

Method of manufacturing colored, patterned, areal textile structures, system for carrying out the method and aerial textile structure formed in accordance with the method.

- 5 The invention relates to a method of manufacturing colored, patterned, areal textile structures in accordance with the preamble of claim 1, to a system for carrying out the method and to a flat textile structure manufactured in accordance with the method.
- 10 For the manufacturing of fabric using weaving technology with a pair of warp threads and a plurality of weft threads, a method is known in which first of all a basic weft and subsequently one or more embroidery wefts of different color are inserted in a selectable sequence into an embroidery weft line, i.e. are inserted into the weaving shed with the apparatus for the cloth take-off switched off and are interlaced by a warp
- 15 thread. For the design of the loom this signifies that the apparatus for the cloth take-off must be switched off for the insertion of the embroidery weft or wefts, so that the switched transmission required for this is subject to a high dynamic loading and an electronically controlled device, for example with a servomotor, does not satisfy the requirements, and so that weft thread spools must be made available at the loom in
- 20 dependence on the number of colors provided in the fabric. The restriction of the speed of rotation of the loom proves disadvantageous in addition to the technical cost and complexity and the high number of weft spools with threads of different color.

In order to reduce the number of weft threads a further method has become known

25 for the manufacture of such fabrics in which for example a basic weft F and three embroidery wefts with the colors blue, green and red are likewise inserted in an embroidery weft line and are interlaced by a warp thread and form a color cell (Figure 1). It is pointed out that the number of embroidery wefts is not restricted. In this arrangement the embroidery wefts are inserted with the apparatus for the cloth take-off

30 switched off. This method has the disadvantage that the fabric becomes voluminous. The disadvantages named above likewise result for the loom.

The above mentioned methods have moreover the common disadvantage that, depending on the fabric pattern, weft threads float at the rear side of the fabric and as rule the length of the floating weft threads increases with the number of the colored weft threads.

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If, in the known method, label tapes are manufactured from a broad web, then a large number of weft threads, and accordingly a large thread mass, must be cut through for the edge formation. This has the disadvantages that a high and thick brew of differing color mixture is produced at the edge of the label and a higher cutting performance is required.

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A method of Jacquard weaving of a colored material is known from DE-A-44 38 535. This method related to a user of the grid methods known from printing technology with a return of the colors of the pattern to the basic colors. The representation to be woven is split up into grid points of the colors yellow, red and blue, and also into black and white, and the material is woven from weavable points of these colors and brightness.

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It has been found that on weaving with weft threads in the colors yellow, red and blue, it is not possible to achieve a color mixture as in color printing and, moreover, the number of colors is restricted. In color printing the colors are printed one after the other, whereas in weaving color cells are formed by the weft threads and the weave.

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The invention wishes to provide assistance here. The invention, as it is characterized in the claims, solves the task of improving a method for the manufacture of colored, patterned areal textile structures.

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In the method of the invention the weaving technology is used with warp threads and at least four weft threads. Weft threads are used in the basic colors red, blue and yellow and in an additional color, in particular green. A color cell is formed in which four weft threads in the elementary colors red, green, blue and yellow are inserted in a specific constant sequence and are interlaced by one of the warp threads. A color

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impression is produced in the cell depending on the selection of the warp threads with respect to color, and depending on the interlacing of the weft threads by the warp threads. The insertion of four weft threads with different colors in the same sequence signifies for the weaving machine an advantageous and significant simplification such that, on the one hand, only four weft thread cones are required and, on the other hand, a switching off of the apparatus for the cloth take-off is avoided, so that the loom can be operated at a high speed of rotation, for example 2000 revolutions/minute. Through the respective interlacing of the weft threads, a specific color impression is produced in the color cell. The color intensity is determined by the combination of the float length of the weft thread over the warp threads and via the respective color of the warp thread which reaches the visible surface. In combination with a warp thread of a specific color, cells can be produced with fourteen different colors. It is of advantage when two warp threads of different color and a weft thread float of up to seven cells are used per cell, because in this way an areal textile structure with up to one hundred and ninety six color impressions can be produced. The color impressions are provided with a code and stored in a color scale so that the user can select the desired color impression in an advantageous and simple manner without technical interlacing manipulations. The number of color impressions can be increased by using a higher number of weft threads. Whereas the one warp thread interlaces the weft threads in accordance with the color impression to be produced, other warp threads can be interlaced at the rear side of the fabric. This has the advantage that the floating of the weft thread is eliminated.

