3

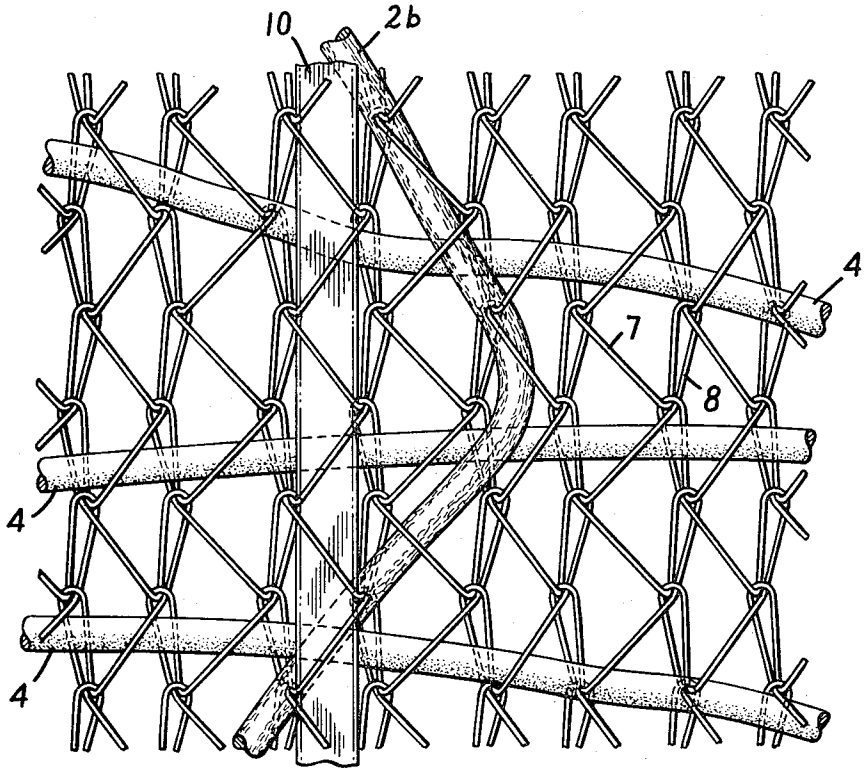

FIG. 4

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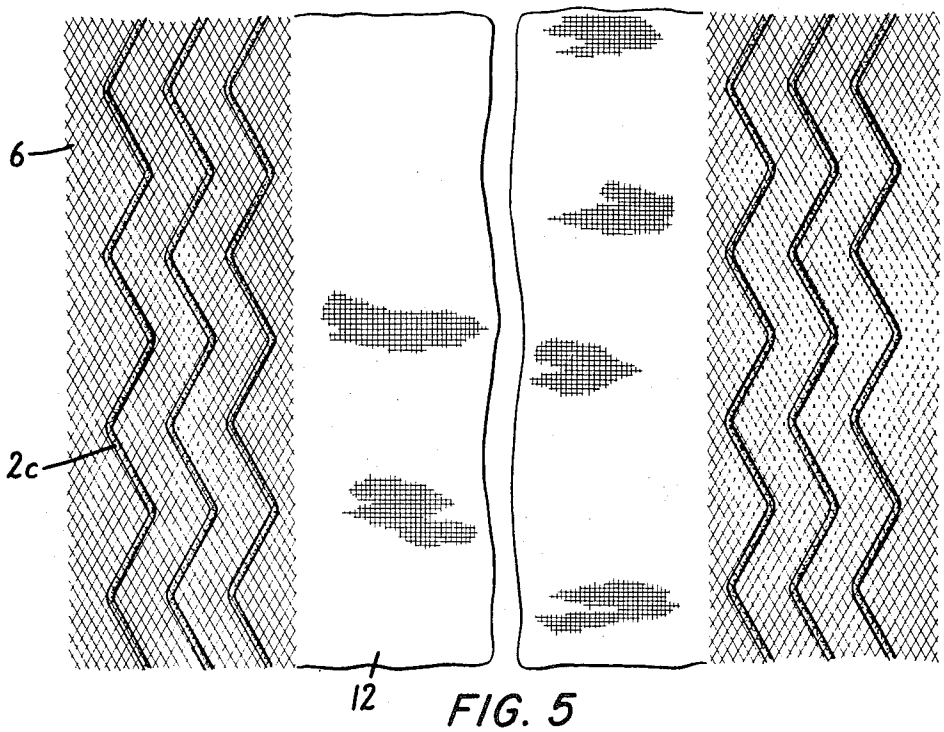

