



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.07.2008 Bulletin 2008/30

(51) Int Cl.:
D04B 21/18 (2006.01)

(21) Application number: **07425005.1**

(22) Date of filing: **05.01.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

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Remarks:

Amended claims in accordance with Rule 137(2) EPC.

(54) **Method for manufacturing a non-run elastic fabric**

(57) Described herein is a method for manufacturing a non-run elastic fabric on warp knitting machines having two thread guide bars and a needle bar, consisting in prearranging a rigid thread (2) on one of the two thread guide bars and an elastic thread (3) on the other thread guide bar, and consisting moreover in arranging a rigid thread (2) and an elastic thread (3) in phase with one another and according to a weave having a periodicity of four stitches, in which three consecutive stitches are obtained on three different consecutive needles.

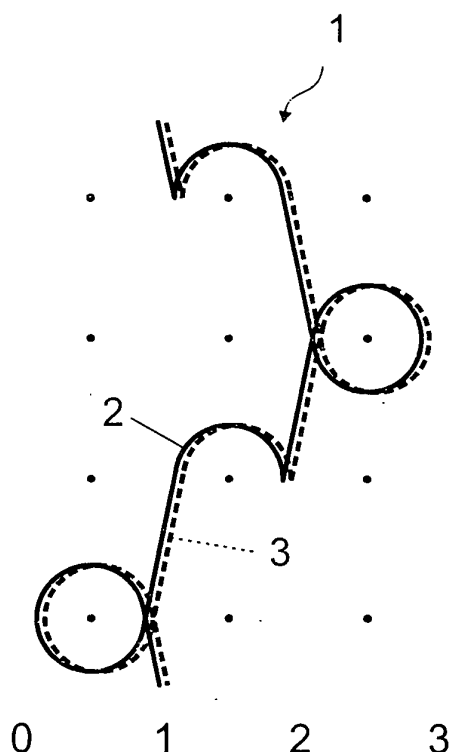


Fig. 1a

Description

[0001] The subject of the present invention is a method for manufacturing a non-run elastic fabric of the type specified in the preamble of Claim 1 and a fabric obtained with said method.

[0002] As it is known, fabrics are produced from a plurality of threads arranged according to particular periodic geometries that enable mutual link of said threads and formation of stitches.

[0003] The characteristics of the fabrics are thus determined by the geometries of the weaves, by the type of the threads, and finally by the dimensions of the individual stitches.

[0004] In particular, so-called non-run elastic fabrics are produced from a plurality of woven threads that develop in a single direction, referred to as warp.

[0005] Said fabrics are made up of a plurality of different types of threads, in particular substantially rigid threads and substantially elastic threads.

[0006] Non-run elastic fabrics are used for different applications and in particular for garments or clothes, such as swimsuits, garments for practising sports activities, underwear and so forth.

[0007] A classic fabric of the type referred to is, for example, the so-called "charmeuse" obtained via the weave of an elastic thread and a rigid thread according to a combination of tricot and double tricot weaves, which bestows elasticity and a high-quality appearance upon the fabric.

[0008] The fabrics in question are industrially produced by purposely designed weaving machines, with loom of a warp/weft type, which comprise a system for conveying and movement of the threads, which are inserted through the eyelets of purposely provided perforated elements, referred to as "weft takers", and fall on one or more rows of needles, arranged transversely with respect to the direction of the threads.

[0009] When said machines are activated, the weft takers and the needles are moved with reciprocating movements, whilst the threads are moved with a continuous motion. In particular, the threads present a vertical and descending continuous motion, the weft takers, which move the threads further, present a longitudinal and transverse reciprocating motion, and the needles, set underneath the weft takers and interacting with the threads moved by the weft takers, present a reciprocating vertical motion.

[0010] The mutual interaction of the threads and the path thereof around the needles hence give rise to the fabric. It is therefore possible to vary the characteristics of the fabric by varying the parameters of movement of the elements that make up the machine, in particular by setting the longitudinal movement of the weft takers, and maintaining the periodic motion of the needles and the continuous motion of the threads constant.

[0011] The known art cited above presents certain important drawbacks.

