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(54) **A METHOD OF MAKING A FINISHED ARTICLE OF TEXTILE**

(57) A method of making a finished article of textile by assembling individual pattern pieces of woven fabric having a desired structure, which individual pattern pieces of woven fabric are made on a programmable loom capable of weaving a fabric containing areas of different structures, which method comprises the following steps of: determine the shape of the individual pattern pieces of woven fabric to be assembled to form the finished article of textile. Determine how to place the individual pattern pieces of woven fabric on one or more woven fabrics, such that the area(s) between the individual pattern pieces of woven fabric is minimized and program-

ming the loom so that the loom weaves one of the one or more specific fabrics containing individual pattern pieces of woven fabric woven with their desired structure while at least some of the space between the individual pattern pieces of woven fabric is woven with a different structure having a smaller average density than the density of any of the individual pattern pieces of woven fabric woven with their desired structure. Cutting out the individual pattern pieces of woven fabric from the woven fabric and creating the finished article of textile by assembling the individual pattern pieces of woven fabric woven with their desired structure.

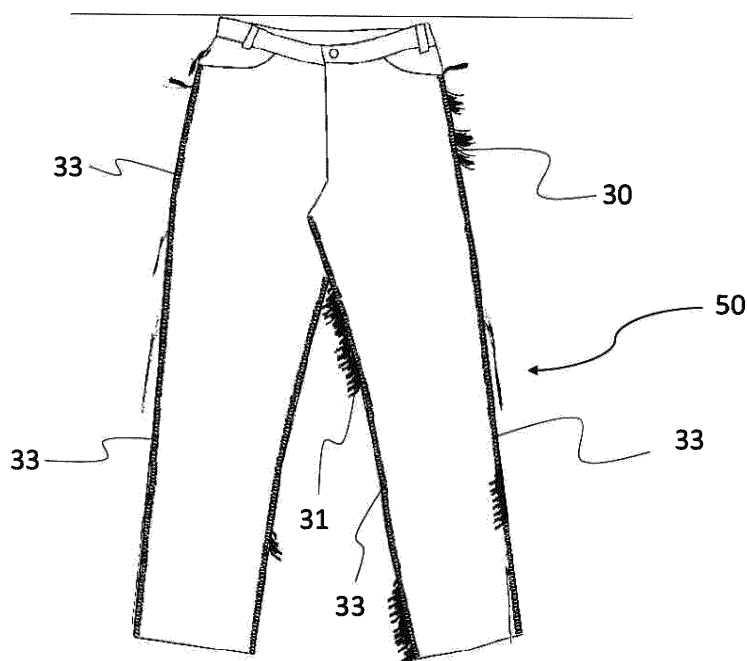


Fig. 4

Description

[0001] The invention relates to a method of making a finished textile article from individual pattern pieces of woven fabric as described in claim 1.

[0002] A loom is a device used to weave fabric. The basic purpose of any loom is to hold threads under tension to facilitate the interweaving of other threads. The threads under tension, are called the warp and the threads being interwaved between the threads of the warp are called the weft. The warp threads are normally the threads going in the vertical direction and the weft threads are normally the threads going in horizontal direction

[0003] The precise shape of the loom and its mechanics may vary, but the basic function is the same.

[0004] When textile objects are made, it is done by cutting a woven fabric into individual pattern pieces of woven fabric having the desired structure which normally are sewn together to form the finished textile object. Since the weaving with weft and warp forms pieces of an essentially rectangular shape, while the individual pattern pieces of woven fabric having the desired structure may have many other shapes, which cannot be assembled to form the essentially rectangular shape, the cut-out of individual pattern pieces of woven fabric having the desired structure from an essentially rectangular piece of woven fabric in prior art technics will always result in having a waste of woven fabric.

[0005] To minimize this waste, software is today being used to determine how the individual pattern pieces of woven fabric, having the desired structure, should be cut out from one or more pieces of woven fabric such that a minimal waste of woven fabric is achieved.

[0006] However, even computer aided optimization is not optimal, as there will still be woven fabric between the individual pattern pieces of woven fabric having the desired structure being cut out and this woven fabric will go to waste. Further, in the prior art, the spaces between the individual pattern pieces of fabric having the desired structure are woven with a density corresponding to the density of the individual pattern pieces of woven fabric having the desired structure. The high quality and thus high density of the discarded material also results in unnecessary losses.

[0007] It is an object of the invention to provide a method by which waste is reduced.

[0008] Another object of the invention is to provide an alternative solution.

