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(54) **THREE-DIMENSIONAL KNITTED FABRIC, METHOD OF KNITTING SAME, AND SUPPORTER**

DREIDIMENSIONALE MASCHENWARE, VERFAHREN ZUM STRICKEN DERSELBEN UND
TRÄGER

ÉTOFFE TRICOTÉE TRIDIMENSIONNELLE, SON PROCÉDÉ DE TRICOTAGE ET SUPPORT

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EP 2 474 653 B1

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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

Prior art document DE 20 2006 016 338 U1 discloses a three-dimensional knitted fabric for a seating furniture comprising a support area for the support of a body portion of a seating person, the support area being knitted in one piece. The support area comprises alternately portions made by a distance knitted fabric and portions made from a second knitted fabric, wherein the portions of the second knitted fabric have a thickness which is smaller than the areas made out of the distance knitted fabric.

[0004] From WO 03/042441 A1, a three-dimensional double-faced fabric is known, which is produced on a weft knitting machine. The fabric comprises two external faces which are connected by means of rows of binding threads. Such fabric comprises hollow zones in which the thread from a first external face works with the second external face; and the binding thread works with only one of the two external faces.

[0005] Document EP 0 734 670 A2 discloses a fabric upholstered structure having a core, whose external surface is covered by a knitted fabric cover, the external surface of the cover having at least one strip of hook member of any hook/loop fastener attached hereto, the hook member engaging knitted loops on the internal surface of the cover which are formed integrally with the knitted cover.

[0006] From EP 2 233 621 A1 a knitted fabric is known which comprises in at least one area a form knitted distance structure so that reinforcement is achieved.

[0007] 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.

This and other objects are solved by a three-dimensional knitted fabric having the features as set forth in claim 1.

5 The method of knitting a three-dimensional knitted fabric as defined in claim 2 does also solve the objects, as well as a supporter comprising the three-dimensional knitted fabric of claim 1

10 **[0008]** A three-dimensional knitted fabric of the present invention is one that has an outer layer knitted fabric, an inner layer knitted fabric and a rear knitted fabric. 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.

20 **[0009]** 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.

30 **[0010]** 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.

45 **[0011]** 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.

50 **[0012]** The three-dimensional knitted fabric comprises the three layers of the outer layer knitted fabric, the inner layer knitted fabric, and the 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.

[0013] 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 an outer layer knitted fabric, an inner layer knitted fabric and a rear 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 executes the steps of: knitting the outer layer knitted fabric on one of the needle beds; knitting the inner layer knitted fabric and the rear 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 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.

[0014] According to the present invention, a flat knitting machine knits 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.

[0015]

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.

[0016] 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]

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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 "V" a yarn feeder for feeding the connecting yarn 18. The symbol "●" represents stitches knitted in a current course, "○" 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,

[0026] 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.

[0027] 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.

[0028] 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.

[0029]

2	Flat knitting machine	
4, 6	Needle bed	
8	Carriage	
9	Racking motor	
10	Three-dimensional knitted fabric	
12	Rear knitted fabric	
14	Inner layer knitted fabric	
16	Outer layer knitted fabric	
17	Concave section	
18	Connecting yarn	

Claims

1. A three-dimensional knitted fabric (10), comprising an outer layer knitted fabric (16), an inner layer knitted fabric (14), and a rear knitted fabric (12), wherein the outer layer knitted fabric (16) and the inner layer knitted fabric (14) are connected to each other with a connecting yarn (18), wherein 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, wherein the three-dimensional knitted fabric (10) is seamless, wherein 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), and wherein 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).
2. A method of knitting a three-dimensional knitted fabric (10) having an outer layer knitted fabric (16), an inner layer knitted fabric (14), and a rear knitted fabric (12) on a flat knitting machine (2) that has at least a pair of needle beds (4, 6) and is capable of transfer-

ring the knitted fabric (14, 16) between the needle beds (4,6), whereby the method executes the steps of:

knitting the outer layer knitted fabric (16) on one of the needle beds (4,6);
knitting the inner layer knitted fabric (14) and the rear knitted fabric (12) 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 inner layer knitted fabric (14) such that the outer layer knitted fabric (16) and the inner layer knitted 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, whereby, 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 tubular knitting of courses forming the outer layer knitted fabric (16) and the inner layer knitted fabric (14) and tubular knitting of courses forming the outer layer knitted fabric (16) and the rear knitted fabric (12) are carried out.