The invention will be explained in the following with reference to the accompanying drawings. There are shown:

Figure 1: a cross-section through a fabric manufactured in accordance with a known method;

Figure 2: a legend for the symbols used in the subsequent Figures;

- Figure 3: a schematic representation of the construction of a color cell with a light red color impression formed from weft threads with four colors;
- 5 Figure 3a: a schematic representation of the construction of a color cell with a light red color impression formed from weft threads with six colors;
- Figure 4: a section along the warp line of the cell of Figure 3;
- 10 Figure 5: a schematic representation of the construction of a color cell with a dark red color impression;
- Figure 5a: a schematic representation of the construction of a color cell with a dark red color impression formed from weft threads with six colors;
- 15 Figure 6: a section along the warp line of the cell of Figure 5;
- Figure 7: a representation of the smallest weave repeat for a color cell with a light red color impression formed from weft threads with four colors;
- 20 Figure 7a: a representation of the smallest weave repeat for a color cell with a light red color impression formed from weft threads with six colors;
- Figure 8: a weave repeat for a color cell with a light red color impression and with a dark red color impression formed from weft threads with four colors;
- 25 Figure 8a: a weave repeat for a color cell with a light red color impression and with a dark red color impression formed from weft threads with six colors;
- Figure 9: a view onto the front side of a section of cloth;
- 30 Figure 10: sections along a warp thread line with differently interlaced weft threads;

Figure 11a/b: a coded color scale of the colors which can be produced with weft threads in four colors;

5 Figure 12a/b: a coded color scale of the colors which can be produced with weft threads in six colors;

Figure 13: a list of the color impressions of the colors which can be produced with weft threads in four colors; and

10 Figure 14: a list of the color impressions of the colors which can be produced with weft threads in six colors.

As Figure 2 shows, the following symbols or synonyms are used for the characterization of the warp threads and weft threads. For a white warp thread, the symbol W and
15 a bounded white surface is used and, for a black warp thread, the symbol BL and a bounded shaded surface is used. For a red weft thread, the symbol R and cross hatching is used, for a green thread the symbol G and hatching inclined to the left is used, for a blue weft thread the symbol B and hatching inclined to the right is used, for a yellow weft thread the symbol Y and vertical hatching is used, for a black weft
20 thread the symbol BL and a horizontal hatching is used and for a white weft thread the symbol W and hatching with circles is used. In the Figures, the warp threads extend in the vertical direction and the weft threads in the horizontal direction or perpendicular to the sheet of Figures.

25 Reference is made to Figures 3 to 6. In these Figures a warp line is shown with a black or white warp thread and also four weft threads.

With the method under discussion here a red weft thread R is inserted when the weft threads are lying downwardly, thereafter the white warp thread is lifted into the upper
30 shed and subsequently a green G, a blue B and a yellow Y weft thread are inserted, so that a constant cell is formed together with the white warp thread, with the white warp thread covering over the green weft thread, the blue weft thread and the yellow

weft thread and tying these in (Figures 3 and 4). If tying in takes place with the warp thread, then a color cell is formed with a color impression which is produced by the exposed red thread and the white warp thread and appears light red at the viewing side. As Figures 5 and 6 show, provision is likewise made in these methods for inserting a red weft thread R when the warp threads are lying low, to then lift the black warp thread into the upper shed and subsequently to insert a green weft thread G, a blue weft thread B and a yellow weft thread Y, so that a constant cell is formed together with the black weft thread, with the black weft thread floating above the green, the blue and the yellow weft thread and covering these over. If interlacing takes place with the warp thread then a color cell with a color impression is formed which is produced by the freely exposed red weft thread and the black warp thread and which appears dark red at the viewing side.

The method is carried out on the basis of the weave repeats. Figure 7 shows an example of the smallest weave repeat with a float length of the weft thread over a warp thread which corresponds to taffeta. The smallest weave repeat comprises two cells lying alongside one another in the weft direction and two cells lying after one another in the warp direction. Figure 7 shows an example of a smallest weave repeat. The weave repeat comprises a first cell in accordance with Figure 3 in the warp thread line 1 and subsequently, in the warp direction, a second cell with an upwardly lying white warp thread which covers over and ties in the weft threads red R, green G, blue B and yellow Y and in the second warp thread line a second cell with an upwardly disposed white warp thread which covers over and ties in the weft threads red R, green G, blue B and yellow Y, and subsequently, in the warp direction, a first cell in accordance with Figure 3. With this weave repeat a bright red color impression is produced. It is self-evident for the person skilled in the art that like and dissimilar weave repeats can be assembled and repeated as desired.

Reference is made to Figure 8. Figure 8 shows two weave repeats I, II with a float length of the weft thread over three warp threads which correspond to the (3-1) body. The repeat I applies for a light red color impression and the repeat II for a dark red color impression. In the following only the repeat I will be considered. The repeat