[0009] This is achieved by programming the loom so that the loom weaves individual pattern pieces of woven fabric having the desired structure, while at least some of the space in between the individual pattern pieces of woven fabric having the desired structure is woven with a different structure having a smaller density than the density of any of the individual pattern pieces of woven fabric having the desired structures and subsequently cut out the individual pattern pieces of woven fabric hav-

ing the desired structure from the woven fabric and creating the finished textile object by assembling the individual pattern pieces of woven fabric having the desired structure. With the invention it is thus realized that the spaces between the individual pattern pieces of woven fabric having the desired structure can be woven so that they have a lower density than the density of the individual pattern pieces of woven fabric having the desired structure.

[0010] Since the fabric that is cut free is normally discarded, the invention will thus cause less waste, as the fabric that is free-cut according to the invention simply has a lower density than corresponding free-cut fabric in the known technique.

[0011] Ideally, the areas with pattern pieces of woven fabric having the desired structure should be arranged (located) on the woven fabric pieces in such a way that all weft threads and all warp threads pass through at least one pattern piece of woven fabric having the desired structure. At the same time, all pattern pieces must be placed in such a way that the total area of low density is minimized as much as possible. This naturally causes the individual warp and weft threads to often pass through several individual areas of low density (pattern pieces of woven fabric having the desired structure). However, all the pattern pieces of woven fabric having the desired structure on such a piece of woven fabric can be separated from each other in a simple manner.

[0012] According to an embodiment of the invention, the method comprises following step; cutting off the selvedge (the border) of the one or more woven fabrics containing the pattern pieces of woven fabric with the desired structure and further cutting all the individual warp threads and/or all the weft threads that connect any pattern piece of woven fabric with the desired structure to another pattern piece of woven fabric with the desired structure, the cutting of the individual warp and weft threads must (preferably) only be done once, and the cut shall be made between the pattern pieces of woven fabric having the desired structure through which the individual weft and warp threads pass.

[0013] When weaving, the edges of the woven fabric are usually formed by passing the horizontal weft thread over or under an outermost warp thread, after which the direction is reversed, and the weft thread is brought back on the opposite side of the outermost warp thread. Thereby, the two threads will be "locked" to each other at the edges of the woven fabric. By cutting the edges of the woven fabric, this lock is destroyed and thereby all weft and warp threads can be untangled, regardless of whether they are connected to pattern pieces of woven fabric having the desired structure.

[0014] In an embodiment, all pattern pieces are placed on a woven fabric such that all the weft and the warp threads are connected to at least one pattern piece of woven fabric having the desired structure. If this first criterion is fulfilled and no weft thread or warp thread is interconnecting any pattern pieces of woven fabric hav-

ing the desired structure, then all the pattern pieces of woven fabric having the desired structure on said woven fabric will be released (by untangling) from each other by simply cutting off the selvage. However normally the woven fabric is made such that it contains several pattern pieces of woven fabric having the desired structure that are connected directly (not via the edges) by warp and/or weft threads that pass through one pattern piece of woven fabric having the desired structure and further through another pattern piece of woven fabric having the desired structure. This connection may or may not (In case the two pattern pieces of woven fabric having the desired structure touch each other) be through an area having smaller density. In case this second criterion is fulfilled the individual pattern pieces of woven fabric having the desired structure may be released from each other by cutting all the individual warp and weft threads that connect the individual pattern pieces of woven fabric having the desired structure, the cutting shall be made between the individual pattern pieces of woven fabric having the desired structure and provided that only the weft and warp threads that are connecting pattern pieces of woven fabric having the desired structure are cut and further that they are only cut once, the thereby cut weft and warp threads will still be connected (attached) to a pattern piece of woven fabric having the desired structure. In this embodiment, the actual separation of the pattern pieces of woven fabric having the desired structure subsequently takes place by untangling these still connected weft and warp threads. To facilitate untangling, these areas are therefore woven with a loose structure and preferably with structure adapted such that the untangling can be done by hand or machine power.

[0015] By assembling thus disconnected individual pattern pieces of woven fabric having the desired structure so that they form the finished article of textile, the still attached threads will protrude from the joints themselves and form fringes.

[0016] According to an embodiment of the invention, the areas/pieces between the pattern pieces of woven fabric having the desired structure are woven with a density adapted so that the wefts and warps in these pieces can be untangled, preferably by hand. This - of course - also includes the scenario where the areas between the pattern pieces of woven fabric having the desired structure are not woven at all.

