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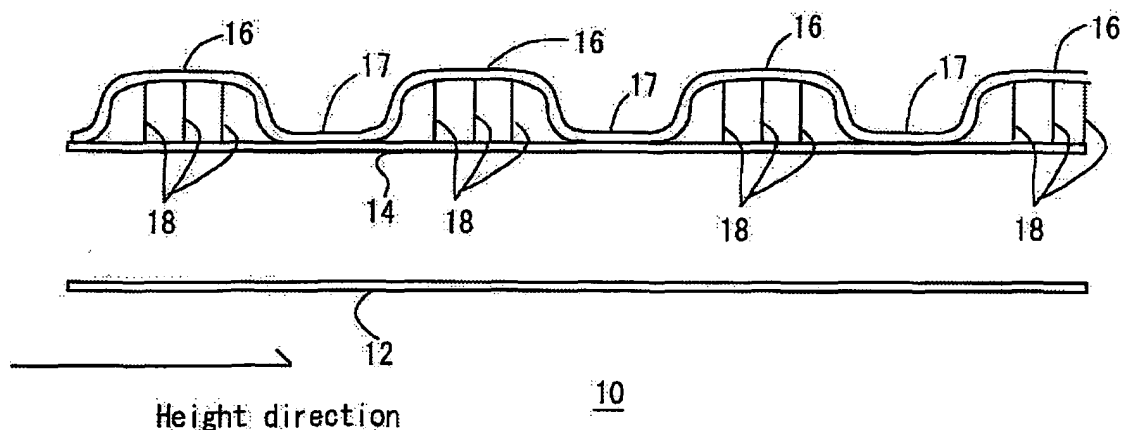
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(54) **Three-dimensional knitted fabric, method of knitting same, and supporter**

(57) The present invention provides a three-dimensional knitted fabric (10), which has an outer layer knitted fabric (16) and an inner layer knitted fabric (14). The outer layer knitted fabric (16) and the inner layer knitted fabric (14) are connected to each other by a connecting yarn (18), such that convex sections where the outer layer knitted fabric (16) and the inner layer knitted fabric (14) are separated from each other by the connecting yarn

(18), and concave sections (17) where the outer layer knitted fabric (16) and the inner layer knitted fabric (14) are attached to each other with no gaps therebetween, are alternately repeated. Further the three-dimensional knitted fabric (10) is seamless. The present invention provides a flexible three-dimensional knitted fabric (10) knitted seamlessly and having sufficient cushion characteristics, and is suitable as a supporter.

FIG. 6



Description

[0001] The present invention relates to a three-dimensional knitted fabric, a method of knitting the same, and a supporter.

[0002] In three-dimensional knitted fabrics the front and rear knitted fabrics are connected with connecting yarns, and a space is knitted between the front and rear knitted fabrics by the elasticity of the connecting yarns. Three-dimensional knitted fabrics with uneven surfaces are disclosed by Patent Document 1 (Japanese Patent Publication No. 2002-294539), a gap is present at the concave sections of the three-dimensional knitted fabrics between the front and rear knitted fabrics. This affects the flexibility of the three-dimensional knitted fabrics. Since in the three-dimensional knitted fabrics do not have any sections where the front and rear knitted fabrics are not directly connected in any portion, the elastic yarns need to be bent when the three-dimensional knitted fabrics are bent. This results in a reduction of the flexibility. Therefore, the three dimensional knitted fabrics according to Patent Document 1 are not suitable for supporters or the like to be bent during use. Furthermore, according to Patent Document 1, the three-dimensional knitted fabrics are knitted by warp knitting not by a flat knitting machine.

[0003] Patent Document 1: JP2002-294539

[0004] An object of the present invention is to provide a three-dimensional knitted fabric, which is knitted seamlessly, provides sufficient cushion characteristics and is flexible, a method of knitting such a three-dimensional knitted fabric, and a supporter.

[0005] A three-dimensional knitted fabric of the present invention is one that has at least an outer layer knitted fabric and an inner layer knitted fabric, characterized in that the outer layer knitted fabric and the inner layer knitted fabric are connected to each other with a connecting yarn, that convex sections where the outer layer knitted fabric and the inner layer knitted fabric are separated from each other by the connecting yarn and concave sections where the outer layer knitted fabric and the inner layer knitted fabric are attached to each other with no gaps therebetween are alternately repeated, and that the three-dimensional knitted fabric is seamless.

[0006] In this three-dimensional knitted fabric of the present invention, the convex sections provide cushion characteristics in order to protect, for example, a human body from an external force. The concave sections of the three-dimensional knitted fabric make the three-dimensional knitted fabric flexible. Therefore, the three-dimensional knitted fabric may deform in response to a movement of the human body, etc. or a motion of a joint, etc. Furthermore, the three-dimensional knitted fabric of the present invention may be produced seamlessly into a required dimension on a flat knitting machine. Note that the term "seamlessly" means that the three-dimensional knitted fabric with an inner layer, an outer layer and a connecting yarn may be knitted seamlessly, and includes

the options of sewing accessories and other parts to the three-dimensional knitted fabric.

[0007] The supporter comprising the three-dimensional knitted fabric of the present invention bends at the concave sections thereof, it is suitable to movements of the human body and the like, protects the human body and the like with the elasticity of the convex sections thereof, and may be produced seamlessly.

[0008] It is preferred that the number of courses in the outer layer knitted fabric is greater than the number of courses in the inner layer knitted fabric, at the convex sections and along a height direction of the three-dimensional knitted fabric. In this manner, the inner layer knitted fabric of the three-dimensional knitted fabric is made flat, and the outer layer knitted fabric of the same is expanded outward.