FIG. 5

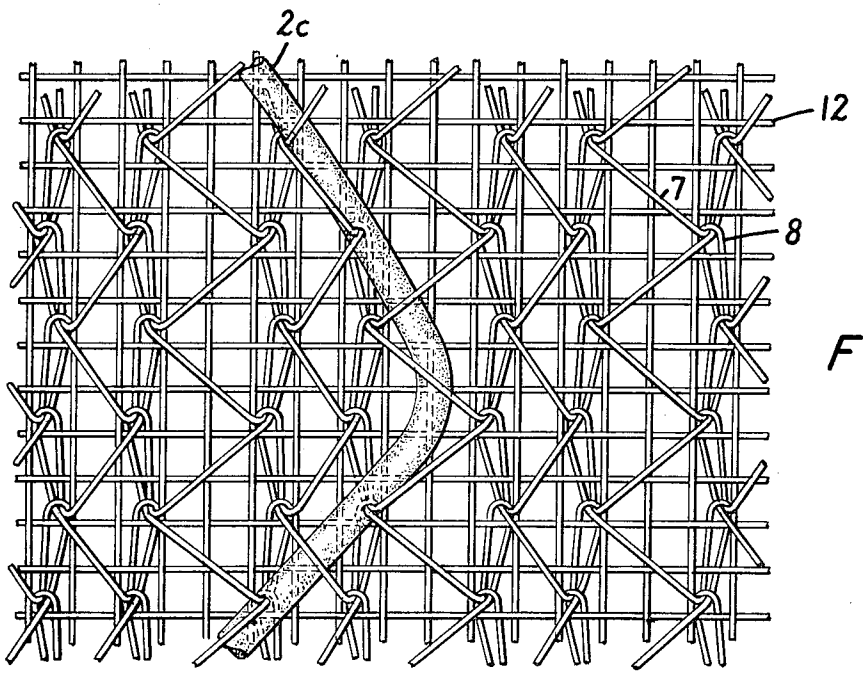

FIG. 6

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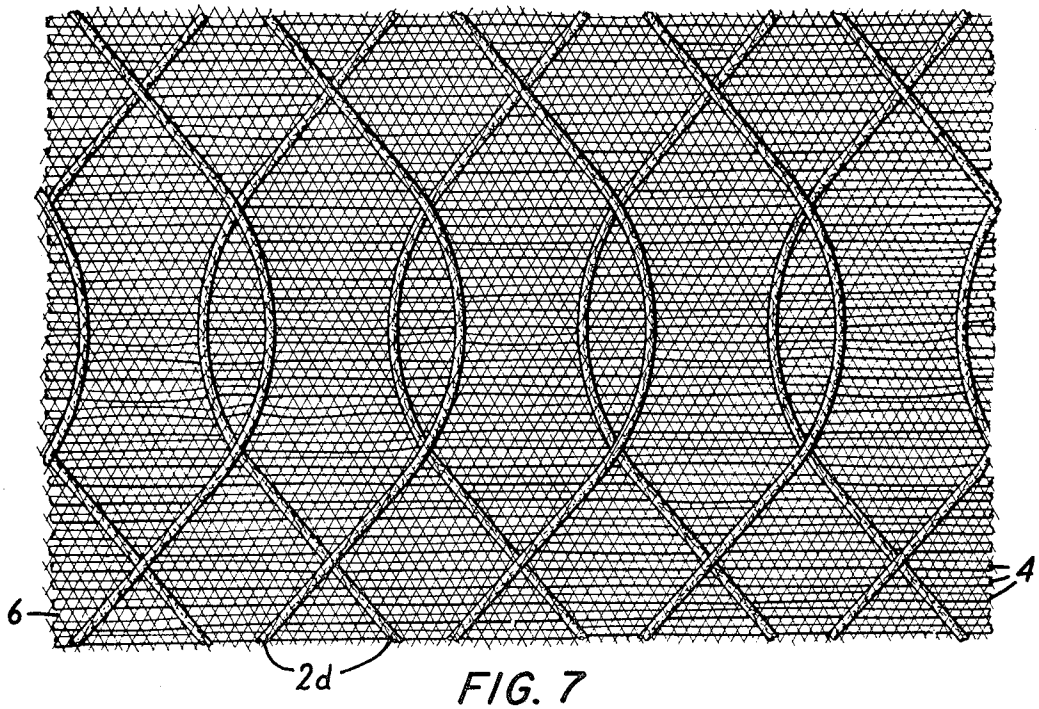