[0017] However, experience with having completely non-woven areas between the pattern pieces has shown that the weaving may become difficult as the areas of high density (the pattern pieces of woven fabric having the desired structure) simply moves during the weaving as the tensions that arise therein deform woven and/or the loose non-woven areas. In an embodiment of the invention these disadvantages are remedied by weaving the areas between the pattern pieces of woven fabric having the desired structure with a density that is adapted so that these are not deformed excessively by the forces (tensions/stress) that arise in the areas with high density

(pattern pieces of woven fabric having the desired structure), whereby both areas can be woven "simultaneously".

[0018] The actual adaptation of the densities so that the woven fabric is not deformed so much that weaving becomes impossible and such that the weft treads and warp thread can be untangled can be done by computer simulation or by carrying out tests where the density (the structure of the weaving) in the areas outside the pattern pieces of woven fabric having the desired structure (ie the low density regions) are raised and/or lowered until untangling is possible by hand or machine and the weaving of the different density regions can take place simultaneously. The parameters found in this way are then used in the subsequent weaving of several pieces of clothing.

[0019] In an embodiment of the invention, the finished textile object is formed by assembling individual pattern pieces of woven fabric having the desired structure that are cut out from two or more pieces of woven fabric.

[0020] Most often one cannot make an entire finished article of textile from just a single piece of woven fabric. There may also be preconditions, such as a desire/need for having the finished article of textile to contain different materials and color, which makes it impossible to make the finished article of textile from a single piece of woven fabric having a given area. The need for clothing having areas possessing different properties, as e.g. work clothing having reinforced areas, normally means that these reinforced areas have to be woven with threads being different from the threads used in other parts of the work clothing. This embodiment of the invention entails that - at least - the above-mentioned examples of finished textile articles can be produced with a reduced waste of material.

[0021] In one embodiment of the invention, the finished article of textile is made solely of individual pattern pieces of woven fabric having the desired structure, woven on programmable looms that produce woven fabric made such that the individual pattern pieces of woven fabric having the desired structure are woven with their desired structure, while the space(s) between the individual pattern pieces of woven fabric having the desired structure is woven with a different structure having a smaller average density than the average density of the individual pattern pieces of the woven fabric having the desired structure.

[0022] Other embodiments of the invention are recited in dependent claims

[0023] An embodiment of the invention will now be described with reference to the figures where:

fig. 1 shows a woven fabric containing areas of different structures,

fig. 2 shows - magnified - a part of area A encircled in fig. 1,

fig. 3 shows an embodiment of a woven fabric,

fig. 4 shows an embodiment of a pair of trousers viewed from the front.

[0024] A loom is a device used to weave fabric. The basic purpose of any loom is to hold threads under tension to facilitate the interweaving of other threads. The threads under tension, is called the warp and the threads being interwaved between the warp is called the weft.

[0025] The precise shape of the loom and its mechanics may vary, but the basic function is the same and such a loom is well known to the skilled person. Accordingly, a loom will not be explained in further details in this application.

[0026] When textile objects are made by use of prior art, it is done by cutting out pieces from a woven fabric and these pieces are sewn together to form the finished textile object. Since the weaving with weft and warp forms pieces of an essentially rectangular shape, while the individual pattern pieces of woven fabric having the desired structure have many other shapes, these pieces cannot be assembled to form the essentially rectangular shape. The cut out of individual pattern pieces of woven fabric having the desired structure from an essentially rectangular piece of woven fabric will inevitably result in having a waste of woven fabric.

[0027] Cutting these individual pattern pieces of woven fabric having the desired structure of fabric from the finished woven fabric is not a trivial problem. If this is done uncritically, for example by simply cutting out the individual pattern pieces of woven fabric having the desired structure in random order and from random places on the fabric, this will mean that large areas of obsolete size are left over when the individual pattern pieces of woven fabric having the desired structure are cut out. These areas are useless and are discarded in the prior art. However, the amount of discharged material may be minimized. In practice, this is done (today) by computers calculating how the individual pattern pieces of fabric should lie/be placed on the woven fabric to achieve the least possible waste.

[0028] The placement of the individual pattern pieces, in order to minimize waste, is by an embodiment of the invention made digitally. According to the invention, the incorporating of a structure 4 with a lesser density (loosely weaved) in the design and applying a specific cutting technique to production, the waste can be reduced even further.

[0029] Incorporating a loose weave structure in the design and applying a specific cutting technique to production, may even eliminate the waste associated with separating the pattern pieces having the desired structure

[0030] An example of how individual pattern pieces of woven fabric having the desired structure could be placed on a woven fabric is shown in figure 1.