[0012] In particular, it is found that it is not possible to produce very fine, light non-run elastic fabrics having a sufficient resistance to wear and to the various stresses.

[0013] The above results in various drawbacks, which derive in particular from the need to have stitches of relatively large dimensions.

[0014] For instance, swimsuits produced with known fabrics do not constitute a sufficient barrier to sand, which can penetrate between the stitches and pass through the fabric. Furthermore, they do not present a high resistance to chemical agents, in particular to chlorine compounds, which are frequently used in swimming pools and running water.

[0015] Said fabrics moreover present long drying times, once again on account of their large thickness.

[0016] Finally, known elastic fabrics have an inhomogeneous elasticity in width and in length and a reduced resistance to "pilling", i.e., to a physical process that leads to the formation of small irregular balls of fibre on the surface of the fabrics.

[0017] In this situation the technical task underlying the present invention is to devise a non-run elastic fabric capable of substantially overcoming the drawbacks referred to.

[0018] Within said technical aim, an important purpose of the invention is to produce a non-run elastic fabric having a high resistance to chemical agents and to mechanical stresses.

[0019] Another important purpose of the invention is to obtain a non-run elastic fabric with a high degree of fineness.

[0020] A further purpose of the invention is to obtain a non-run elastic fabric with a reduced mass per unit surface.

[0021] Last but not least aim of the invention is to obtain a fabric that will present a homogeneous elasticity in any direction.

[0022] The technical aim and purposes specified above are achieved by a non-run elastic fabric according to the annexed Claim 1.

[0023] Preferred embodiments of the invention are highlighted in the subordinate claims.

[0024] Further characteristics and advantages of the invention are clarified more fully by the ensuing detailed description of preferred embodiments of the invention, with reference to the attached plate of drawings, wherein:

Figure 1a shows the basic scheme for manufacturing a first example of fabric according to the invention;

Figure 1b shows the basic scheme for the disposition of a first thread designed to produce the fabric illustrated in Figure 1a;

Figure 1c presents the basic scheme for the disposition of a second thread designed to produce the fabric illustrated in Figure 1a;

Figure 2a shows the basic scheme for manufacturing a second example of fabric according to the in-

vention;

Figure 2b shows the basic scheme for the disposition of a first thread designed to produce the fabric illustrated in Figure 2a; and

Figure 2c presents the basic scheme for the disposition of a second thread designed to produce the fabric illustrated in Figure 2a.

[0025] With reference to the figures listed above, the fabric according to the invention is designated as a whole by 1.

[0026] It is produced by weaving machines with looms of a single-knit warp/weft type having at least two rows of weft takers.

[0027] Said machines are of a known type, marketed, for example, by the German firm LIBA Maschinenfabrik GmbH under the name of Copcentra.

[0028] As previously mentioned, said machines comprise a system for conveying and moving the threads, appropriately on beams, which are inserted in two bars of perforated weft takers and conveyed to a bar of needles.

[0029] In particular, the two weft-taker bars are arranged one at the front and one at the rear, and can be moved with rectilinear reciprocating motion in a longitudinal direction and in a transverse direction.

[0030] Moreover conveyed to each weft-taker bar are threads of one and the same type, whilst to the two different bars there can be conveyed selectively two different types of threads.

[0031] The threads fall then in a position corresponding to the needles, around which they can form open or closed stitches.

[0032] Upon activation of said machines, the interaction and phasing of the vertical and constant movement of the thread, provided by the system of reciprocating longitudinal and transverse conveying of the weft-taker bars and by the system of reciprocating vertical conveying of the needles gives rise to the weave of the threads and to the creation of the fabric.

[0033] In particular, the movement of the thread-conveying system, the reciprocating movement of the needles, and the reciprocating longitudinal movement of the weft-taker bars always remain substantially constant, irrespective of the type of weave, whilst the reciprocating transverse movement of the weft-taker bars is regulated according to the type of fabric. Said movement enables in fact the threads to pass around one or the other needle and form open or closed stitches.

[0034] The fabric 1 is produced using two different types of threads: a substantially rigid thread 2 and a substantially elastic thread 3.