FIG. 7

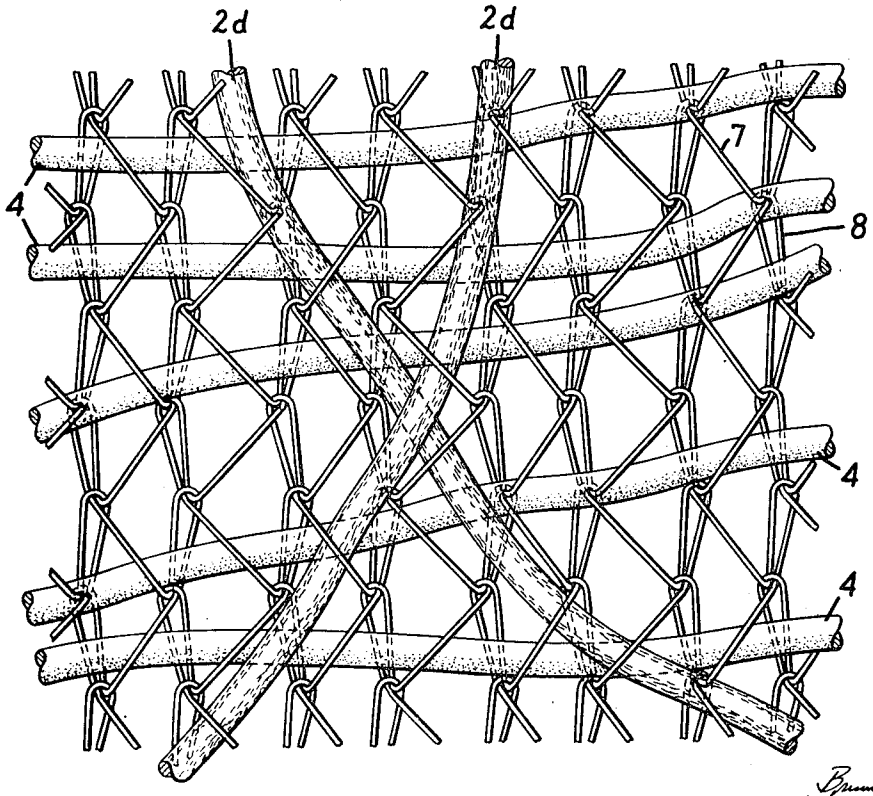

FIG. 8

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FABRIC

BACKGROUND OF THE INVENTION

This invention relates to an improved fabric and to a process for making such product.

Malimo fabrics typically comprise a layer of substantially parallel warp elements, and a layer of substantially parallel filling elements. By spacing the warp elements, the filling elements, or both, an open mesh fabric may be obtained. The filling elements are affixed to the warp by placing them together and joining them by knitting threads. This structure may be obtained on a machine of the "Malimo" type, using procedures and apparatus described in U.S. Pat. Nos. 2,890,579 and 3,030,786.

The ability to easily mass produce a basic fabric in many different patterns is extremely important. While fabrics may be produced with the "Malimo" machine at a very high rate, fabrics heretofore made with this machine have lacked the design flexibility needed to meet the demands of the market. Different designs may now only be achieved on the "Malimo" machine by changing the color arrangements of the elements, by changing the spacing between them and the number of elements through a given area, and by omitting one or more of the elements. Thus, the possibilities are limited.

It is also desirable to provide surface designs on knitted and woven goods as well as other substrates including paper, foam sheets, fibrous batting and various plastic sheets. Present day processes for supplying such designs produce products at a relatively low rate.

SUMMARY OF THE INVENTION

It is the primary object of the present invention to provide a basic fabric with a higher degree of flexibility for providing design variations therein than have been obtainable from basic fabrics of the various types, including "Malimo" type, woven and knitted, as well as other continuous substrates, including fibrous batting, foam, paper and plastic sheets.