3. A supporter comprising the three-dimensional knitted fabric (10) of claim 1.

Patentansprüche

1. Dreidimensionales Gestrick (10), das ein Außenschicht-Gestrick (16), ein Innenschicht-Gestrick (14) und ein hinteres Gestrick (12) umfasst, wobei:

das Außenschicht-Gestrick (16) und das Innenschicht-Gestrick (14) über einen Verbindungsfaden (18) miteinander verbunden sind, wobei konvexe Abschnitte, an denen das Außenschicht-Gestrick (16) und das Innenschicht-Gestrick (14) durch den Verbindungsfaden (18) voneinander getrennt sind, und konkave Abschnitte (17), an denen das Außenschicht-Gestrick (16) und das Innenschicht-Gestrick (14)

- ohne Zwischenräume miteinander verbunden sind, alternierend wiederholt werden, wobei das dreidimensionale Gestrück (10) nahtlos ist, wobei die Anzahl der Reihen in dem Außenschicht-Gestrück (16) größer als die Anzahl der Reihen in dem Innenschicht-Gestrück (14) an den konvexen Abschnitten entlang einer Höhenrichtung des dreidimensionalen Gestrücks (10) ist, und wobei das Außenschicht-Gestrück (16) auf einer Seite des Innenschicht-Gestrücks (14) angeordnet ist, das hintere Gestrück (12) auf der anderen Seite des Innenschicht-Gestrücks (14) angeordnet ist, und das Innenschicht-Gestrück (14) und das hintere Gestrück (12) einen Schlauch bilden, der sich in der Höhenrichtung des dreidimensionalen Gestrücks (10) erstreckt.
2. Verfahren zum Stricken eines dreidimensionalen Gestrücks (10) mit einem Außenschicht-Gestrück (16), einem Innenschicht-Gestrück (14) und einem hinteren Gestrück (12) auf einer Flachstrickmaschine (2), die wenigstens ein Paar von Nadelbetten (4, 6) aufweist und das Gestrück (14, 16) zwischen den Nadelbetten (4, 6) umhängen kann, wobei das Verfahren die folgenden Schritte durchführt:
- Stricken des Außenschicht-Gestrücks (16) an einem der Nadelbetten (4, 6),
Stricken des Innenschicht-Gestrücks (14) und des hinteren Gestrücks (12) an dem anderen der Nadelbetten (4, 6),
Verbinden des Außenschicht-Gestrücks (16) und des Innenschicht-Gestrücks (14) mit einem Verbindungsfaden (18) derart, dass das Außenschicht-Gestrück (16) und das Innenschicht-Gestrück (14) durch den Verbindungsfaden (18) an den Nadelbetten (4, 6) voneinander getrennt sind, und
Stricken des Außenschicht-Gestrücks (16) und des Innenschicht-Gestrücks (14) derart, dass das Außenschicht-Gestrück (16) und das Innenschicht-Gestrück (14) ohne Zwischenräume an den Nadelbetten (4, 6) miteinander verbunden sind, um dadurch das dreidimensionale Gestrück (10) nahtlos zu stricken, sodass konvexe Abschnitte, an denen das Außenschicht-Gestrück (16) und das Innenschicht-Gestrück (14) durch den Verbindungsfaden (18) voneinander getrennt sind, und konkave Abschnitte (17), an denen das Außenschicht-Gestrück (16) und das Innenschicht-Gestrück (14) ohne Zwischenräume miteinander verbunden sind, alternierend wiederholt werden, wobei, um die Anzahl von Reihen in dem Außenschicht-Gestrück (16) größer als die Anzahl von Reihen in dem Innenschicht-Gestrück

(14) vorzusehen, ein Schlauchstricken von Reihen für das Bilden des Außenschicht-Gestrücks (16) und des Innenschicht-Gestrücks (14) und ein Schlauchstricken von Reihen für das Bilden des Außenschicht-Gestrücks (16) und des hinteren Gestrücks (12) durchgeführt werden.