[0031] In fig. 1 is shown a woven fabric 1 containing areas of different structures 3, 4, 5. The white areas in

figure 1 are individual pattern pieces of woven fabric having the desired structure, which are to be joined together and thereby form a finished piece of textile, or a part thereof.

[0032] The fabric 1 is made by use of a conventional programmable loom capable of weaving a fabric containing areas of different structures. In the conventional technique, all the areas to be used for the finished textile (the white areas) would be woven with a density corresponding to the density of the area 4 between these individual pattern pieces of woven fabric having the desired structure.

[0033] As seen in figure 2, this is not the case in the embodiment of the invention shown here. The areas 4 between the individual pattern pieces of woven fabric having the desired structure 3, 2, 5 are woven with an average density lower than the average density of the individual pattern pieces of woven fabric having the desired structure 2, 3, 5 to be assembled to form part - or all - of a finished piece of textile.

[0034] In this embodiment, the individual pattern pieces of woven fabric having the desired structure are woven directly on the loom and the space 4 in between is woven with a density lower than the density of the individual pattern pieces of woven fabric having the desired structure. This results in a minimized waste, even if the loosely woven areas are still discarded, the loss of fabric using the invention is less than the loss using conventional techniques where the areas between the individual pattern pieces of woven fabric having the desired structure are woven with a higher density, viz. a density substantially equal to the density of the individual pattern pieces of woven fabric having the desired structure.

[0035] If the spaces 4 are woven too loosely (to achieve minimum waste) the irregularly loosely woven area (s) will lead to extreme unbalanced tension on the loom. Continuous unbalanced tension will lead to multiple warp thread breakage resulting in a damaged fabric and potentially damaging the loom itself. The density of the loose weave structure in between the individual pattern pieces of woven fabric needs to be loose enough to be able to be taken apart in (after) the cutting process in an efficient way, and tight enough to keep a balanced tension on the loom. The loose structures may in all embodiments of the invention be woven such that the loose structures can be untangled by hand or machine.

[0036] The density of the loosely woven structure in these areas has a direct link to the material used. Its strength and thickness. A strong thick yarn would be able to operate at a higher number of lifted warp thread than a thin delicate yarn. A silk yarn for example, a cotton warp and weft made up of Nm 1/34 (50% recycled cotton, 50% virgin cotton) operates at 20 warp threads lifted (in a warp count of 40 thread $\times$ 40 threads) and 21 weft threads lifted. The warp movement dictates the tension on the loom.

[0037] In figure 3 is shown a woven fabric 1 where the individual pattern pieces of woven fabric having a desired

structure are woven directly on the woven fabric 1. The areas between the individual pattern pieces of woven fabric with the desired structure (the black areas) 10, 11, 12 are relatively small in relation to the size of the individual pattern pieces of woven fabric with the desired structure (the white areas). This efficient utilization of the woven fabric 1 is achieved by means of computers that have calculated how the individual pattern pieces of woven fabric with the desired structure should be placed on the woven fabric 1. As can also be seen in Figure 3, several of the areas between the individual pattern pieces of woven fabric with the desired structure are delimited areas.

[0038] Figure 4 shows a pair of trousers 50 made according to an embodiment of the invention. The trousers are assembled from individual pattern pieces. Fringes 30, 31 are protruding in different places from the seams 33. These fringes are weft and warp threads originating from the loose woven.

[0039] It is by the invention realized that relatively large areas of loosely woven fabric between the individual pattern pieces of woven fabric having the desired structure will tend to cause an uneven pull in the loom. This can have a negative impact on the finished result. It may therefore be advantageous to vary the density in the loosely woven areas depending on their relative size. Thus, in the example shown in Figure 3, weaving can be done with a looser structure in area 10 than in area 12. However, even the largest "loose area" will be made with a density lower than the density of the adjacent individual pattern pieces of woven fabric having the desired structure.

[0040] It is further realized by the invention that in embodiments such as shown in figure 3 all the individual pattern pieces of woven fabric having desired structure can be cut out of the woven fabric 1 without any unwoven yarn being disconnected from the individual pattern pieces of woven fabric having the desired structure. By further assembling the thus disconnected individual pattern pieces of woven fabric having the desired structure so that they form the finished article of textile, the still attached threads will protrude from the joints themselves and form fringes.

[0041] It is decorative, but also a direct outcome of the technique. In that way the technique dictates the aesthetic of the finished textile object.