[0035] Defined herein as "substantially rigid" is a thread having a percentage stretch lower than 20% of the total length, whilst defined as "substantially elastic" is a thread having a percentage stretch higher than 80% of the total length.

[0036] The rigid thread 2 is made of materials of a

known type; for example, it may be a polyamide multifilament thread; alternatively, it may be made of polyester, polypropylene or some other material.

[0037] It appropriately has a titre comprised between 22 and 60 dTex and more appropriately between 22 and 44 dTex. As it is known the titre, which is the linear density of the threads, is measured in dTex, which corresponds to the weight in grams of ten kilometres of yarn (1 dTex = 0.1 g/km).

[0038] The elastic thread 3 is made of elastic material of a known type, in particular elastomeric polymers, for example, polyurethane. It moreover has appropriately a titre comprised between 22 and 60 dTex and more appropriately between 33 and 44 dTex.

[0039] Furthermore, the ratio between the linear density expressed in dTex of the rigid threads 2 and elastic threads 3 is appropriately comprised between 0.5 and 0.9.

[0040] To manufacture the fabric 1 the threads 2 and 3 are set on the machines described above.

[0041] In particular, the rigid threads 2 are arranged on the conveying system and on the eyelets of the front weft-taker bar; each weft taker of the front bar is traversed by a rigid thread 2.

[0042] Likewise, the elastic threads 3 are arranged on the conveying system and on the eyelets of the rear weft-taker bar; each weft taker of the rear bar is traversed by an elastic thread 3.

[0043] Alternatively, it is possible to exchange the position of the threads and arrange the elastic thread 3 on the front bar and the rigid thread 2 on the rear bar.

[0044] The threads 2 and 3 are arranged according to weaves determined by the reciprocating movement of the two weft-taker bars.

[0045] For example, illustrated in the attached figures are two preferred solutions for manufacturing the fabric 1.

[0046] Schematically illustrated in said figures are the basic schemes that are repeated periodically, to lead to the formation of the fabric 1.

[0047] Also shown in the above figures is a plurality of points, each of which represents a needle in a temporary position of its own. The needles are arranged in horizontal rows (hereinafter "ranks") and vertical rows (hereinafter "lines"). The lines are in actual fact defined by the periodic movement of the threads and of the needles themselves, whereas the ranks are defined by the horizontal positioning of the needles themselves, so that a line of needles represents the periodic positioning of one and the same needle, whilst each rank represents a plurality of different needles.

[0048] The blank spaces between the lines are numbered with natural numbers from zero to four and represent the positions in which the weft takers arrange the threads.

[0049] In particular, the weft takers can arrange the threads in a circle around a needle so as to form a closed stitch, or according to a non-closed path, so as to form an open stitch.

[0050] The fabric 1 is obtained starting from a basic portion, which includes a rigid thread 2, represented by a solid line, and an elastic thread 3, represented by a dashed line.

[0051] The two threads 2 and 3 of a basic portion are arranged in phase; i.e., in each rank they are always arranged on the same needle. Furthermore, the threads 2 and 3 are appropriately always arranged parallel, i.e., they always follow the same identical path and compose on the same needle one and the same type of closed or open stitch.

[0052] Furthermore, the two threads 2 and 3 are arranged according to a weave having a periodicity of four stitches, in which three consecutive stitches are obtained on different needles. By the term "consecutive" are meant non-skipped needles.

[0053] Said weave can comprise closed or open stitches; in particular, of the four stitches envisaged, the closed stitches can vary in number from zero to four, whilst the remaining stitches will be open.

[0054] Illustrated in Figures 1a-1c is a weave in which closed stitches are envisaged, alternating with open stitches, and in particular the closed stitches are set on the two lateral needles of the three needles.

[0055] Said weave is defined by a movement of the two front and rear weft-taker bars, which occurs in parallel to enable the described parallel arrangement of the threads 2 and 3, in a position corresponding to the spaces from 1 to 0 in a first rank, from 1 to 2 in a second rank, from 2 to 3 in a third rank, and from 2 to 1 in the fourth rank.

[0056] Illustrated in Figures 2a-2c is a weave in which closed stitches are envisaged, alternating with open stitches, and in particular the closed stitches are set on the central needle.

