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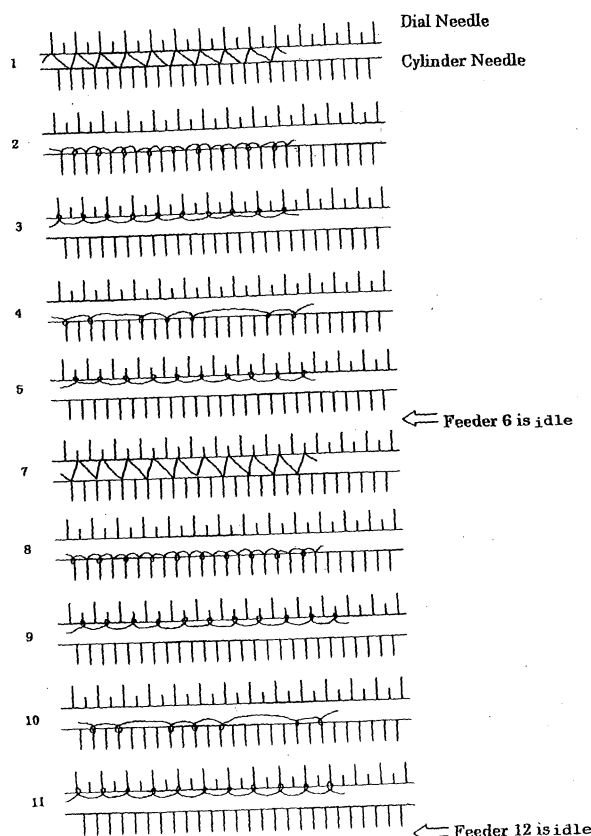
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(54) **A jacquard spacer fabric and a knitting method thereof**

(57) A knitted spacer fabric having at least one of:
(a) a knit welt 1 x 1 long stitch jacquard pattern; (b) a knit tuck 1 x 1 piqué long stitch jacquard pattern; and (c) a knit welt jacquard pattern of at least two colours ap-

pearing on the surface of the fabric. Either the cylinder side or the dial side of the knitting machine employed can be used to produce these patterns. The invention also provides methods of manufacturing such fabric.

FIG. 4



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Description

[0001] The present invention relates to a jacquard spacer fabric and a knitting method thereof. In the present invention, a "spacer fabric" refers to a two-face circular fabric consisting of a cylinder-side fabric and a dial-side fabric connected by joint yarns.

[0002] Conventionally, when manufacturing thick knit fabrics called spacer fabrics on a circular knitting machine, a double knit raceway knitting machine has been used. Spacer fabrics made on such a machine usually have solid knit surfaces. In order to produce a pattern on the surface of a knit fabric, a printed pattern is heat transferred during the finishing process or a pattern is embossed on the knit fabric surface. Spacer fabrics with patterns obtained in such a method are expensive to process, and there is not much variety in the types of patterns that can be produced. Spacer fabrics that are commonly manufactured are mostly used for garments such as sweatshirts and pyjamas. The limited variety also means that the applications of these fabrics to those other than apparel products are limited.

[0003] By making it possible to have jacquard patterns appear on the surfaces of spacer fabrics, it is expected that the applications of spacer fabrics can be expanded to include those other than apparel. For example, the excellent cushioning, insulation and moisture absorption properties of the spacer fabric can make it a perfect material for industrial applications including car seats, bedding mattresses, chair upholstery, as well as for special garments including thermal underwear and aged care products.

[0004] The object of the present invention, therefore, is to have a jacquard pattern appear on the surface of a spacer fabric.

[0005] The spacer fabric of the present invention is characterized by having at least one of the following jacquard patterns (a) - (c) appear on the surface of the fabric.

- (a) a knit welt 1 x 1 long stitch jacquard pattern
- (b) a knit tuck 1 x 1 piqué long stitch jacquard pattern
- (c) a knit welt jacquard pattern of at least two colours. These patterns can be made to appear on either the cylinder side or the dial side.

[0006] The jacquard spacer fabric of the present invention is manufactured in one of the following methods (e) - (j).

(e) At a particular feeder, the H needles or the L needles of the cylinder are pushed to the knit welt position according to the pattern to be produced, while all of the dial needles are pushed to the welt position, thereby having a knit welt 1 x 1 long stitch jacquard pattern appear on the cylinder side.