[0009] It is preferred that the three-dimensional knitted fabric comprises the three layers of the outer layer knitted fabric, the inner layer knitted fabric, and a rear knitted fabric, that the outer layer knitted fabric is disposed on one side of the inner layer knitted fabric, the rear knitted fabric is disposed on the other side of the inner layer knitted fabric, and that the inner layer knitted fabric and the rear knitted fabric configure a tube extending in a height direction of the three dimensional knitted fabric. In this manner, an arm, a leg and the like of the human body may be passed through the tube of the three-dimensional knitted fabric.

[0010] The method of knitting a three-dimensional knitted fabric according to the present invention is a method of knitting a three-dimensional knitted fabric having at least an outer layer knitted fabric and an inner layer knitted fabric, on a flat knitting machine that has at least a pair of needle beds and is capable of transferring the knitted fabric between the needle beds. The method is characterized in that the method executes the steps of: knitting the outer layer knitted fabric on one of the needle beds; knitting the inner layer knitted fabric on the other of the needle beds; connecting the outer layer knitted fabric and the inner layer knitted fabric on a connecting yarn such that the outer layer knitted fabric and the inner layer knitted fabric are separated from each other with the connecting yarn on the needle beds; and knitting the outer layer knitted fabric and the inner layer knitted fabric such that the outer layer knitted fabric and the inner layer knitted fabric are attached to each other with no gaps therebetween, on the needle beds, to thereby knit the three-dimensional knitted fabric seamlessly such that convex sections where the outer layer knitted fabric and the inner layer knitted fabric are separated from each other with the connecting yarn and concave sections where the outer layer knitted fabric and the inner layer knitted fabric are attached to each other with no gaps therebetween, are alternately repeated.

[0011] According to the present invention, a flat knitting machine may knit seamlessly the three-dimensional knitted fabric in which the convex sections where the outer layer knitted fabric and the inner layer knitted fabric are

separated from each other with the connecting yarn, and the concave sections where the outer layer knitted fabric and the inner layer knitted fabric are attached to each other with no gaps therebetween, are alternately repeated. In this specification, the descriptions on the three-dimensional knitted fabric may be applied to the method of knitting the three-dimensional knitted fabric and to the supporter. The order of the steps executed in the method of knitting the three-dimensional knitted fabric may be changed depending on the situation, and there are not special orders in the step of knitting the outer layer knitted fabric on one needle bed and the step of knitting the inner layer knitted fabric on the other needle bed. The step of knitting the outer layer knitted fabric on one needle bed and the step of knitting the inner layer knitted fabric on the other needle bed may repeatedly be executed as many times as needed. The step of connecting the outer layer knitted fabric and the inner layer knitted fabric to each other with the connecting yarn and the step of knitting the outer knitted fabric and the inner layer knitted fabric such that they are attached to each other with no gaps therebetween may also repeatedly be executed as many times as needed.

[0012]

FIG. 1 is a front view of a three-dimensional knitted fabric (supporter) of an embodiment;

FIG. 2 is a side view of the three-dimensional knitted fabric of the embodiment;

FIG. 3 is a diagram showing a state in which the three-dimensional knitted fabric of the embodiment is applied to a human body;

FIG. 4 is a diagram showing a three-dimensional knitted fabric of a modified example and a three-dimensional knitted fabric of a comparative example;

FIG. 5 is a plan view of a flat knitting machine;

FIG. 6 is a diagram schematically showing the three-dimensional knitted fabric of the embodiment along a height direction thereof;

FIG. 7 is a diagram showing a state in which the three-dimensional knitted fabric of the embodiment is latched onto needle beds of the flat knitting machine; and

FIG. 8 is a diagram showing a method of knitting the three-dimensional knitted fabric of the embodiment.

[0013] Best modes for carrying out the present invention are described hereinafter. The scope of the present invention should be interpreted based upon the patent claims with the possibility of modifications in accordance with the well-known techniques.

[Embodiment]

[0014] FIGS. 1 to 8 illustrate an embodiment. FIGS. 1 to 3 show a three-dimensional knitted fabric of the embodiment, which is a supporter. The white part in the knitted fabric in FIGS. 1 to 3 are the substantial part of this

three-dimensional knitted fabric, which are simply described as "three-dimensional knitted fabric" hereinafter. The three-dimensional knitted fabric is knitted of three layers, i.e., a rear knitted fabric, an inner layer knitted fabric, and an outer layer knitted fabric shown sequentially from right to left of FIG. 2. The inner layer knitted fabric and the outer layer knitted fabric are connected to each other by a connecting yarn and are joined to each other with no gaps therebetween, at a plurality of parts arranged at regular intervals along a height direction of the three-dimensional knitted fabric. Joining the outer layer knitted fabric and the inner layer knitted fabric to each other with no gaps therebetween is called "closing stitches." The inner layer knitted fabric is invisible in FIGS. 1 to 3 as it is positioned between the rear knitted fabric and the outer layer knitted fabric. The connecting yarn is also invisible in FIGS. 1 to 3 as it is positioned between the inner layer knitted fabric and the outer layer knitted fabric. The number of courses (the number of rows of stitches in the height direction) knitted in the outer layer knitted fabric is greater than the number of courses knitted in the inner layer knitted fabric. As a result, the length of the outer layer knitted fabric in the height direction, the knitting length is greater than that of the inner layer knitted fabric, and the three-dimensional knitted fabric consequently expands outward. The inner layer knitted fabric has a flat front surface to fit to a human body and the like. The number of courses in the rear knitted fabric is smaller than those of the inner layer knitted fabric and the outer layer knitted fabric. The number of stitches along a course direction (a knitting width direction) in the rear knitted fabric is also smaller than those of the inner layer knitted fabric and the outer layer knitted fabric. For this reason, as shown in FIGS. 1 and 2, the three-dimensional knitted fabric is bent into an L-shape with the outer layer knitted fabric protruding into the inside and is also bent such that the outer layer knitted fabric covers an area larger than half the circumference of an arm. Colored parts at top and bottom ends of the three-dimensional knitted fabric shown in FIGS. 1 to 3 represent the knitting start part and the knitting end part, and there are no connecting yarns. The structures of these parts are, for example, rib structures but may be plain structures. The inner layer knitted fabric and the outer layer knitted fabric have, for example, a plain structure but may have a rib structure or the like.