[0042] In an embodiment of the invention, the invention relates to a method of making a finished article of textile having fringes. This method involves the steps of: weaving a woven fabric where the individual pattern pieces of woven fabric having the desired structure are placed adjacent or separated by areas of (loosely woven) fabric having a lower average density than the adjacent individual pattern pieces of woven fabric having the desired structure, the individual pattern pieces of woven fabric having the desired structure further being placed on the fabric such that they can be released from the woven fabric by cutting without releasing any yarn; cutting free

the individual pattern pieces of woven fabric having the desired structure without releasing any yarn; assembling the individual pattern pieces of woven fabric having the desired structure such that they form the finished article (having fringes protruding from the joints). The invention in this embodiment entails a production of finished articles of textile with a very low waste of material and under ideal conditions even zero waste production.

[0043] In an embodiment of the invention the finished textile is made of pieces of woven fabric from two pieces of woven fabric. At least one of the woven fabrics being woven such that individual pattern pieces of woven fabric are woven with their desired structure while at least some of the space between these individual pattern pieces of woven fabric is woven with a different structure having a smaller density than the density of their neighboring individual pattern pieces of woven fabric woven with their desired structure.

[0044] In an embodiment of the invention the finished piece of textile is made from individual pattern pieces of woven fabric, woven such that the individual pattern pieces of woven fabric are woven with their desired structure, while the space (s) between individual pattern pieces of woven fabric is woven with a different structure having a smaller density than the density of the individual pattern pieces of woven fabric.

Claims

1. A method of making a finished article of textile by assembling individual pattern pieces of woven fabric having a desired structure, which individual pattern pieces of woven fabric are made on a programmable loom capable of weaving a fabric containing areas of different structures, which method comprises the following steps of:

- determine the shape of the individual pattern pieces of woven fabric to be assembled to form the finished article of textile;
- determine how to place the individual pattern pieces of woven fabric on one or more woven fabrics, such that the area(s) between the individual pattern pieces of woven fabric is minimized and
- programming the loom so that the loom weaves the one or more woven fabrics containing the individual pattern pieces of woven fabric woven with their desired structure, the weaving being made such that at least some of the space between the individual pattern pieces of woven fabric is woven with a different structure having a smaller average density than the density of any of the individual pattern pieces of woven fabric woven with their desired structure;
- cutting free the individual pattern pieces of woven fabric having a desired structure;

- creating the finished article of textile by assembling the individual pattern pieces of woven fabric woven with their desired structure.
2. A method according to claim 1 comprising the step of assembling individual pattern pieces of woven fabric having the desired structure from two pieces of woven fabric, at least one of the woven fabrics being woven such that individual pattern pieces of woven fabric having the desired structure are woven with their desired structure while at least some of the space between these individual pattern pieces of woven fabric having the desired structure is woven with a different structure having a smaller density than the density of their neighboring individual pattern pieces of woven fabric having the desired structure.
 3. A method according to claim 1 or 2, which method further comprises the step of:
 - weaving the areas/pieces between the pattern pieces of woven fabric having the desired structure with a density adapted so that the wefts and warps in these areas can be untangled, preferably by hand.
 4. A method according to any of the claims 1-3, which method further comprises the step of:
 - cutting off the selvage (border) of the fabric.
 5. A method according to any of the claims 1-4, which method comprises the steps of: cutting free the individual pattern pieces of woven fabric having the desired structure, the cutting free being made by cutting all the individual warp threads and/or all the individual weft threads that connect a pattern piece of woven fabric with the desired structure to another pattern piece of woven fabric with the desired structure, the cutting being made between the pattern pieces of woven fabric and the cutting of the individual warp and weft threads must preferably only be done in one place between the pieces of woven fabric with the desired structure and preferably only between the pieces of woven fabric with the desired structure.
 6. A method according to any of the claims 1-5, which method comprises the steps of: cutting free the individual pattern pieces of woven fabric having the desired structure, the cutting free being made by cutting all the individual warp threads and/or all the individual weft threads that connect a pattern piece of woven fabric with the desired structure to another pattern piece of woven fabric with the desired structure, the cutting being made between the pattern pieces of woven fabric and the cutting of the individual warp and weft threads is only done in one place between the pieces of woven fabric with the desired structure and preferably only between the pieces of woven fabric with the desired structure.
 7. A method according to any of the claims 1-6, which method comprises the steps of: cutting free the individual pattern pieces of woven fabric having the desired structure, the cutting free being made by cutting all the individual warp threads and/or all the individual weft threads that connect a pattern piece of woven fabric with the desired structure to another pattern piece of woven fabric with the desired structure, the cutting being made between the pattern pieces of woven fabric and the cutting of the individual warp and weft threads is only done in one place between the pieces of woven fabric with the desired structure and only between the pieces of woven fabric with the desired structure.
 8. A method according to any of the claims 1-7, which method comprises the steps assembling the individual pattern pieces of woven fabric having the desired structure so that they form the finished article of textile and such that thereto still attached warp and/or weft threads are protruding from the joints themselves and form fringes.
 9. A method according to any of the claims 1-8, which method comprises the steps assembling the individual pattern pieces of woven fabric having the desired structure so that they form the finished article of textile and such that thereto still attached warp and/or weft threads are protruding from the joints themselves and form fringes on the side that is the outside of the finished article of garment when a user uses the garment
 10. A method according to any of the claims 1-9 comprising the step of making the finished article of textile by exclusively using individual pattern pieces of woven fabric having the desired structure woven on programmable looms that produce fabric (s) made such that the individual pattern pieces of woven fabric having the desired structure are woven and the space (s) between the individual pattern pieces of woven fabric having the desired structure is woven with a different structure having a smaller density than the density of the individual pattern pieces of woven fabric having the desired structure.
 11. A method according to any of the claims 1-10 comprising the step of assembling individual pattern pieces of woven fabric having the desired structure by sewing.
 12. A method according to any of the claims 1-11 comprising the step of assembling individual pattern pieces of woven fabric having the desired structure by