(f) At a particular feeder, the H needles or the L needles of the dial are pushed to the knit welt position

according to the pattern to be produced, while all of the cylinder needles are pushed to the welt position, thereby having a knit welt 1 x 1 long stitch jacquard pattern appear on the dial side.

(g) At a particular feeder, the L needles of the cylinder are pushed to the knit position and the H needles of the cylinder are pushed to the tuck position, or the H needles of the cylinder are pushed to the knit position and the L needles of the cylinder are pushed to the tuck position, while all of the dial needles are pushed to the welt position, to perform 1 x 1 cylinder knit tuck knitting, thereby having a knit tuck 1 x 1 piqué long stitch jacquard pattern appear on the cylinder side.

(h) At a particular feeder, the L needles of the dial are pushed to the knit position and the H needles of the dial are pushed to the tuck position, or the H needles of the dial are pushed to the knit position and the L needles of the dial are pushed to the tuck position, while all of the cylinder needles are pushed to the welt position, to perform 1 x 1 dial knit tuck knitting, thereby having a knit tuck 1 x 1 piqué long stitch jacquard pattern on the dial side.

(i) At a particular feeder, using a first colour yarn, the cylinder needles are pushed to the knit welt position according to the pattern to be produced, while all of the dial needles are pushed to the welt position; and at another feeder, using a second colour yarn, the cylinder needles are pushed to the knit welt position according to the pattern to be produced, while all of the dial needles are pushed to the welt position, thereby having a knit welt jacquard pattern of at least two colours appear on the cylinder side.

(j) At a particular feeder, using a first colour yarn, the cylinder needles are pushed to the knit welt position according to the pattern to be produced, while all of the cylinder needles are pushed to the welt position; and at another feeder, using a second colour yarn, the dial needles are pushed to the knit welt position according to the pattern to be produced, while all of the cylinder needles are pushed to the welt position, thereby having a knit welt jacquard pattern of at least two colours appear on the dial side.

[0007] The apparatus for manufacturing a spacer fabric according to the present invention is a double knit circular knitting machine, preferably, a computerized jacquard knitting machine. Because the thickness of the spacer fabric is proportional to the gap between the cylinder and the dial, the cylinder may have to be modified as necessary.

[0008] The length of the latch of the cylinder needle must also be considered in accordance with the thickness of the fabric. In FIG. 1, in order to obtain a certain thickness of the fabric, which is a characteristic of the spacer fabric, the gap (x) between the cylinder and the

dial must be of a certain width. In this case, at the tuck yarn feeder, the distance between the upper end (b) of the cheek of the dial needle and the upper end (a) of the hook of the cylinder needle in the tuck position must be such that it is sufficient to feed tuck yarn via the yarn carrier. Moreover, the lower end (c) of the latch of the cylinder needle has to be lower than the upper end (d) of the cylinder. In other words, it is necessary to raise the tuck position of the cylinder as high as possible. Accordingly, the length of the latch of the cylinder needle must be sufficiently long.

[0009] There is no limit in the type of yarn that can be used in the spacer fabric of the present invention. Whatever type of yarn that suits the purpose can be chosen. It is also possible to use different types of yarn. For example, filaments made of synthetic fibres such as polyester, nylon, polypropylene, polyethylene, etc., spun yarn made of natural fibres such as wool, cotton, linen, etc., blended yarn, twisted union yarn and combined filament yarn, etc., can be used. There is also no limit in the thickness of yarn either. Whatever thickness that is appropriate for the knit texture and knitting machine, etc., can be chosen.

[0010] Embodiments of the present invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is an enlarged drawing of a knitting needle in the knitting section,

FIG. 2 shows a cam line according to the first embodiment,

FIG. 3 is a pattern development chart for the cylinder side according to the first embodiment, in which patterns up to the twelfth feeder are shown,

FIG. 4 shows knit texture diagrams according to the first embodiment,

FIG. 5 shows a cam line according to the third embodiment,

FIG. 6 is a pattern development chart for the cylinder side according to the third embodiment, in which patterns up to the twelfth feeder are shown, and FIG. 7 shows knit texture diagrams according to the third embodiment.

First embodiment

A knit welt 1 x 1 long stitch jacquard spacer fabric

[0011] This fabric is knit using a double knit computerized knitting machine (V-LEC4C 30" 20G 48F 1862N). The cylinder and dial cams are adjusted so as to show a cam line as shown in FIG. 2.