3. Träger, der das dreidimensionale Gestrück (10) von Anspruch 1 umfasst.

Revendications

1. Tissu tricoté tridimensionnel (10), comprenant un tissu tricoté de couche extérieure (16), un tissu tricoté de couche intérieure (14), et un tissu tricoté arrière (12), dans lequel le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) sont connectés entre eux par un fil de connexion (18), dans lequel des sections convexes où le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) sont séparés entre eux par le fil de connexion (18) et des sections concaves (17) où le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) sont attachés entre eux sans intervalles entre les deux sont répétées alternativement, dans lequel le tissu tricoté tridimensionnel (10) est sans couture, dans lequel le nombre de courses dans le tissu tricoté de couche extérieure (16) est supérieur au nombre de courses dans le tissu tricoté de couche intérieure (14) au niveau des sections convexes suivant une direction de hauteur du tissu tricoté tridimensionnel (10), et dans lequel le tissu tricoté de couche extérieure (16) est disposé sur un côté du tissu tricoté de couche intérieure (14), le tissu tricoté arrière (12) est disposé sur l'autre côté du tissu tricoté de couche intérieure (14), et le tissu tricoté de couche intérieure (14) et le tissu tricoté arrière (12) configurent un tube s'étendant dans la direction de la hauteur du tissu tricoté tridimensionnel (10).
2. Procédé de tricotage d'un tissu tricoté tridimensionnel (10) comportant un tissu tricoté de couche extérieure (16), un tissu tricoté de couche intérieure (14), et un tissu tricoté arrière (12) sur une machine à tricoter à plat (2) qui comporte au moins deux fontures (4, 6) et est capable de transférer le tissu tricoté (14, 16) entre les fontures (4, 6), d'où il résulte que le procédé exécute les étapes suivantes tricoter le tissu tricoté de couche extérieure (16) sur l'une des fontures (4, 6) ; tricoter le tissu tricoté de couche intérieure (14) et le tissu tricoté arrière (12) sur l'autre des fontures (4, 6) ;

connecter le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) par un fil de connexion (18) de telle sorte que le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) sont séparés entre eux par à le fil de connexion (18) sur les fontures (4, 6) ; et tricoter le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) de telle sorte que le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) sont attachés entre eux sans intervalles entre les deux sur les fontures (4, 6), pour tricoter ainsi le tissu tricoté tridimensionnel (10) sans couture de telle sorte que des sections convexes où le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) sont séparés entre eux par le fil de connexion (18) et des sections concaves (17) où le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) sont attachés entre eux sans intervalles entre les deux, sont répétées alternativement, d'où il résulte que, afin de faire en sorte que le nombre de courses dans le tissu tricoté de couche extérieure (16) soit supérieur au nombre de courses dans le tissu tricoté de couche intérieure (14), on réalise à la fois un tricotage tubulaire de courses formant le tissu tricoté de couche extérieure (16) et le tissu tricoté de couche intérieure (14) et un tricotage tubulaire de courses formant le tissu tricoté de couche extérieure (16) et le tissu tricoté arrière (12).