gluing.

- 13.** A method according to any of the claims 1-12 comprising the step of assembling all the individual pattern pieces of woven fabric having the desired structure by sewing. 5
- 14.** A method according to any of the claims 1-13 comprising the step of: determine how to place the individual pattern pieces of woven fabric on a multi-density fabric, such that the area(s) between the individual pattern pieces of woven fabric is minimized and such that each least 90% -99.9 % of the weft threads and/or warp threads are connected to at least one individual pattern piece of woven fabric. 10 15

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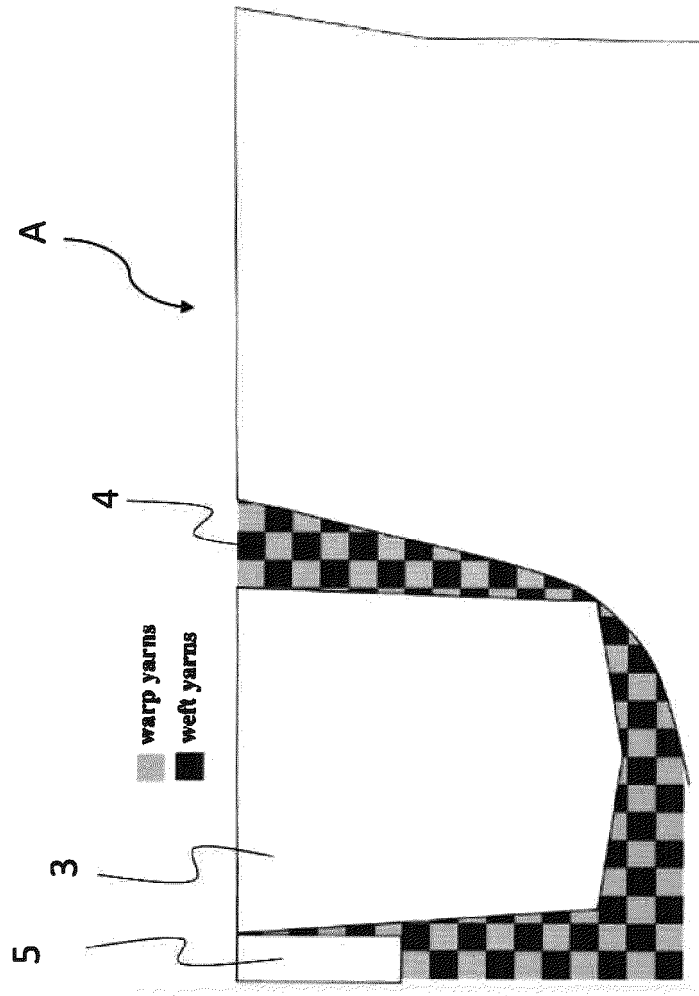