[0057] Said weave is defined by a parallel movement of the front and rear weft-taker bars in positions corresponding to the spaces from 0 to 1 in a first rank, from 2 to 1 in a second rank, from 3 to 2 in a third rank, and from 1 to 2 in the fourth rank.

[0058] The weave described is moreover produced on machines having a density of needles per inch (1 inch = 2.54 cm) comprised between 32 and 44, and an identical density of weft takers per inch. In particular, the density of needles per inch is comprised between 40 and 44.

[0059] Said density of needles and weft takers determines the size of the stitches, and consequently the number of stitches of the fabric and the surface density of stitches. The density of needles per unit of measurement is thus a parameter useful for identifying rapidly a fundamental characteristic of a fabric.

[0060] The method described can be produced also on different types of weaving machines, provided that the characteristics of the basic portion, of the threads that make it up, and of the surface density of stitches remain the same.

[0061] The invention achieves important advantages.

[0062] In particular, the solution of using two threads 2 and 3 arranged in phase or in parallel means that the

elastic threads 3 do not work in phase opposition and do not cross the rigid threads 2 themselves.

[0063] This solution leads to a considerable reduction in the mechanical friction within the fabric 1 and to a consequent longer duration of the two threads and in particular of the elastic thread 3.

[0064] Furthermore, it has been found that the action of the mechanical friction, present in elastic fabrics of a known type, combined with the corrosive chemical action of certain substances present in water, and in particular sodium hypochlorite present in swimming pools and running water, leads to a rapid degradation of known fabrics.

[0065] Instead, the fabric 1 maintains a high resistance also in the presence of sodium hypochlorite precisely by virtue of the practically absent mechanical wear.

[0066] Furthermore, other important advantages are provided by the disposition of the threads 2 and 3. In fact, the basic portion of the weave presents a number of vertical stitches very close to the number of horizontal stitches, and hence a substantially square shape.

[0067] Thanks to said characteristics, it is possible to produce a fabric with very fine threads and above all with a high number of stitches per unit surface, as mentioned previously.

[0068] Further advantages are provided by the selection of the threads 2 and 3 having the dimensions and characteristics indicated and made of the materials indicated.

[0069] The above characteristics can lead to manufacturing fabrics 1 that are very fine and light.

[0070] In particular, fabrics 1 are produced having a mass per unit area of 160 g/m², a thickness comprised between 0.25 and 0.80 mm and approximately 50% less than that of the classic charmeuse, with a duration equal to or longer than non-run elastic fabrics of a known type.

[0071] The fabrics 1 moreover enable, precisely by virtue of their fineness, an excellent coverage and resistance to sand.

[0072] In fact, the fineness described of the stitches that produce the fabrics 1 is such as to prevent sand or other particles from penetrating between the stitches of the fabric or passing through it.

[0073] In particular, so-called "sand tests" have been conducted on swimsuits produced with the fabric 1. Said tests substantially envisage intense use of the swimsuit on a sandy surface and measure the amount of sand imprisoned therein. They give the results in a numeric scale of values comprised between 1 and 5. The evaluation of the fabrics 1 has always yielded the maximum score that can be given.

[0074] The fineness itself moreover enables rapid drying of the fabric 1 and a pleasant sensation to the touch, seeing that the fabric 1 is perceived as a second skin instead of as a foreign body.

[0075] The fabric 1 moreover has a high transpirability and thus enables optimal dispersion of heat.

[0076] The fabric 1 moreover has an elasticity that is homogeneous in every direction by virtue of the particular

weave of fibres.

[0077] Finally, the fabric 1 has proven very resistant to pilling and curling, i.e., the tendency to roll up and curl. In fact, in appropriate tests dedicated to the two characteristics listed, the fabric 1 always yielded excellent results.