The above and other objects of the invention are attained in accordance with the invention by providing a plurality of new elements, hereinafter called design elements, which are substantially spaced apart and are laid on a flexible substrate along paths in the warp direction. The paths taken by the design elements may be linear or nonlinear. In addition, a portion of the design elements may follow linear paths while another portion may follow nonlinear paths. After the design elements are laid on, they are affixed to the substrate by knit-stitching. Knitting thread, forming a series of loop chains, interlace and bind together the substrate and the design elements into an integral structure. The knitting thread either laps the design element or pierces it at intervals to secure the element to the substrate.

The design elements provide the fabric of the present invention with an additional degree of design flexibility. Many different designs may be obtained by changing the paths along which the design elements are laid, the spacing between the design elements, the nature of the substrate used with the design elements, the portion of the material over which the design elements are laid, and the color and material of the design elements. Thus, the basic fabric of the present invention may be designed to provide such diverse fabric end products as draperies, table linens, upholstery and clothing. Furthermore, if desired, the design elements may be arranged to give the fabric a hand-made appearance.

The design elements of the fabric of this invention may be made from any flexible material, the choice of which is determined by the design desired. For example, the elements may be preshrunk, predyed cotton or synthetic yarn, or the design elements may be a narrow plastic ribbon.

A plurality of design elements may be laid on the substrate from a controlled changing oblique direction with one or a plurality of design element carrying units, moving back and forth in a lateral direction. As many as four independently movable units in the form of bars, each guiding 240 yarns

(four per inch), have been used in conjunction with a "-Malimo" machine to produce fabrics according to the present invention at a high rate. The units move independently from each other, allowing a high degree of control over the design employed. It is recognized, however, that any number of units can be used, with any desired number of decorative yarns per inch, and this also may be varied, depending on the size of yarn and hole in the units.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, reference is made to the following description of exemplary embodiments, taken in conjunction with the figures of the appended drawings, in which:

FIG. **1** is a plan view of one embodiment of the fabric of the invention;

FIG. **2** is an enlarged view of a portion of the fabric of FIG. **1** showing the relationship between the elements thereof;

FIG. **3** is a plan view of a second embodiment of the fabric of the invention;

FIG. **4** is an enlarged view of a portion of the fabric of FIG. **3** showing the relationship between the elements thereof;

FIG. **5** is a plan view of a third embodiment of the fabric of the invention;

FIG. **6** is an enlarged view of a portion of the fabric of FIG. **5** showing the relationship between the elements thereof;

FIG. **7** is a plan view of a fourth embodiment of the fabric of the invention; and

FIG. **8** is an enlarged view of a portion of the fabric of FIG. **6** showing the relationship between the elements thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following description, the corresponding elements as shown in each figure of the drawings are given the same reference numerals, and a letter suffix is added to designate specific ones of those elements when necessary.

In the embodiment shown in FIGS. **1** and **2**, the design elements **2***a* are laid on a layer of spaced apart filling elements **4** to provide a fabric, the filling constituting a flexible substrate in the composite fabric of substrate stitching and design elements. The design elements and the filling elements are secured in their relative positions by means of knitting threads **6** which form parallel rows of warpwise loop chains **8** and diagonally extending portions **7** which cross between adjacent loop chains. Each pair of adjacent loop chains shares two knitting elements, alternate loops of each chain being parts of a first element and the remaining loops being from a second element, in the form of a half tricot stitch. The filling yarns are engaged and held on one side of the fabric by the loops of the loop chains and on the other side by the diagonal parts of the knitting elements. The knitting threads lock the various components in position relative to one another to form a composite fabric.

In the embodiment shown in FIGS. **1** and **2**, the design elements have been laid along nonlinear paths which are saw-tooth shaped. The apexes of adjacent saw-tooth paths are alternatively contiguous to each other and spaced from each other resulting in a diamond pattern over the entire fabric. This diamond effect may be easily obtained by utilizing at least two design element carrying units, moving back and forth in the filling direction. If preferred, however, all of the saw-tooth shaped paths may be laid parallel to each other to create a design without the diamond effect.

Other embodiments may be prepared according to this invention. In one alternate embodiment, design elements **2***a* may be laid on a substrate of warp elements instead of the filling elements **4** with no filling used. The structure is held together by application of knitting threads in the form of a half tricot stitch. In another embodiment, the structures shown in FIGS. **1** and **2** contain knitting thread in the form of chain stitch or a full tricot stitch and design elements only, both with and without filling elements or other substrate.