3. Dispositif de soutien comprenant le tissu tricoté tridimensionnel (10) selon la revendication 1.

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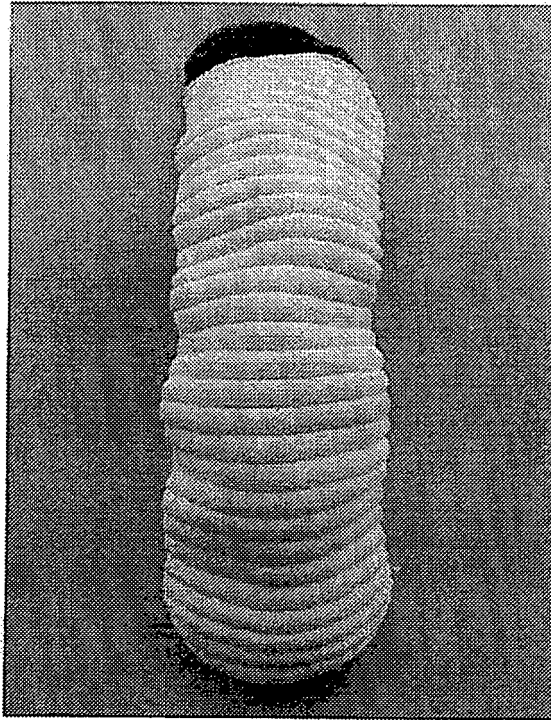
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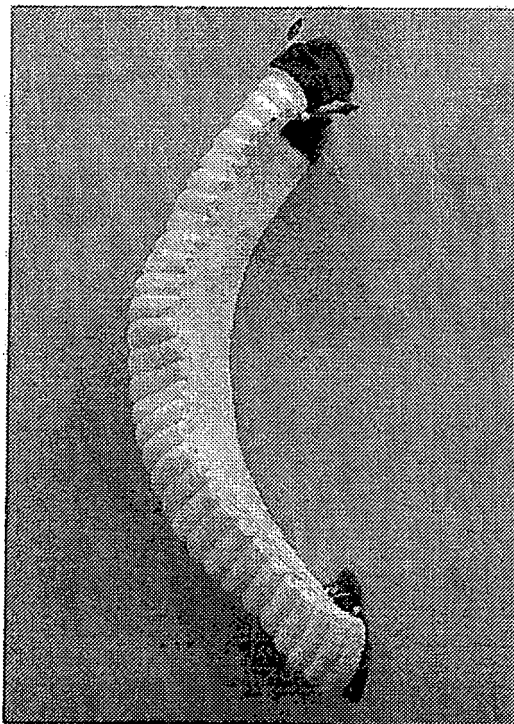
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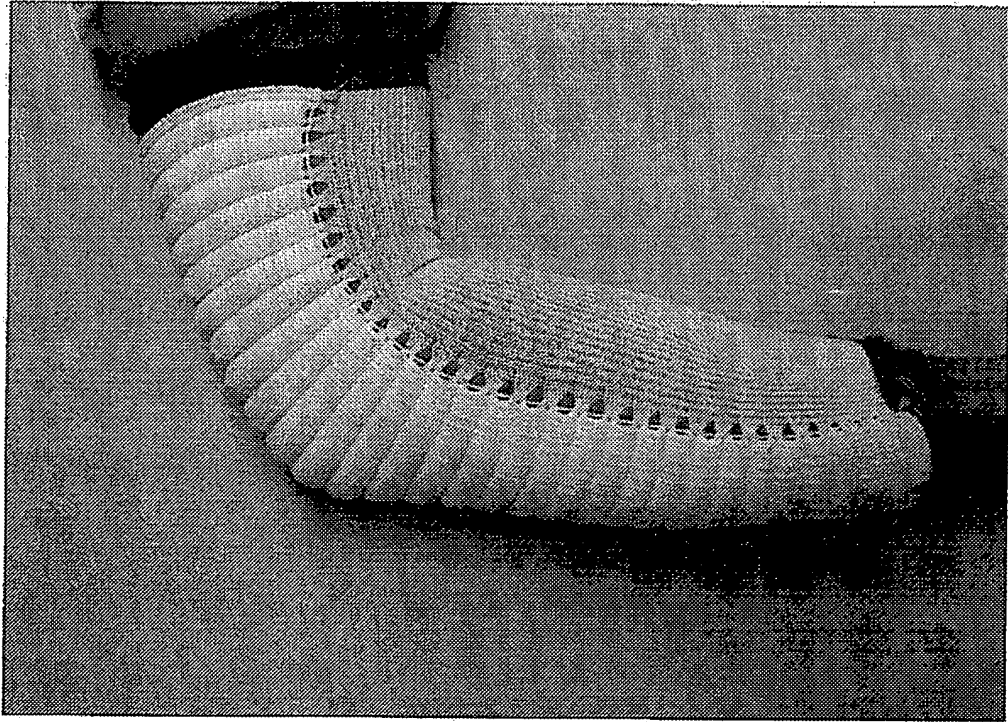
F I G. 1