[0015] The inner layer knitted fabric, the outer layer knitted fabric and the rear knitted fabric are knitted by a yarns with appropriate strength and stretchability. The connecting yarn is knitted by wooly nylon made of, for example, multifilament nylon yarn or other yarn with appropriate cushion characteristics. The connecting yarn may also be a monofilament, and in that case a hard three-dimensional knitted fabric is obtained. The material and other characteristics of the yarn for the three-dimensional knitted fabric are determined according to the purpose of the three-dimensional knitted fabric. The three-dimensional knitted fabric may be used as a supporter for an arm, a leg, an elbow and a knee, and may also be

used in a part of a sock lower than the ankle, a helmet. They may be for sport activities or for medical purpose. Moreover, the three-dimensional knitted fabric of the embodiment may be used as a cover for protecting one surface of a column, a pipe or the like. The three-dimensional knitted fabric of the present embodiment has the convex sections where spaces are knitted between the outer layer knitted fabric and the inner layer knitted fabric by the connecting yarn and the concave sections where the outer layer knitted fabric and the inner layer knitted fabric are attached to each other with no gaps therebetween. They are alternately repeated. The three-dimensional knitted fabric of the embodiment is made elastic by the cushion characteristics in the convex sections to protect the human body, and is also made bendable at the concave sections so as to be bent in response to a movement of the human body.

[0016] FIG. 4 shows a three-dimensional knitted fabric of a modified example (left) and a three-dimensional knitted fabric of a comparative example (right), and the difference therebetween is whether the existence or the absence of the connecting yarn between the outer layer knitted fabric and the inner layer knitted fabric. In the three-dimensional knitted fabric on the left-hand side (the modified example), wooly nylon is the connecting yarn and filled in a gap between the inner layer knitted fabric and the outer layer knitted fabric with tucking them. The three-dimensional knitted fabric on the right-hand side (the comparative example), on the other hand, has no connecting yarns. In both the right and left three-dimensional knitted fabric, the outer layer knitted fabric and the inner layer knitted fabric are joined to each other at regular intervals, with no gaps therebetween. The three-dimensional knitted fabric of the comparative example lacks the cushion characteristics because no connecting yarns are used therein. Two layers of the outer layer knitted fabric and the inner layer knitted fabric protect an arm, a leg and the like. The three-dimensional knitted fabric of the modified example provides the cushion characteristics by the connecting yarn between the inner layer knitted fabric and the outer layer knitted fabric, and the connecting yarn is compressed in response to an external force, thereby protecting a human body or the like from the external force.

[0017] FIG. 5 shows a flat knitting machine 2 used in the embodiment, which has a pair of front and rear needle beds 4, 6. The flat knitting machine 2 may have a total of four needle beds at the front, the rear, the top and the bottom. Reference numeral 8 represents a carriage that reciprocally moves on the needle beds 4, 6 and operates the needles of the needle beds 4, 6 to form the three-dimensional knitted fabric. Reference numeral 9 represents a racking motor for laterally moving the needle beds 4, 6 relatively in a horizontal direction of FIG. 5. The racking motor 9 may also move the knitted fabric between the front and rear needle beds 4, 6 with transferring the knitted fabric. In place of the carriage 8, a group of linear motors may be provided to the needle beds 4, 6 to move

the needles back and forth. In order to change height direction sizes among the inner layer knitted fabric, the outer layer knitted fabric and the rear knitted fabric, the stitch sizes may be changed among the fabrics, or the course numbers may be altered among the fabrics. In order to alter stitch sizes among the fabrics, the extent to which the needles pulled by the stitch cam in the carriage is altered. Further, the inner layer knitted fabric may be knitted with heat shrinkable yarn by the same number of courses and stitch size as the outer layer knitted fabric, and then the inner layer may thermally be shrunk after knitting.

[0018] In this specification, the knitting length (the length of the three-dimensional knitted fabric in the height direction) means the length of the three-dimensional knitted fabric in a direction perpendicular to a longitudinal direction of the needle beds 4, 6 when the three-dimensional knitted fabric is knitted on the flat knitting machine 2 shown in FIG. 5. The knitting width, or the size of the knitted fabric in the course direction, means the width of the three-dimensional knitted fabric along the needle beds 4, 6 when the three-dimensional knitted fabric is knitted on the flat knitting machine 2 shown in FIG. 5. The number of courses means the number of rows of stitches in the knitting height direction and is proportional to the knitting length when the size of stitches is constant.