[0012] At the first feeder, the L needles of both the dial and the cylinder are in the tuck position while their H needles are in the welt position to knit a 1 x 1 two-face tuck. This feeder is called a "knot" feeder, which connects the dial-side fabric and the cylinder-side fabric using tuck yarns.

[0013] At the second feeder, the L needles of the cylinder are in the knit position and the H needles of the cylinder are in the welt position, while all of the dial needles are in the welt position to perform 1 x 1 cylinder jersey knitting (knit welt knitting). This feeder is equipped with a plate that presses the tuck knot yarn from the back of the cylinder needles so that the tuck knot yarn is cleared from the cylinder needles.

[0014] At the third feeder, the L needles of the dial are in the knit position and the H needles of the dial are in the welt position, while all of the cylinder needles are in the welt position to perform 1 x 1 dial jersey knitting (knit welt knitting). This feeder is equipped with a plate that presses the tuck knot yarn from the back of the dial needles so that the tuck knot yarn is cleared from the dial needles.

[0015] At the fourth feeder, the H needles of the cylinder are pushed to the knit welt position according to the pattern to be produced, while all of the dial needles are pushed to the welt position. A long stitch is formed using the portion of the cylinder needles that are in the welt position.

[0016] At the fifth feeder, the H needles of the dial are pushed to the knit position and the L needles of the dial are pushed to the welt position, while all of the cylinder needles are pushed to the welt position to perform 1 x 1 dial jersey knitting (knit welt knitting).

[0017] At the sixth feeder, all of the dial and cylinder needles are pushed to the welt position, making the feeder idle.

[0018] From the seventh feeder to the twelfth feeder, the needles opposite to those at the first to the sixth feeder are activated to perform knitting. For example, the L needles in the knit position at the first to the sixth feeder correspond to the H needles in the knit position at the seventh to the twelfth feeder, while the L needles in the welt position at the first to the sixth feeder correspond to the H needles in the knit position at the seventh to the twelfth feeder.

[0019] From the twelfth feeder onward, the knitting methods of the first to the twelfth feeder are repeated four times until the 48th feeder.

[0020] FIG. 3 is a pattern development chart for the cylinder side according to the first embodiment. Patterns up to the twelfth feeder are shown. Knit welt 1 x 1 long stitch jacquard patterns appear at the fourth and the tenth feeder. The yarns employed in the different feeders referred to in the chart are as follows:

Knot Feeder : Polyester Textured Yarn 280T-48 (feeders 1 and 7) ;

Cylinder 1 X 1 Jersey Feeder : Polyester Bright Silk Yarn 167T-48 (feeders 2 and 8);

Cylinder Jacquard Feeder : Polyester Textured Yarn 167T-48 (feeders 4 and 10);

Dial Jersey Feeder : Polyester Textured Yarn 167T-48 (feeders 5, 9 and 11).

[0021] FIG. 4 shows knit texture diagrams according to the first embodiment.

Second embodiment

A knit tuck piqué long stitch jacquard spacer fabric

[0022] The second embodiment is the same as the first embodiment except that at the second feeder, the L needles of the cylinder are pushed to the knit position, the H needles of the cylinder are pushed to the tuck position, and all of the dial needles are pushed to the welt position to perform 1 x 1 cylinder knit tuck knitting.

Third embodiment

A knit welt two-colour jacquard spacer fabric

[0023] This fabric is knit, using a double knit computerized knitting machine (V-LEC4C 30" 20G 48F 1862N). The cylinder and dial cams are adjusted so as to show a cam line as shown in FIG. 5.

[0024] At the first feeder, the L needles of both the dial and the cylinder are in the tuck position while their H needles are in the welt position to knit a 1 x 1 two-face tuck. This feeder is called a "knot" feeder, which connects the dial-side fabric and the cylinder-side fabric using tuck yarns.

[0025] At the second feeder, using a first colour yarn, the cylinder needles are pushed to the knit welt position according to the pattern to be produced, while all of the cylinder needles are pushed to the welt position. This feeder is equipped with a plate that presses the tuck knot yarn from the back of the cylinder needles so that the tuck knot yarn is cleared from the cylinder needles.