F I G. 2



F I G. 3



F I G. 4

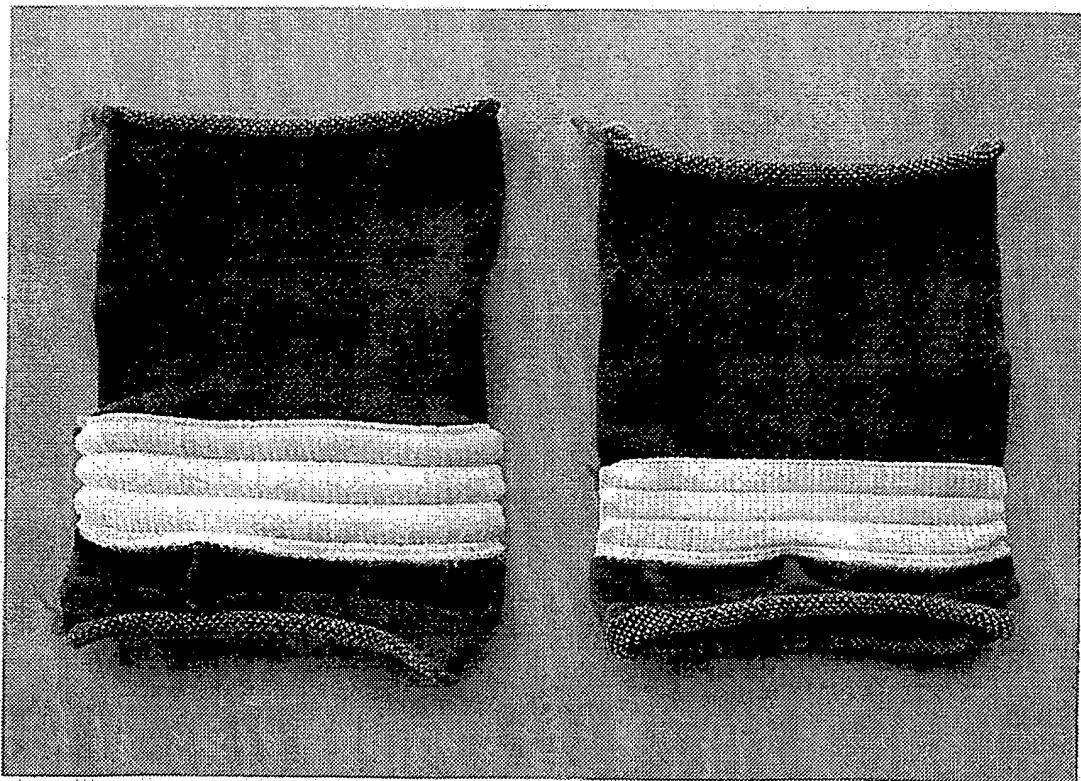


FIG. 5

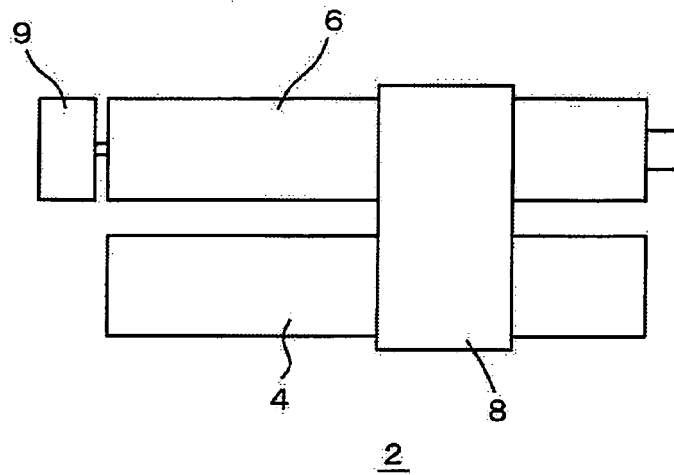