[0019] FIG. 6 schematically shows a cross section of the three-dimensional knitted fabric 10 of the embodiment. Reference numeral 12 represents the rear knitted fabric, 14 the inner layer knitted fabric, and 16 the outer layer knitted fabric. The three-dimensional knitted fabric 10 comprises these three layers of the rear knitted fabric 12, the inner layer knitted fabric 14, and the outer layer knitted fabric 16. The inner layer knitted fabric 14 and the outer layer knitted fabric 16 are joined to each other such that the inner layer knitted fabric 14 and the outer layer knitted fabric 16 are attached to each other at concave sections 17 arranged for example at regular intervals. A connecting yarn 18 is filled in the areas between the concave sections 17 to connect the knitted fabrics 14, 16 to each other. Sections where the inner layer knitted fabric 14 and the outer layer knitted fabric 16 are connected to each other by the connecting yarn 18 configure the convex sections of the three-dimensional knitted fabric 10.

[0020] With a flat knitting machine having four needle beds at the front, the rear, the top and the bottom, the knitted fabrics 12, 14, 16 are assigned to separate needle beds, and the three-dimensional knitted fabric 10 is knitted with knitting the knitted fabrics 12, 14, 16 on the assigned needle beds. With the flat knitting machine 2 having two needle beds at the front and the rear, the three-dimensional knitted fabric 10 is knitted in a manner shown in FIG. 7, for example. The rear knitted fabric 12 is assigned to one of the needle beds, and the inner layer knitted fabric 14 and the outer layer knitted fabric 16 are assigned to the other needle bed. The inner layer knitted fabric 14 is disposed in a position shifted closer to a trick gap between the needle beds than the outer layer knitted

fabric 16. The rear knitted fabric 12 may be knitted in an arrangement shown in an upper part of FIG. 7. The inner layer knitted fabric 14 may be transferred between the upper arrangement and lower arrangement in FIG. 7. The inner layer knitted fabric 14 and the outer layer knitted fabric 16 may be knitted in the lower arrangement in FIG. 7, and the space between the knitted fabrics 14, 16 may be filled with the connecting yarn 18 by tucking or knitting the connecting yarn 18. The tucking operation is shown in FIG. 7. In the knitting operation, a series of operations such as <... missing several stitches, knitting one stitch (forming one stitch) on the inner layer knitted fabric 14, missing several stitches, knitting one stitch on the outer layer knitted fabric 16, ...> are performed with the connecting yarn 18.

[0021] In order to make the number of courses in the outer layer knitted fabric 16 greater than the number of courses in the inner layer knitted fabric 14, both the tubular knitting courses for the outer layer knitted fabric 16 and the inner layer knitted fabric 14 and those for the outer layer knitted fabric 16 and the rear knitted fabric 12 are carried out. As a result, the three-dimensional knitted fabric shown in FIGS. 1 to 3 may be knitted.

[0022] FIG. 8 shows a method of knitting the three-dimensional knitted fabric shown in FIGS. 1 to 3. The symbol "FB" in the diagram represents the front needle bed of the flat knitting machine, "BB" the rear needle bed, "▼" a yarn feeder for feeding yarns for the outer layer knitted fabric 16, the inner layer knitted fabric 14 and the rear knitted fabric 12, and "▽" a yarn feeder for feeding the connecting yarn 18. The symbol "●" represents stitches knitted in a current course, "O" stitches that have already been knitted in the previous courses, and "V" tuck stitches. The number of needles and the number of stitches in the diagram are less than the actual numbers. The outer layer knitted fabric 16 is held by the needles of the front needle bed FB, and the inner layer knitted fabric 14 and the rear knitted fabric 12 are held by the needles of the rear needle bed BB. The inner layer knitted fabric 14 is held such that the prolongations between stitches are positioned closer to the front needle bed FB than the prolongations of the rear knitted fabric 12. The inner layer knitted fabric 14 is held by the needles b, d, f, h, of the rear needle bed BB, and the rear knitted fabric 12 is held by the needles a, c, e, g,

[0023] The outer layer knitted fabric 16 is knitted by these courses in steps 1, 4, 7 among steps 1 to 8, the inner layer knitted fabric 14 is knitted by two courses in steps 2, 8, and the rear knitted fabric 12 is knitted by one course in step 5. Therefore, the knitting lengths of these knitted fabric are in the order of the outer layer knitted fabric 16 > the inner layer knitted fabric 14 > and the rear knitted fabric 12. The outer layer knitted fabric 16 expands outward at the convex sections. In step 3, the inner layer knitted fabric 14 is transferred to the front needle bed FB, and, in step 4, the outer layer knitted fabric 16 is knitted by one course on the front needle bed FB. Therefore, prolongations of the outer layer knitted fabric

16 fix prolongations of the inner layer knitted fabric 14 to the front needle bed FB side, knitting the concave sections 17. In step 5, the rear knitted fabric 12 is knitted by one course on the rear needle bed BB. At this moment, because the inner layer knitted fabric 14 has been moved to the front needle bed FB, the prolongations do not fix the inner layer knitted fabric 14 when the rear knitted fabric 12 is knitted. On the other hand, if the rear knitted fabric 12 is knitted in step 2 in place of the inner layer knitted fabric 14, the prolongations of the rear knitted fabric 12 fix the prolongations of the inner layer knitted fabric 14, and the rear knitted fabric 12 and the inner layer knitted fabric 14 are joined to each other. The inner layer knitted fabric 14 is transferred back to the rear needle bed BB in step 6, and one course of the outer layer knitted fabric 16 and one course of the inner layer knitted fabric 14 are knitted in steps 7, 8.