In the embodiment of the fabric shown in FIGS. 3 and 4, design elements 2*b* are laid on a substrate in the form of a layer of filling elements 4 and a layer of warp elements 10 laid on top of the filling. As in FIG. 1, the design elements have been laid along saw-tooth paths, but the paths of the design elements 2*b* of the fabric shown in FIG. 3 are parallel to each other. The knitting threads 6 connect and lock the warp 10 relative to the design elements 2*b* and the layer of filling elements 4 by the series of loop chains 8.

In the embodiment of the fabric shown in FIGS. 5 and 6, the design elements 2*c* are laid on a flexible continuous substrate 12, in particular a woven fabric, in the warp direction along parallel saw-tooth or zig-zag paths, but they are laid on only near the border of the fabric. Alternatively, the design elements 2*c* may be laid on the fabric along saw-tooth paths which are not parallel to each other to provide a diamond effect near the borders. When used in conjunction with a flexible substrate 12, the design elements need not be restricted to the borders, but when they are so restricted, as shown in FIG. 5, the design renders the fabric particularly suitable for use as a tablecloth. The embodiment shown in FIG. 5 may also be modified by laying a warp of spaced apart filaments on the flexible substrate beneath the design elements to provide a cord-like effect. Still another modification may be made by laying down warp elements on the portion of the flexible substrate which is not beneath the design elements prior to application of the knitting threads.

The flexible substrate 12 in the embodiment of FIGS. 5 and 6 is a woven fabric and in the other embodiments is a layer of warp and/or filling elements. Alternatively, the flexible substrate 12 may be a knitted fabric, a sheet of elastomeric foam of the type disclosed in the Duhl patents, U.S. Pat. Nos. 3,274,805 and 3,274,806, a fibrous batting, a paper sheet, or a plastic sheet. Where sheet material is used, it need only be of sufficient strength that it can withstand the piercing by needles required to apply the knitting thread and at the same time maintain its continuous nature.

FIGS. 7 and 8 show an embodiment of the fabric wherein the design elements 2*d* have been laid on a substrate in the form of a layer of filling elements 4, along sinusoidal-shaped paths which cross each other at a plurality of positions. A pleasing effect results when each of the design elements 2*d* are made from a yarn which is alternately dyed to a plurality of colors along its length.

The above-described embodiments of the invention are merely exemplary, and many variations and modifications thereof may be made by those skilled in the art without departing from the spirit and scope of the invention. For example, the design elements may follow any nonlinear path in the warp direction and need not be restricted to paths which are saw-tooth or sinusoidal shaped. Also, any of the open mesh fabrics described herein may be made with any of the flexible substrates described above in place of the spaced apart warp or filling elements.

I claim:

1. A fabric made on a stitch-through type machine such as a Malimo machine comprising a flexible substrate, a plurality of substantially spaced apart design elements laid on the substrate along nonlinear paths in the warp direction, each design element including portions of substantial length extending non-parallel to the warp direction, and knitting thread forming a series of warpwise loop chains which bind together into an integral structure the substrate and the design elements and which pierce the substrate and pierce the individual design elements at a substantial number of random points to secure the substrate and design elements against relative displacement.

2. The fabric of claim 1, wherein alternate loops in each chain are formed with a different thread, and each thread forms a series of loop chains.

3. The fabric of claim 2, wherein the knitting thread is applied as a tricot stitch.

4. The fabric of claim 1, wherein the flexible substrate is a knitted fabric.

5. The fabric of claim 1, wherein the flexible substrate is a woven fabric.

6. The fabric of claim 1, wherein the flexible substrate is an elastomeric foam sheet.

7. The fabric of claim 1, wherein the flexible substrate is at least one layer of textile elements.

8. The fabric of claim 7, wherein the layer of textile elements is filling.

9. The fabric of claim 2, wherein the flexible substrate is at least one layer of textile elements.

10. The fabric of claim 1, wherein the design elements include portions of substantial length extending diagonally, relative to the warp directions, along straight lines.

11. The fabric of claim 1, wherein the design elements include portions of substantial length curving substantially uniformly.

12. The fabric of claim 1, wherein the design elements are disposed in groups composed of at least two adjacent design elements following an identical pattern.

13. The fabric of claim 1, wherein adjacent design elements form different patterns.

14. The fabric of claim 1, wherein adjacent design elements form the same pattern but one is reversed relative to the other.

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