FIG. 6

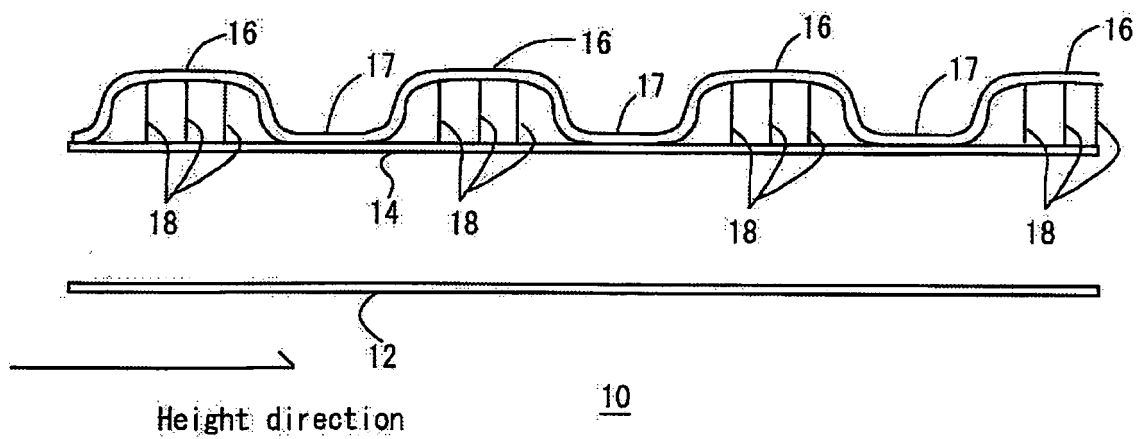


FIG. 7

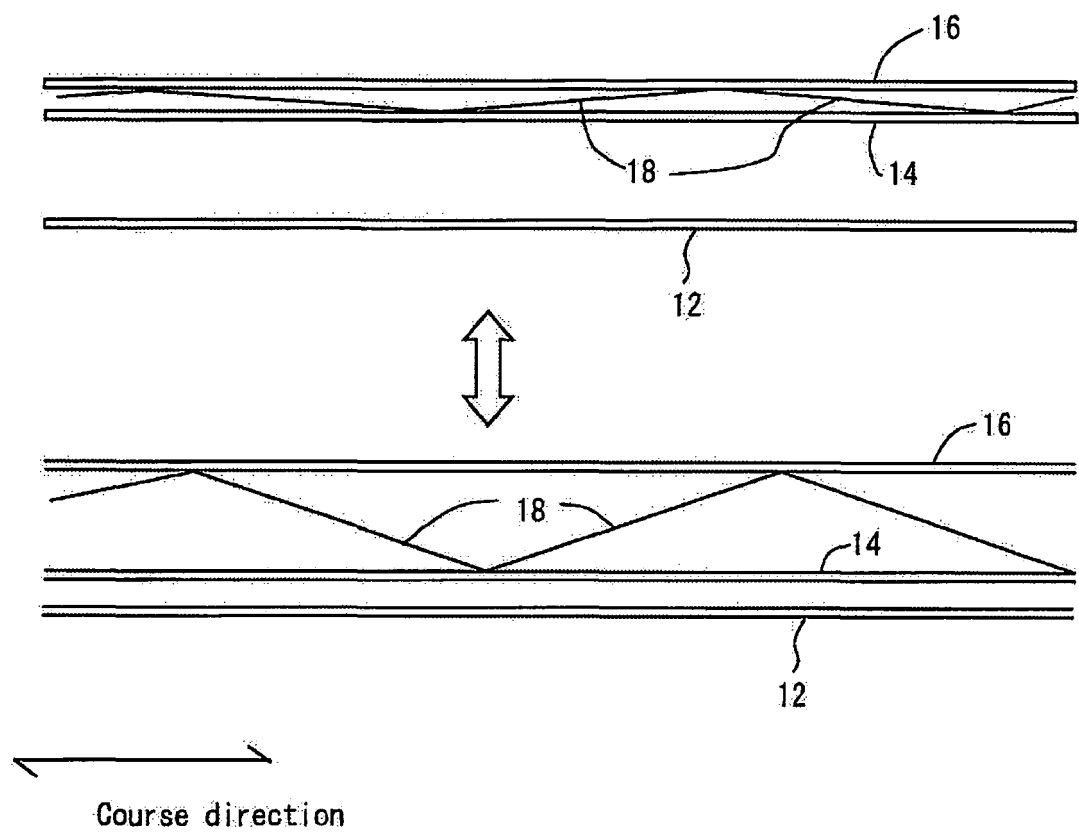