[0024] In steps 9 to 13, the outer layer knitted fabric 16 and the inner layer knitted fabric 14 are connected to each other with the connecting yarn 18, and the outer layer knitted fabric 16 and the inner layer knitted fabric 14 are tucked alternately every several needles (the number of stitches is 1/2 the number of needles), while shifting the tucking needles for each course (step). The number of courses knitted in steps 1 to 8 and the number of courses tucked in steps 9 to 13 are arbitrary. The three-dimensional knitted fabric shown in FIGS. 1 to 3 is knitted with repeating steps 1 to 13.

[0025] The three-dimensional knitted fabric with three layers has been described in the embodiment. However, when a sewn stretchable band or the like in place of the rear knitted fabric 12, is incorporated, or when a semi-spherical helmet is knitted, the seamless three-dimensional knitted fabric may have the two layers, the outer layer knitted fabric 16 and the inner layer knitted fabric 14.

[0026]

2 Flat knitting machine

40 4, 6 Needle bed

8 Carriage

9 Racking motor

45 10 Three-dimensional knitted fabric

12 Rear knitted fabric

50 14 Inner layer knitted fabric

16 Outer layer knitted fabric

17 Concave section

55 18 Connecting yarn

Claims

1. A three-dimensional knitted fabric (10), comprising at least an outer layer knitted fabric (16) and an inner layer knitted fabric (14),
characterized in that the outer layer knitted fabric (16) and the inner layer knitted fabric (14) are connected to each other with a connecting yarn (18), that convex sections where the outer layer knitted fabric (16) and the inner layer knitted fabric (14) are separated from each other by the connecting yarn (18) and concave sections (17) where the outer layer knitted fabric (16) and the inner layer knitted fabric (14) are attached to each other with no gaps therebetween are alternately repeated, and that the three-dimensional knitted fabric (10) is seamless.

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 2. The three-dimensional knitted fabric (10) according to claim 1, **characterized in that** the number of courses in the outer layer knitted fabric (16) is greater than the number of courses in the inner layer knitted fabric (14) at the convex sections along a height direction of the three-dimensional knitted fabric (10).

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 3. The three-dimensional knitted fabric (10) according to claim 1 or 2,
characterized in that the three-dimensional knitted fabric (10) comprises three layers of the outer layer knitted fabric (16), the inner layer knitted fabric (14), and a rear knitted fabric (12),
 that the outer layer knitted fabric (16) is disposed on one side of the inner layer knitted fabric (14), the rear knitted fabric (12) is disposed on the other side of the inner layer knitted fabric (14), and the inner layer knitted fabric (14) and the rear knitted fabric (12) configure a tube extending in a height direction of the three dimensional knitted fabric (10).

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 4. A method of knitting a three-dimensional knitted fabric (10) having at least an outer layer knitted fabric (16) and an inner layer knitted fabric (14), on a flat knitting machine (2) that has at least a pair of needle beds (4, 6) and is capable of transferring the knitted fabric (14, 16) between the needle beds (4, 6), **characterized in that** the method executes the steps of:

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knitting the outer layer knitted fabric (16) on one of the needle beds (4, 6);

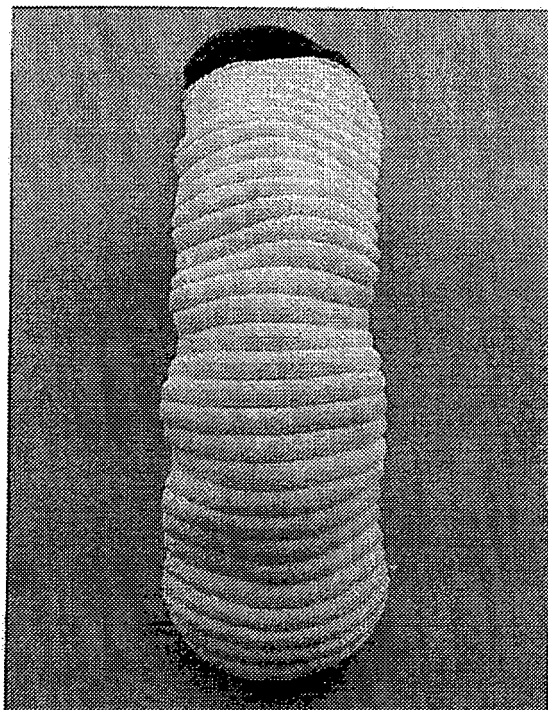
knitting the inner layer knitted fabric (14) on the other of the needle beds (4, 6);

connecting the outer layer knitted fabric (16) and the inner layer knitted fabric (14) with a connecting yarn (18) such that the outer layer knitted fabric (16) and the inner layer knitted fabric (14) are separated from each other with the connecting yarn (18) on the needle beds (4, 6); and

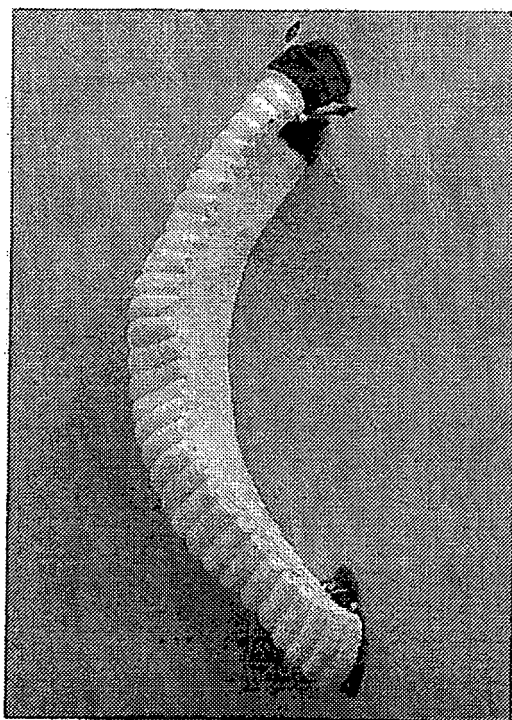
knitting the outer layer knitted fabric (16) and the