[0026] At the third feeder, the L needles of the dial are in the knit position and the H needles of the dial are in the welt position, while all of the cylinder needles are in the welt position to perform 1 x 1 dial jersey knitting (knit welt knitting). This feeder is equipped with a plate that presses the tuck knot yarn from the back of the dial needles so that the tuck knot yarn is cleared from the dial needles.

[0027] At the fourth feeder, using a second colour yarn, the cylinder needles are pushed to the knit welt position according to the pattern to be produced, while all of the dial needles are pushed to the welt position. This feeder is equipped with a plate that presses the tuck knot yarn from the back of the cylinder needles so that the tuck knot yarn is cleared from the cylinder needles.

[0028] At the fifth feeder, the H needles of the dial are pushed to the knit position and the L needles of the dial are pushed to the welt position, while all of the cylinder needles are pushed to the welt position to perform 1 x 1 dial jersey knitting (knit welt knitting).

[0029] At the sixth feeder, all of the dial and cylinder needles are pushed to the welt position, making the feeder idle.

[0030] From the seventh feeder to the twelfth feeder, the needles opposite to those at the first to the sixth feeder are activated to perform knitting. For example,

the L needles in the knit position at the first to the sixth feeder correspond to the H needles in the knit position at the seventh to the twelfth feeder, while the L needles in the welt position at the first to the sixth feeder correspond to the H needles in the knit position at the seventh to the twelfth feeder.

[0031] From the twelfth feeder onward, the knitting methods of the first to the twelfth feeder are repeated four times until the 48th feeder.

[0032] FIG. 6 is a pattern development chart for the cylinder side according to the third embodiment. Patterns up to the twelfth feeder are shown. The yarns employed in the different feeders referred to in the chart are as follows:

Knot Feeder : Polyester Textured Yarn 280T-48 (feeders 1 and 7),

Cylinder First Color Feeder : Polyester Black Textured Yarn 167T-48 (feeders 2 and 8),

Cylinder Second Color Feeder : Polyester Textured Yarn 167T-48 (feeders 4 and 10),

Dial Jersey Feeder : Polyester Textured Yarn 167T-48 (feeders 5, 9 and 11).

[0033] FIG. 7 shows knit texture diagrams according to the third embodiment.

[0034] In all of the above embodiments, jacquard patterns are made to appear on the cylinder side, but they can also be made to appear on the dial side.

[0035] According to the present invention, the following effects can be achieved.

1. Spacer fabrics incorporating a jacquard pattern texture can be used for applications other than general garments.

2. Conventionally, the applications of spacer fabrics have been limited to garments. By making it possible to have jacquard patterns appear on the surfaces of spacer fabrics, the present invention realizes novel, jacquard spacer fabrics that take advantage of the excellent cushion properties of the spacer fabric. Such jacquard spacer fabrics can be used for car seats and furniture upholstery, etc.

3. By making it possible to have jacquard patterns appear on the surfaces of spacer fabrics, the present invention realizes novel, jacquard spacer fabrics that take advantage of the excellent insulation properties of the spacer fabric. Such jacquard spacer fabrics can be used for thermal garments including thermal underwear for women and thermal outerwear, etc.

4. By making it possible to have jacquard patterns appear on the surfaces of spacer fabrics, the present invention realizes novel, jacquard spacer fabrics that take advantage of the excellent moisture absorption properties of the spacer fabric. Such jacquard spacer fabrics can be used for aged care fabrics and bedding fabrics, etc.