Fig. 1

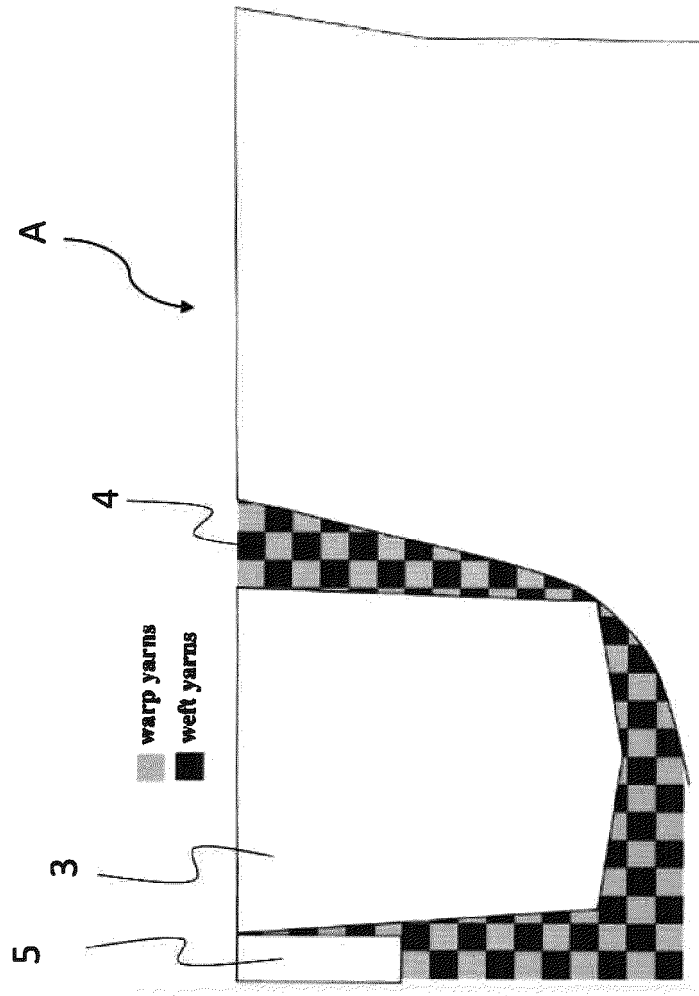


Fig. 2

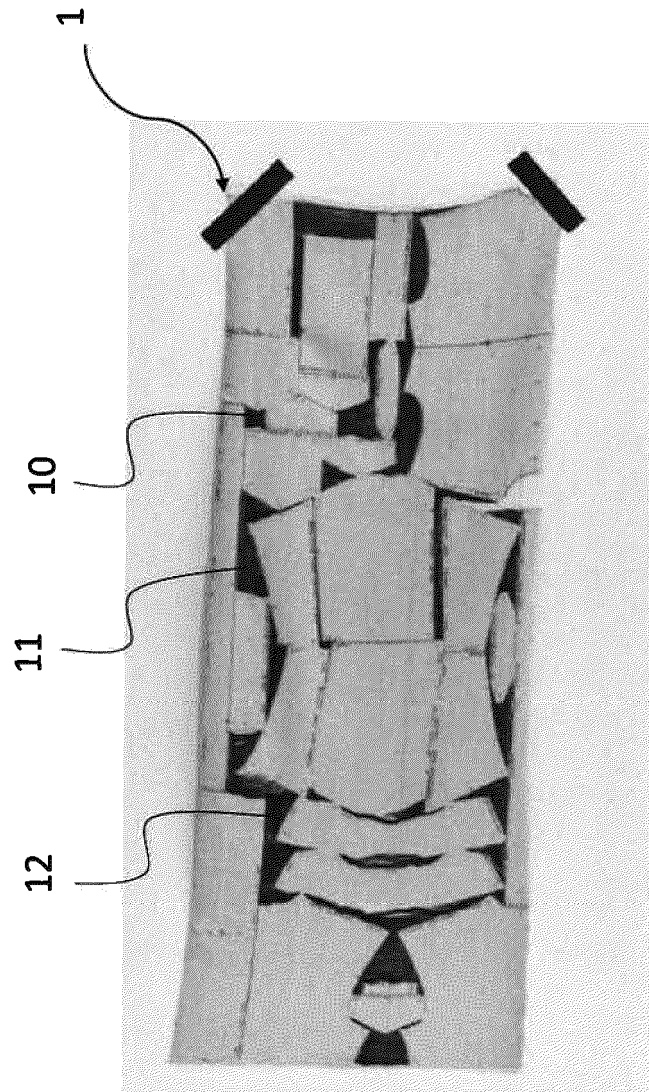


Fig. 3

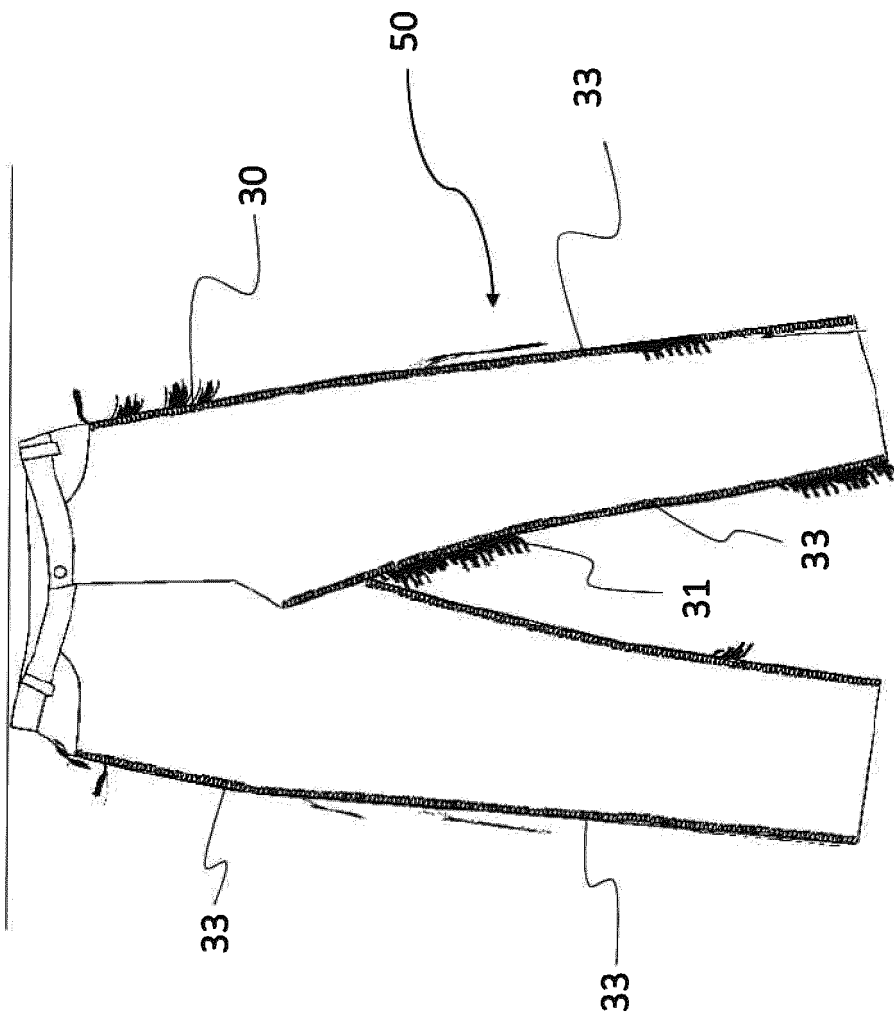


Fig. 4



EUROPEAN SEARCH REPORT

Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2008/099830 A1 (MIYAKE DESIGN JIMUSHO KK [JP]; TOSHIO FUJIWARA [JP] ET AL.) 21 August 2008 (2008-08-21) * abstract; figures 1-12 * -----	1-14	INV. D03C19/00 D03D13/00
A	US 2020/048826 A1 (THARPE RALPH BERNARR [US] ET AL) 13 February 2020 (2020-02-13) * paragraph [0104]; figures 11,12 * -----	1-14	
A	EP 0 387 766 A1 (LONATI SPA [IT]) 19 September 1990 (1990-09-19) * abstract * * column 3, lines 5-16 * * column 3, line 54 - column 4, line 14 * * column 4, line 39 - column 5, line 40 * -----	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			D03C D03D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 February 2023	Examiner Louter, Petrus
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 22 19 4907

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008099830 A1	21-08-2008	JP 2010111953 A	20-05-2010
		WO 2008099830 A1	21-08-2008
US 2020048826 A1	13-02-2020	CA 2959034 A1	03-03-2016
		CN 107075785 A	18-08-2017
		US 2016060807 A1	03-03-2016
		US 2020048826 A1	13-02-2020
		WO 2016033367 A1	03-03-2016
EP 0387766 A1	19-09-1990	CZ 284875 B6	17-03-1999
		DE 69012177 T2	19-01-1995
		EP 0387766 A1	19-09-1990
		ES 2059856 T3	16-11-1994
		IT 1228732 B	03-07-1991
		JP H0368140 B2	25-10-1991
		JP H02269847 A	05-11-1990
		US 5081854 A	21-01-1992

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82