Claims

1. A method for manufacturing a non-run elastic fabric on weaving machines with loom of a warp/weft type having two weft-taker bars and a needle bar, consisting in prearranging a rigid thread (2) on one of said weft-taker bars and an elastic thread (3) on the other of said weft-taker bars, and being **characterized in that** it moreover consists in arranging said rigid thread (2) and said elastic thread (3) in phase with one another, and according to a weave having a periodicity of four stitches, in which three consecutive stitches are obtained on three different consecutive needles.
2. The method according to Claim 1, in which said rigid thread (2) and said elastic thread (3) are arranged parallel to one another.
3. The method according to Claim 1 or Claim 2, in which said needles are prearranged on said needle bar with a density comprised between 32 and 44 needles per inch.
4. The method according to Claim 3, in which said needles are prearranged on said needle bar with a density comprised between 40 and 44 needles per inch.
5. The method according to one or more of the preceding claims, in which a weave is provided presenting a closed stitch alternating with an open stitch.
6. The method according to one or more of the preceding claims, in which said rigid thread (2) is provided with a linear density comprised between 22 and 44 dTex.
7. The method according to one or more of the preceding claims, in which said elastic thread (3) is provided with a linear density comprised between 33 and 44 dTex.
8. The method according to one or more of the preceding claims, in which said rigid thread (2) and said elastic thread (3) are provided with a ratio between the linear densities comprised between 0.5 and 0.9.
9. The method according to one or more of the preceding claims, in which said weft-taker bars are set one at the front and one at the rear and in which said rigid

thread (2) is set on said front bar.

10. A fabric produced with the method according to one or more of the preceding claims.

Amended claims in accordance with Rule 137(2) EPC.

1. A method for manufacturing a non-run elastic fabric on warp knitting machines having two thread guide bars and a needle bar, consisting in prearranging a rigid thread (2) on one of said thread guide bar and an elastic thread (3) on the other of said thread guide bars, said rigid thread (2) and said elastic thread (3) being prearranged in phase with one another and said method being **characterized in that** it moreover consists in arranging said rigid thread (2) and said elastic thread (3) in accord to a weave having a periodicity of four stitches, in which three consecutive stitches are obtained on three different consecutive needles.
2. The method according to Claim 1, in which said rigid thread (2) and said elastic thread (3) are arranged parallel to one another.
3. The method according to Claim 1 or Claim 2, in which said needles are prearranged on said needle bar with, a density comprised between 32 and 44 needles per inch.
4. The method according to Claim 3, in which said needles are prearranged on said needle bar with a density comprised between 40 and 44 needles per inch.
5. The method according to one or more of the preceding claims, in which a weave is provided presenting a closed stitch alternating with an open stitch.
6. The method according to one or more of the preceding claims, in which said rigid thread (2) is provided with a linear density comprised between 22 and 44 dTex.
7. The method according to one or more of the preceding claims, in which said elastic thread (3) is provided with a linear density comprised between 33 and 44 dTex.
8. The method according to one or more of the preceding claims, in which said rigid thread (2) and said elastic thread (3) are provided with a ratio between the linear densities comprised between 0.5 and 0.9.
9. The method according to one or more of the preceding claims, in which said thread guide bars are

set one at the front and one at the rear and in which said rigid thread (2) is set on said front bar.

10. A fabric obtained starting from a basic portion, including a rigid thread (2) and an elastic thread (3), disposed in phase with one another and **characterized in that** said rigid thread (2) and said elastic thread (3) are furthermore disposed in accord to an Atlas weave with periodicity of four stitches.

11. The fabric according to Claim 1, in which said rigid thread (2) and said elastic thread (3) are arranged parallel to one another.

12. The fabric according to claim 10 or 11, in which said rigid thread (2) is provided with a linear density comprised between 22 and 44 dTex.

13. The fabric according to one or more of claims from 10 to 12, in which said elastic thread (3) is provided with a linear density comprised between 33 and 44 dTex.

14. The fabric according to one or more of claims from 10 to 13, in which said rigid thread (2) and said elastic thread (3) are provided with a ratio between the linear densities comprised between 0.5 and 0.9.

Amended claims in accordance with Rule 137(2) EPC.

ALTERNATIVE CLAIM 10

10. A fabric obtained by a warp knitting machines starting from a basic portion, including a rigid thread (2) and an elastic thread (3), disposed in phase with one another and **characterized in that** said rigid thread (2) and said elastic thread (3) are furthermore disposed with a periodicity of four stitches, in which three consecutive stitches are obtained on three different consecutive needles of said wrap knitting machine.