Claims

1. A spacer fabric **characterized by** having at least one of the following jacquard patterns (a) - (c) appear on the surface of the fabric.
 - (a) a knit welt 1 x 1 long stitch jacquard pattern
 - (b) a knit tuck 1 x 1 piqué long stitch jacquard pattern
 - (c) a knit welt jacquard pattern of at least two colours.
2. A method for manufacturing a jacquard spacer fabric using a double knit circular knitting machine having a cylinder and a dial, in which at a particular feeder, the H needles or the L needles of the cylinder are pushed to the knit welt position according to the pattern to be produced, while all of the dial needles are pushed to the welt position, thereby having a knit welt 1 x 1 long stitch jacquard pattern appear on the cylinder side.
3. A method for manufacturing a jacquard spacer fabric using a double knit circular knitting machine having a cylinder and a dial, in which at a particular feeder, the H needles or the L needles of the dial are pushed to the knit welt position according to the pattern to be produced, while all of the cylinder needles are pushed to the welt position, thereby having a knit welt 1 x 1 long stitch jacquard pattern appear on the dial side.
4. A method for manufacturing a jacquard spacer fabric using a double knit circular knitting machine having a cylinder and a dial, in which at a particular feeder, the L needles of the cylinder are pushed to the knit position and the H needles of the cylinder are pushed to the tuck position, or the H needles of the cylinder are pushed to the knit position and the L needles of the cylinder are pushed to the tuck position, while all of the dial needles are pushed to the welt position, to perform 1 x 1 cylinder knit tuck knitting, thereby having a knit tuck 1 x 1 piqué long stitch jacquard pattern appear on the cylinder side.
5. A method for manufacturing a jacquard spacer fabric using a double knit circular knitting machine having a cylinder and a dial, in which at a particular feeder, the L needles of the dial are pushed to the knit position and the H needles of the dial are pushed to the tuck position, or the H needles of the dial are pushed to the knit position and the L needles of the dial are pushed to the tuck position, while all of the cylinder needles are pushed to the welt position, to perform 1 x 1 cylinder knit tuck knitting, thereby having a knit tuck 1 x 1 piqué long stitch jacquard pattern on the dial side.
6. A method for manufacturing a jacquard spacer fabric using a double knit circular knitting machine having a cylinder and a dial, in which at a particular feeder, the L needles of the cylinder are pushed to the knit position and the H needles of the cylinder are pushed to the tuck position, or the H needles of the cylinder are pushed to the knit position and the L needles of the cylinder are pushed to the tuck position, while all of the dial needles are pushed to the welt position, to perform 1 x 1 cylinder knit tuck knitting, and at another feeder, the H needles or the L needles of the cylinder are pushed to the knit welt position according to the pattern to be produced, while all of the dial needles are pushed to the welt position, thereby having a knit tuck 1 x 1 piqué texture and a knit welt 1 x 1 long stitch jacquard pattern appear on the cylinder side.
7. A method for manufacturing a jacquard spacer fabric using a double knit circular knitting machine having a cylinder and a dial, in which at a particular feeder, the L needles of the dial are pushed to the knit position and the H needles of the dial are pushed to the tuck position, or the H needles of the dial are pushed to the knit position and the L needles of the dial are pushed to the tuck position, while all of the cylinder needles are pushed to the welt position, to perform 1 x 1 dial knit tuck knitting, and at another feeder, the H needles or the L needles of the dial are pushed to the knit welt position according to the pattern to be produced, while all of the cylinder needles are pushed to the welt position, thereby having a knit tuck 1 x 1 piqué texture and a knit welt 1 x 1 long stitch jacquard pattern appear on the dial side.
8. A method for manufacturing a jacquard spacer fabric using a double knit circular knitting machine having a cylinder and a dial, in which at a particular feeder, using a first colour yarn, the cylinder needles are pushed to the knit welt position according to the pattern to be produced, while all of the dial needles are pushed to the welt position; and at another feeder, using a second colour yarn, the cylinder needles are pushed to the knit welt position according to the pattern to be produced, while all of the dial needles are pushed to the welt position, thereby having a knit welt jacquard pattern of at least two colours appear on the cylinder side.
9. A method for manufacturing a jacquard spacer fabric using a double knit circular knitting machine having a cylinder and a dial, in which at a particular feeder, using a first colour yarn, the dial needles are pushed to the knit welt position according to the pattern to be produced, while all of

the cylinder needles are pushed to the welt position;
and at another feeder, using a second colour yarn,
the dial needles are pushed to the knit welt position
according to the pattern to be produced, while all of
the cylinder needles are pushed to the welt position, 5
thereby having a knit welt jacquard pattern of at
least two colours appear on the dial side.

10. A method as claimed in any of claims 2 to 9, in which
at the tuck yarn feeder, a sufficient distance for feed- 10
ing tuck yarn via the yarn carrier is provided be-
tween the upper end (b) of the cheek of the dial nee-
dle and the upper end (a) of the hook of the cylinder
needle in the tuck position, and that the lower end 15
(c) of the latch of the cylinder needle is lower than
the upper end (d) of the cylinder.