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- inner layer knitted fabric (14) such that the outer layer knitted fabric (16) and the inner layer fabric (14) are attached to each other with no gaps therebetween on the needle beds (4, 6), to thereby knit the three-dimensional knitted fabric (10) seamlessly such that convex sections where the outer layer knitted fabric (16) and the inner layer knitted fabric (14) are separated from each other with the connecting yarn (18) and concave sections (17) where the outer layer knitted fabric (16) and the inner layer knitted fabric (14) are attached to each other with no gaps therebetween, are alternately repeated.
5. A supporter comprising the three-dimensional knitted fabric (10) of any one of claims 1 to 3.

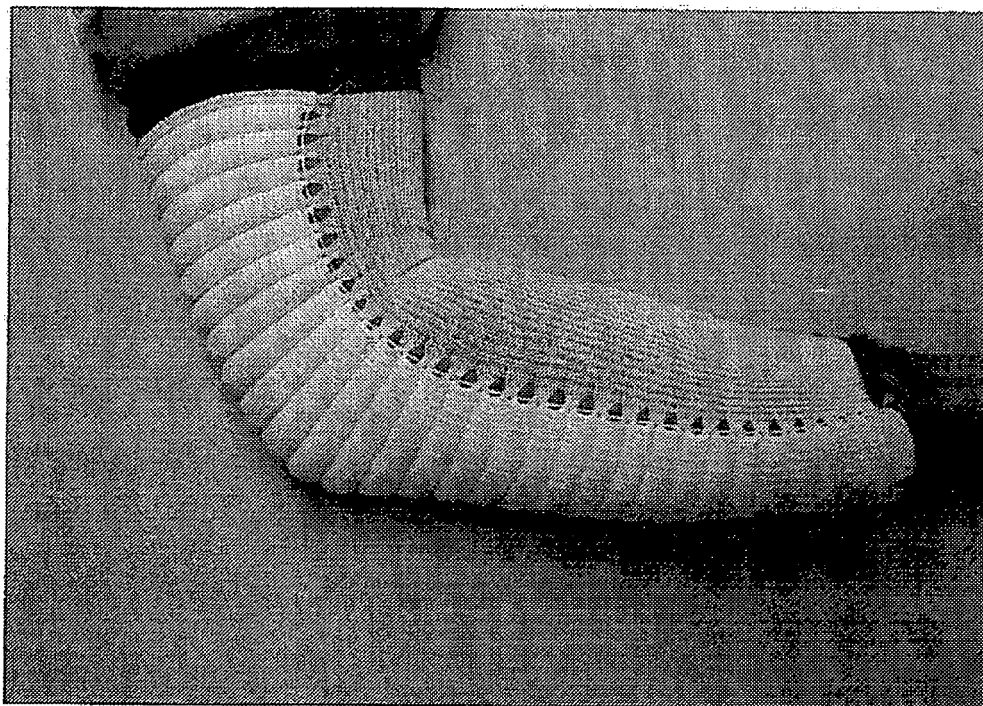
F I G. 1



F I G. 2



F I G. 3



F I G. 4

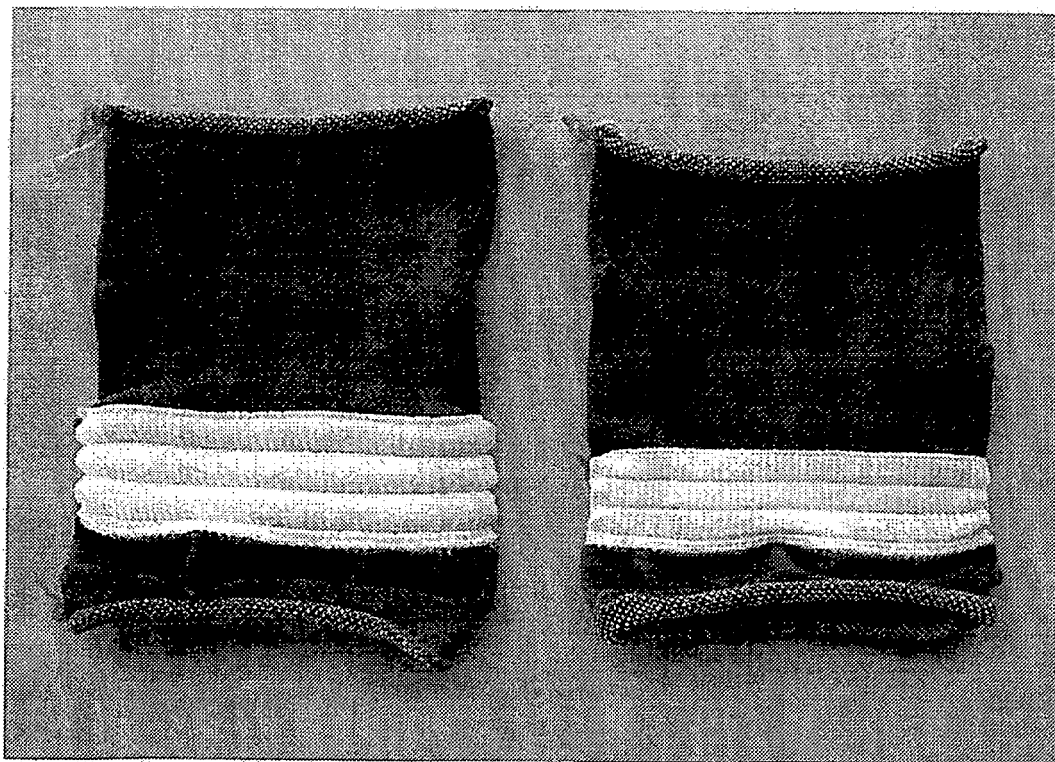


FIG. 5

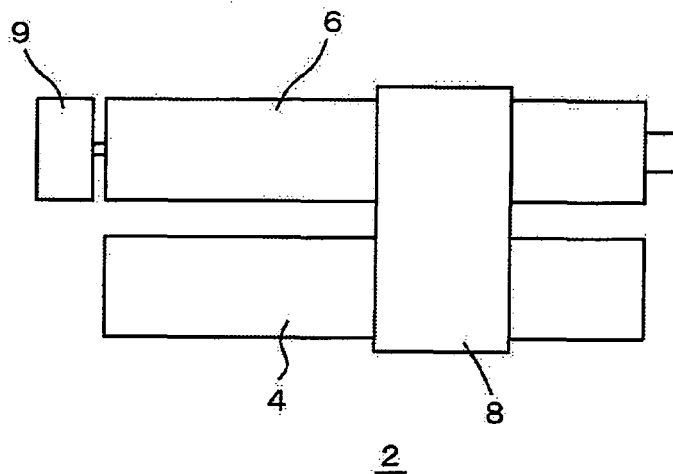


FIG. 6

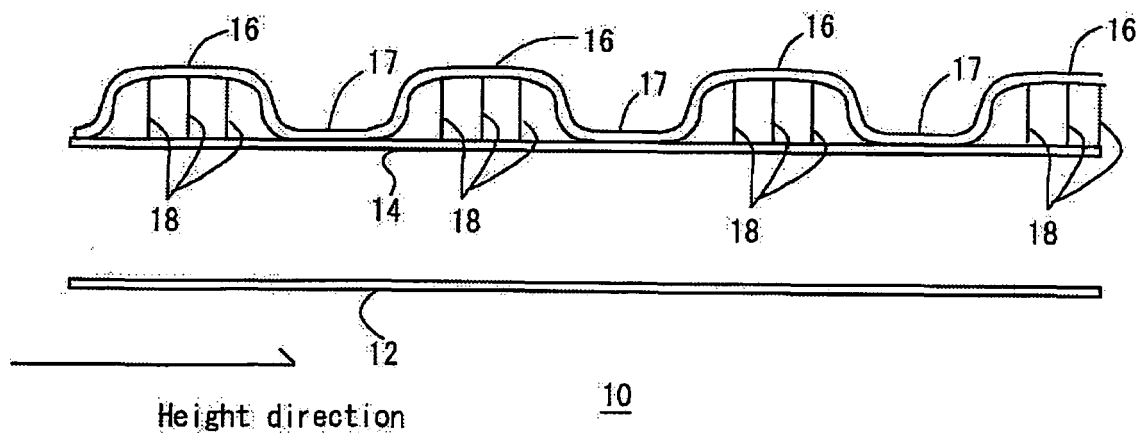


FIG. 7

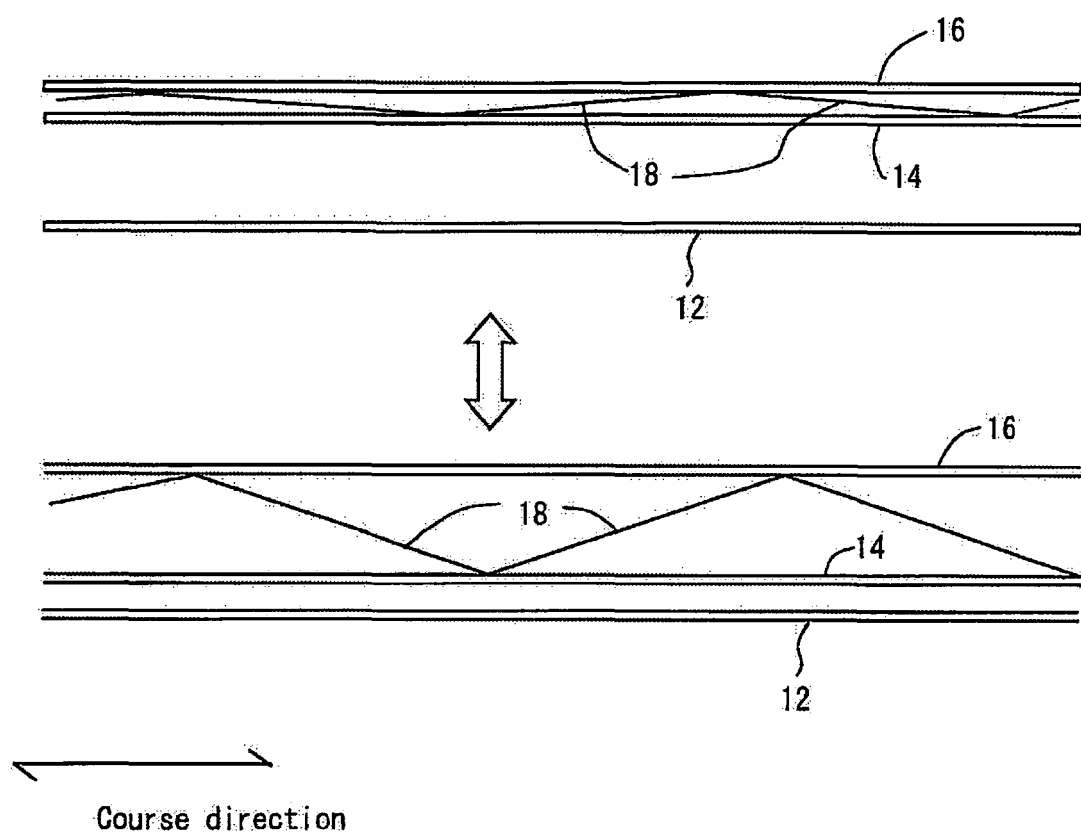
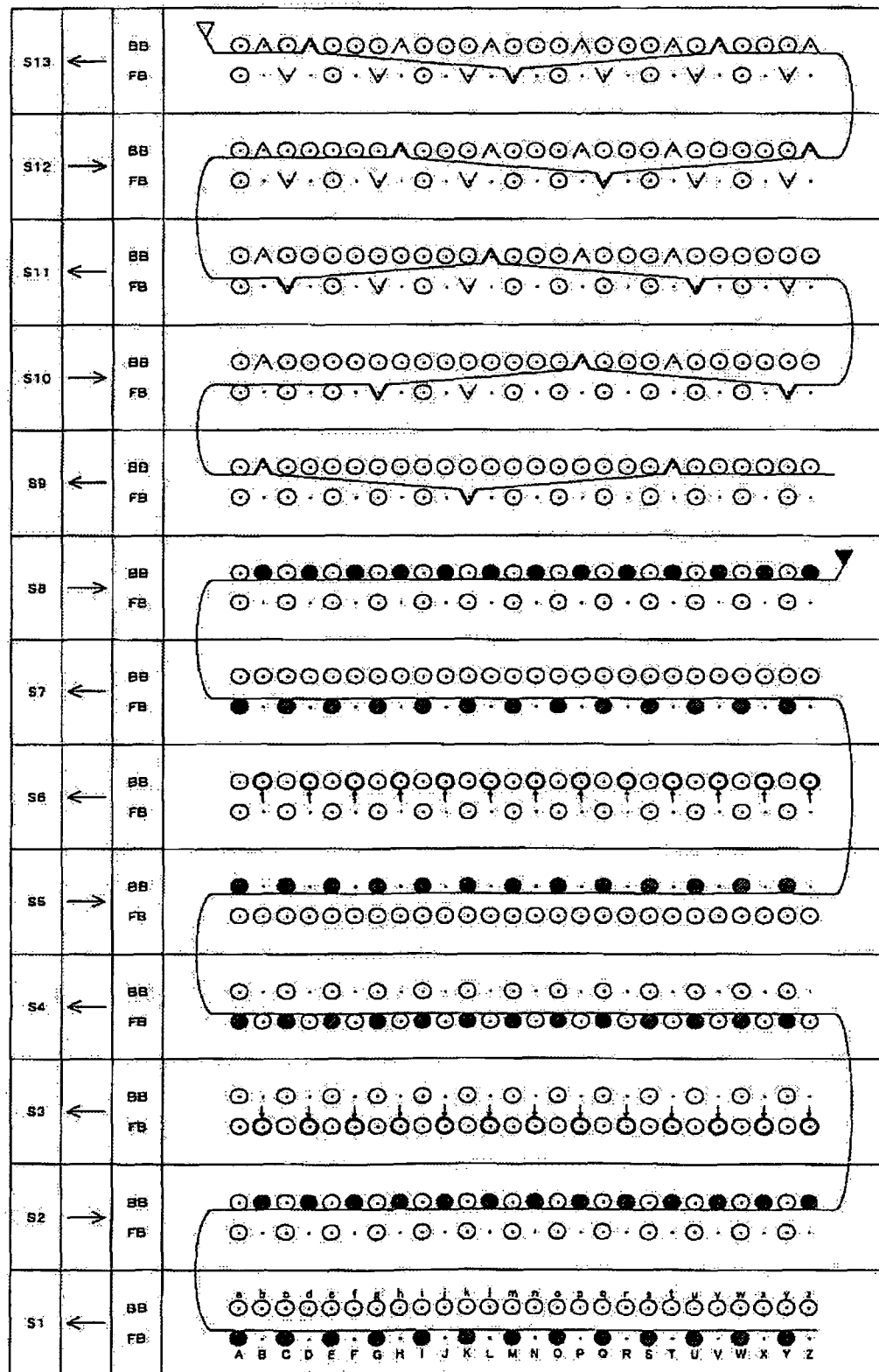


FIG. 8





EUROPEAN SEARCH REPORT

 Application Number
EP 11 01 0011

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	DE 20 2006 016338 U1 (ACHTER GMBH & CO KG GEB [DE]) 4 January 2007 (2007-01-04)	1,4	INV. D04B1/22
Y	* paragraph [0009] - paragraph [0013]; figures 1-3 *	2,3,5	
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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 31 May 2012	Examiner Zirkler, Stefanie
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			

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EPO FORM 1503 03.82 (P04C01)

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

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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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