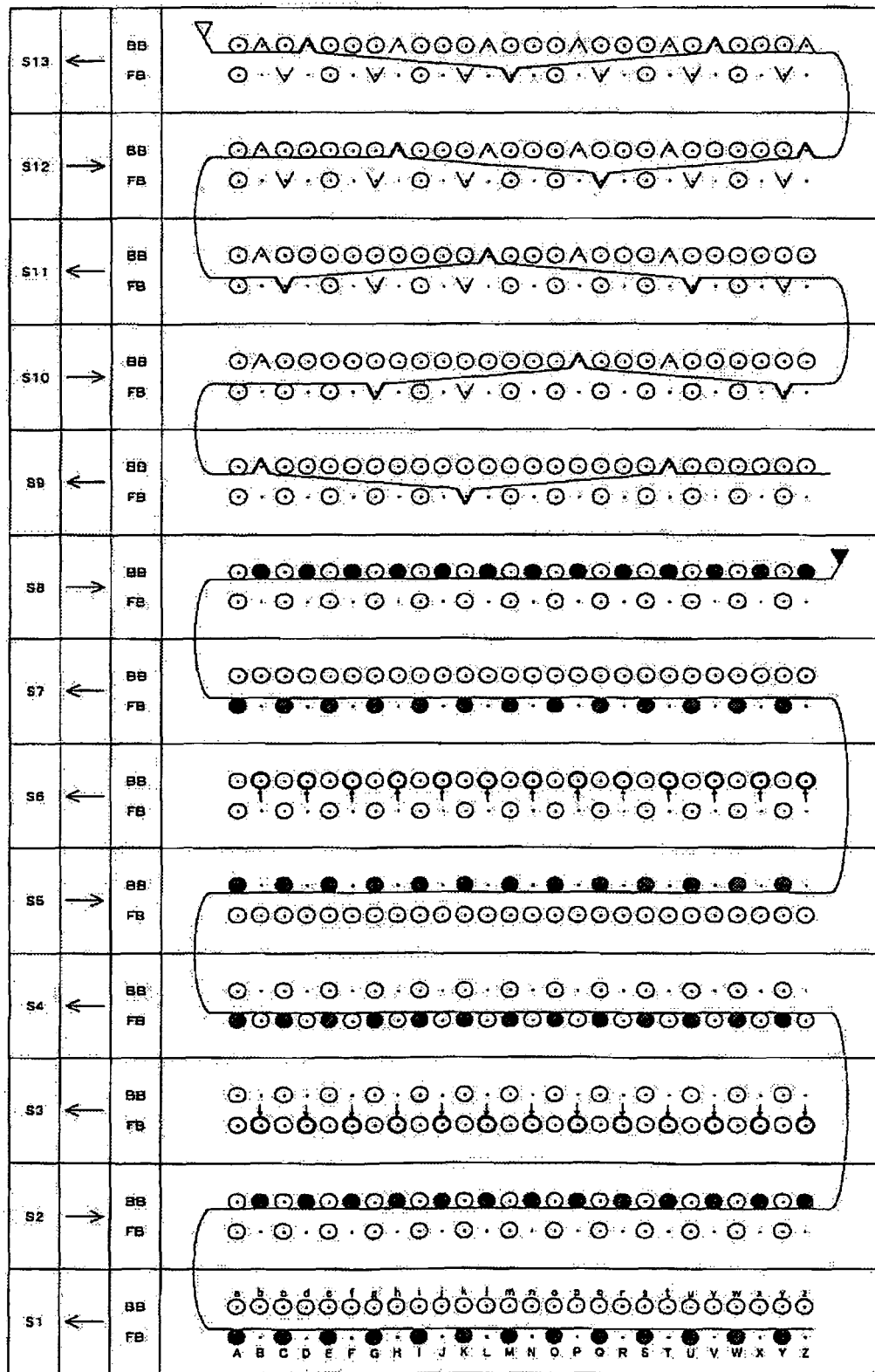


FIG. 8



REFERENCES CITED IN THE DESCRIPTION

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