comprises four warp thread lines 1 to 4 and sixteen weft threads. In accordance with this repeat, a red weft thread R is inserted in a first step with downwardly lying warp threads of the warp thread lines 1 to 3 and with the white warp thread of the warp thread line 4 raised into the upper shed. In a second step the white warp threads of the warp thread lines 1 to 3 are raised onto the upper shed. In a third step a green weft thread G, a blue weft thread B and a yellow weft thread Y are inserted one after the other into the shed. In a fourth step a red weft thread R is inserted with the warp threads in the warp thread line 1 raised into the upper shed and with downwardly lying warp threads in the warp thread lines 2 to 4. In a fifth step, the white warp threads of the warp thread lines 2 to 4 are raised into the upper shed. In a sixth step, a green weft thread G, a blue weft thread B and a yellow weft thread Y are inserted into the shed. In a seventh step, with warp threads in the warp thread line 2 raised into the upper shed and with warp threads in the warp thread lines 1, 3 and 4 lying downwardly, a red weft thread R is inserted. In an eighth step the white warp threads of the warp thread lines 1, 3 and 4 are raised into the upper shed. In a ninth step, a green weft thread G, a blue weft thread B, and a yellow weft thread Y are inserted into the shed. In a tenth step, with warp threads in the warp thread lines 3 raised into the upper shed and with warp threads in the warp thread lines 1, 2 and 4 lying downwardly, a red weft thread R is inserted. In an eleventh step the white warp threads of the warp threads of the warp thread lines 1, 2 and 4 are raised into the upper shed. In a twelfth step a green weft thread G, a blue weft thread B, and a yellow weft thread G are inserted into the shed. The repeat II is distinguished solely in that in each case the black weft threads are raised into the upper shed in place of the white weft threads.

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Figure 9 shows the front side of a section of fabric which was woven in accordance with the above described repeats.

Figure 10 shows sections along a warp thread line with different interlacings of the warp threads. The representations are self explanatory and will thus not be described.

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With the method of the invention twenty eight color impressions can be produced in the cells by corresponding interlacing of the weft threads with a white warp thread (Figure 11a) or a black warp thread (Figure 11b). These color impressions are provided with a code. The Figures 11a and 11b show a coded color scale.

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These colors result with a float length of the weft thread over one warp thread. The float length of the weft thread can jointly extend over up to seven warp thread lines. The intensity of the color impression is determined by the float length and by the color of the warp threads, i.e. with two warp threads twenty eight intensities result.

10 From this there results in total one hundred and ninety six color impressions, and indeed from the product of the number of colors multiplied by the number of intensities and the number of the warp threads ($14 \times 7 \times 2 = 196$).

In another embodiment of the method, six weft threads in the colors red R, green G, blue B, yellow Y, black BL and white W are inserted. This method has the advantage
15 that the number of color impressions is further increased.

The Figures 12a and 12b show a coded color scale.

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Patent Claims

1. Method for the manufacture of colored, patterned areal textile structures using weaving technology with warp threads which form a shed and weft threads, characterized in that at least four weft threads of different base color are inserted in a specific constant sequence such that a constant cell is formed with at least one warp thread and in that the weft threads can be tied in the cell with the warp thread such that a color cell with a specific color impression is produced.
2. Method in accordance with claim 1, characterized in that the weft threads are used in a selectable sequence.
3. Method in accordance with claim 1 or 2, characterized in that weft threads are used in the base colors red (R) , green (G), blue (B), and yellow (Y).
4. Method in accordance with claim 1, characterized in that the weft threads are used in the sequence red (R), green (G), blue (B), and yellow (Y).
5. Method in accordance with one of the claim 2 to 4, characterized in that in combination with a warp thread of a specific color up to 14 color impressions are produced in the cell.
6. Method in accordance with claim 1 or 2, characterized in that six weft threads of different base color are inserted.
7. Method in accordance with claim 1 or 6, characterized in that a warp thread pair in different colors is used, with each warp thread being selectively used for the tying in.
8. Method in accordance with claim 5 or 7, characterized in that a warp thread pair is used in the colors black and white and in that a warp thread is selected for the weaving of the cell such that the color intensity of the cell is changed.



9. Method in accordance with claim 5 or 7, characterized in that, on the changing of the shed, the warp thread pair is moved along a warp thread line.
- 5 10. Method in accordance with one of the preceding claims, characterized in that a first weave repeat is produced which includes two cells lying alongside one another in the weft direction and two cells lying after one another in the warp direction.
- 10 11. Method in accordance with one of the preceding claims, characterized in that a plurality of cells are combined into a second weave repeat such that special weft thread float lengths are produced and a desired color intensity is achieved.
12. Method in accordance with claim 11, characterized in that the weft thread float
15 length is restricted to twenty warp threads.
13. Method in accordance with one of the preceding claims, characterized in that a constant weft density is provided in the color cell.
- 20 14. Method in accordance with one of the preceding claims, characterized in that a different weft density is provided for at least one weft thread of a color cell.
15. Method in accordance with claim 1,5,6,7,8,9,10,11 or 12, characterized in that a code is specified for each color impression and in that the code is stored in a
25 color scale.
16. System for carrying out the method in accordance with one of the preceding claims, characterized by a loom with a Jacquard machine and/or a CAD system.
- 30 17. Textiles manufactured in accordance with the method, characterized by a colored patterned fabric for labels, tie material, dress material, upholstery material and the like.