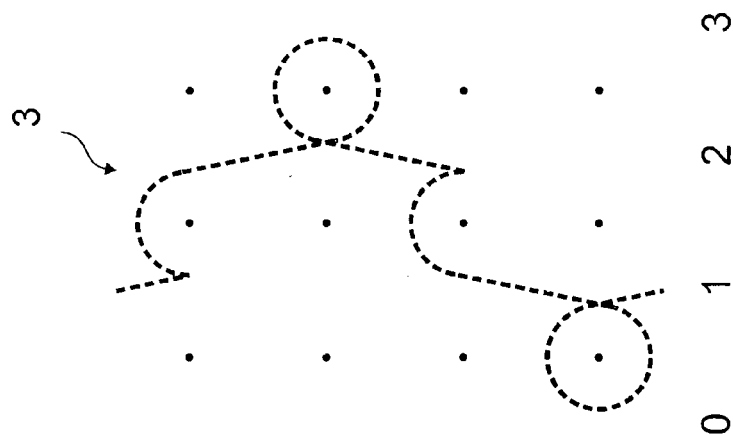


Fig. 1c

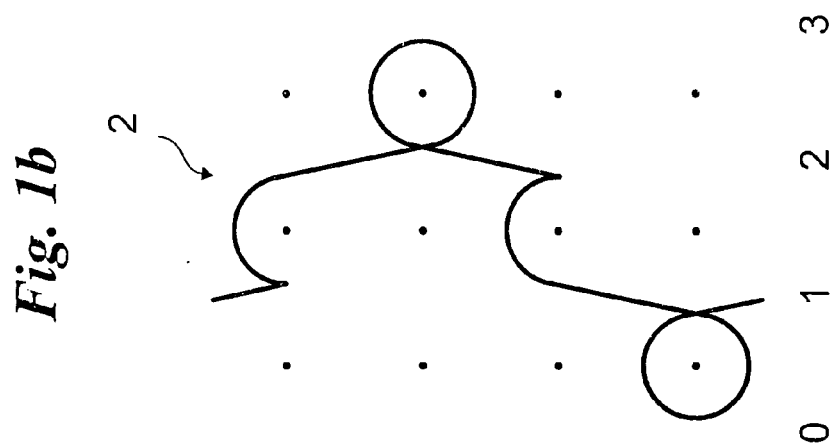


Fig. 1b

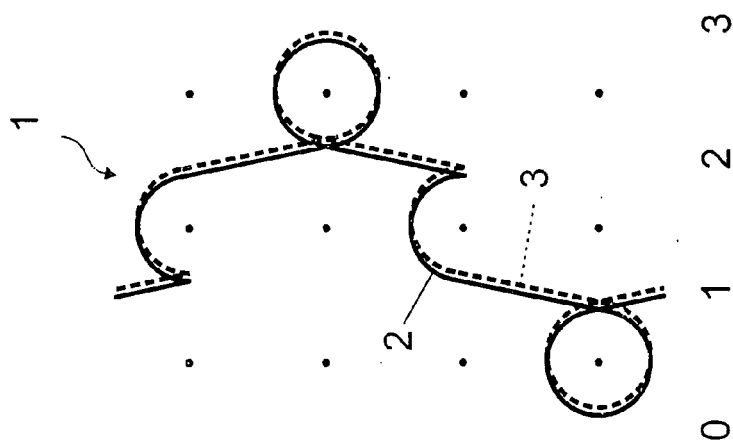


Fig. 1a

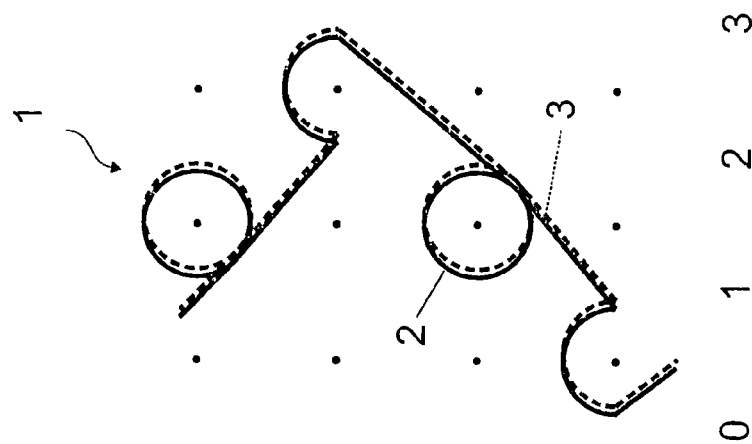


Fig. 2a

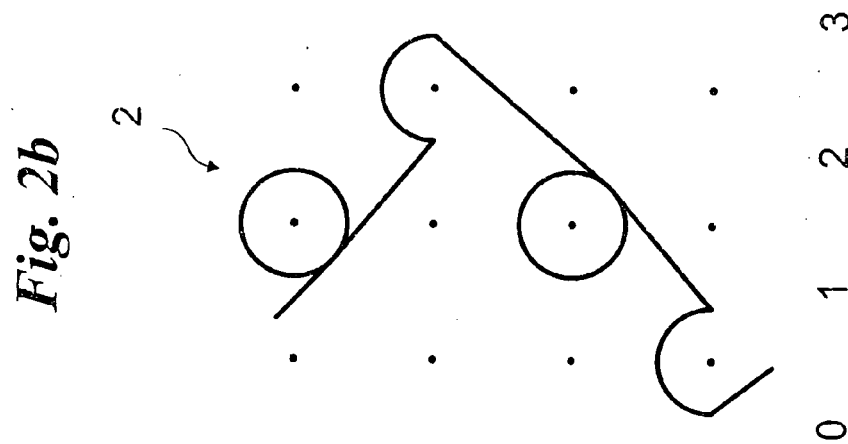


Fig. 2b

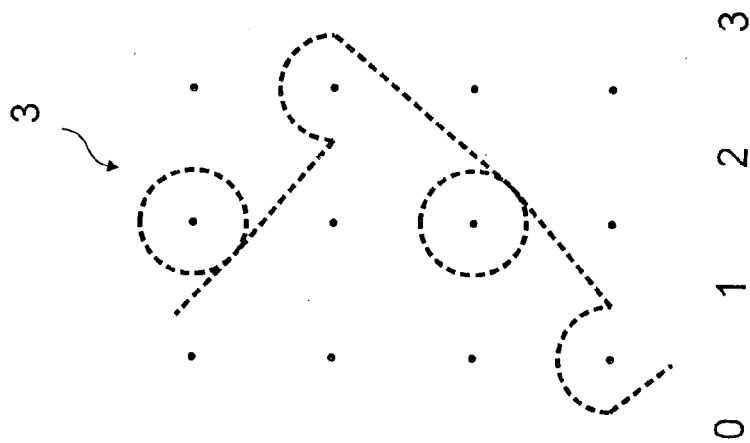


Fig. 2c



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EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5005

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 443 135 A (WACOAL CORP [JP]) 4 August 2004 (2004-08-04) * column 2, line 55 - column 3, line 5; claim 1; figures 2,4; examples 1,3 * * column 18, lines 33-48 * -----	1,2,5-10	INV. D04B21/18
A	EP 1 281 798 A (IND CENTENARI E ZINELLI SPA [IT]) 5 February 2003 (2003-02-05) * column 4, lines 29-56; claim 5; figure 3 * * column 3, line 57 - column 4, line 1; claim 1 * -----	1,2,5-7, 9,10	
			TECHNICAL FIELDS SEARCHED (IPC)
			D04B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 August 2007	Examiner Sterle, Dieter
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 42 5005

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08-08-2007

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 1443135	A	04-08-2004	CN	1464923 A	31-12-2003
			WO	03040448 A1	15-05-2003
			TW	230214 B	01-04-2005
			US	2006101863 A1	18-05-2006
			US	2004237597 A1	02-12-2004

EP 1281798	A	05-02-2003	BR	0203024 A	27-05-2003
			CN	1418997 A	21-05-2003
			KR	20030011675 A	11-02-2003
			MX	PA02007400 A	12-03-2003
			US	2003051512 A1	20-03-2003