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FIG. 1

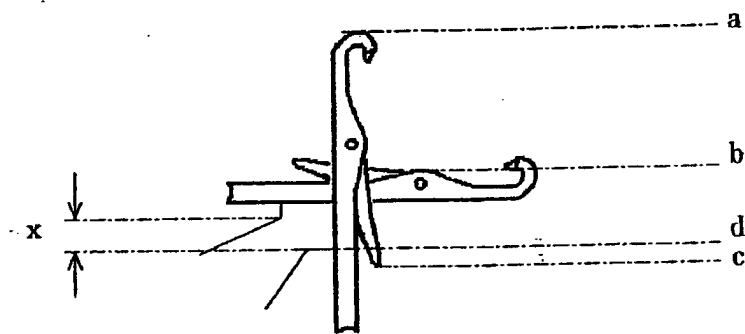


FIG. 2

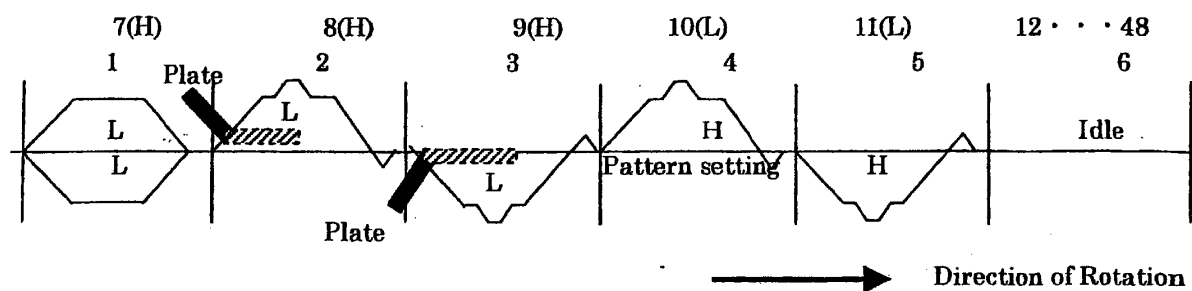


FIG. 3

12	-	-	-	-	-	-	-	-	Idle Feeder
11	-	-	-	-	-	-	-	-	Dial L Knit
10	○	-	○	-	■	-	○	-	Jacquard Feeder
9	-	-	-	-	-	-	-	-	Dial H Knit
8	-	○	-	○	-	○	-	○	Cylinder H Knit
7	-	△	-	△	-	△	-	△	Knot Feeder
6	-	-	-	-	-	-	-	-	Idle Feeder
5	-	-	-	-	-	-	-	-	Dial H Knit
4	-	○	-	○	-	■	-	○	Jacquard Feeder
3	-	-	-	-	-	-	-	-	Dial L Knit
2	○	-	○	-	○	-	○	-	Cylinder L Knit
1	△	-	△	-	△	-	△	-	Knot Feeder

■ Explanation of Signs

○ : Knit

△ : Tuck

- : Welt

■ : Long stitch formed portion

FIG. 4

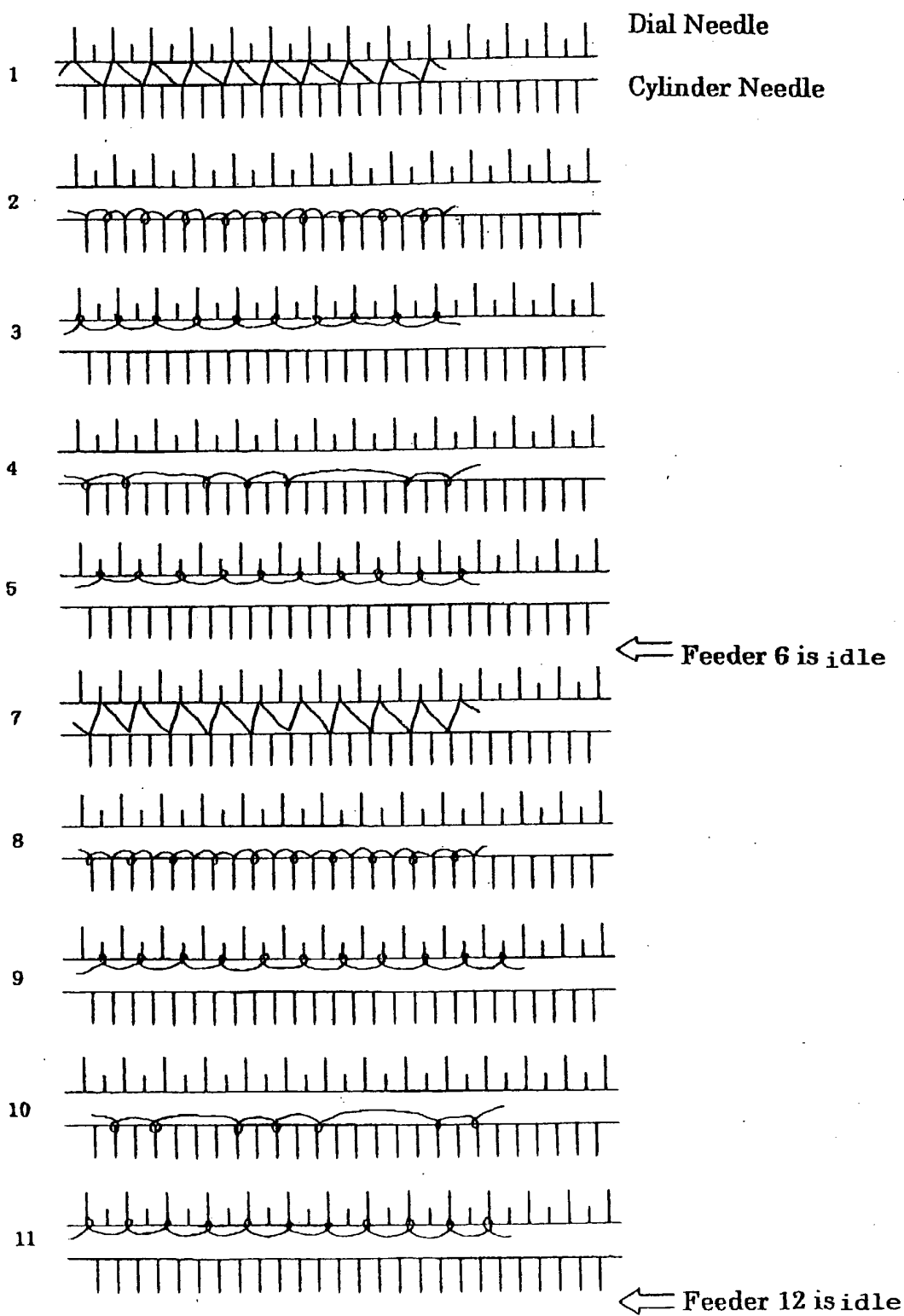


FIG. 5

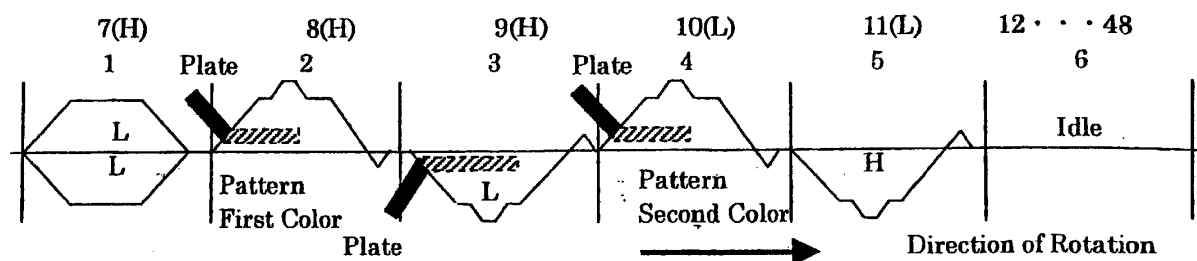


FIG. 6

12	-	-	-	-	-	-	-	-	Idle Feeder
11	-	-	-	-	-	-	-	-	Dial L Knit
10	-	-	-	-	○	○	○	○	Cylinder Second Color Knit
9	-	-	-	-	-	-	-	-	Dial H Knit
8	○	○	○	○	-	-	-	-	Cylinder First Color Knit
7	-	△	-	△	-	△	-	△	Knot Feeder
6	-	-	-	-	-	-	-	-	Idle Feeder
5	-	-	-	-	-	-	-	-	Dial H Knit
4	-	-	-	-	○	○	○	○	Cylinder Second Color Knit
3	-	-	-	-	-	-	-	-	Dial L Knit
2	○	○	○	○	-	-	-	-	Cylinder First Color Knit
1	△	-	△	-	△	-	△	-	Knot Feeder

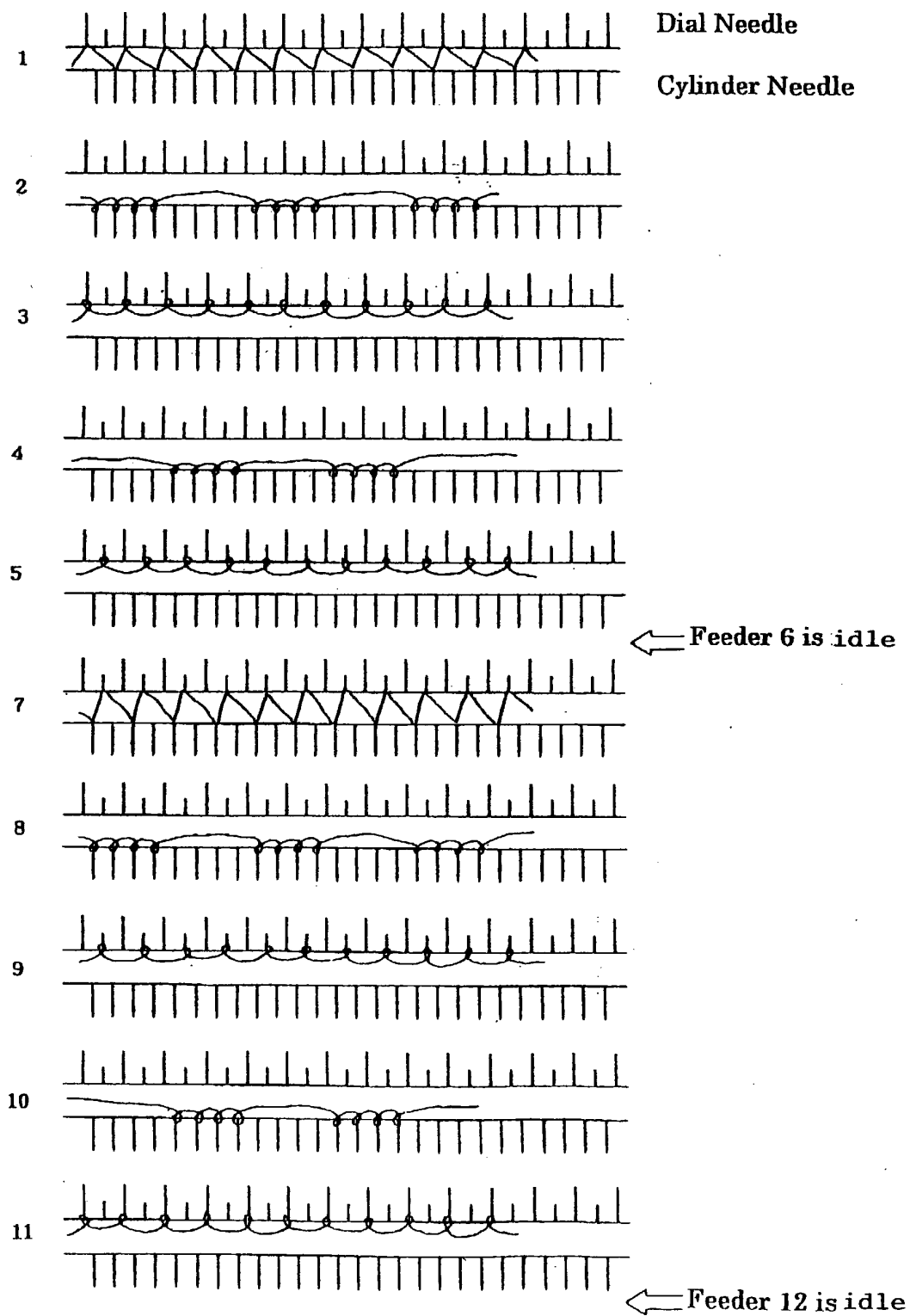
■ Explanation of Signs

○ : Knit

△ : Tuck

- : Welt

FIG. 7





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 03 25 1848

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 735 145 A (PERNICK BRUCE M) 7 April 1998 (1998-04-07) * column 4, line 57-60; figures 3,5 *	1-4	D04B1/00
Y	* column 3, line 22-24 * * column 3, line 62-64 * * column 7, line 51-53 *	5-9	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 10 July 2003	Examiner Sterle, D
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EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 25 1848

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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10-07-2003

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