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(54) **METHOD FOR KNITTING AND FORMING WEFT-KNITTED FABRIC WITH VARYING THICKNESS BY FLAT KNITTING MACHINE AND WEFT-KNITTED FABRIC THEREOF**

VERFAHREN ZUM STRICKEN UND FORMEN VON GESTRICKEN MIT UNTERSCHIEDLICHER DICKE DURCH FLACHSTRICKMASCHINE UND GESTRICKE DAVON

PROCÉDÉ DE TRICOTAGE ET DE FORMATION DE TRICOT À MAILLES CUEILLIES D'ÉPAISSEUR VARIABLE PAR UNE TRICOTEUSE RECTILIGNE ET TRICOT À MAILLES CUEILLIES CORRESPONDANT

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a method for knitting to form a fabric with varying thickness and a fabric thereof, and more particularly to a method for knitting and forming a weft-knitted fabric with varying thickness by a flat knitting machine and a weft-knitted fabric thereof.

BACKGROUND OF THE INVENTION

[0002] Although three-dimensional fabrics have been invented for a long time, even though techniques of making three-dimensional fabrics with varying thickness have been developed, such as disclosed in CN102978823A, three-dimensional fabrics are always knitted independently. If the clothing design has a thick pad part formed by a three-dimensional fabric and a cloth surface part formed by a general knitted fabric, it is necessary to knit the three-dimensional fabric and the general knitted fabric separately, and then combine the two by sewing and splicing or using chemical adhesives. However, combining the three-dimensional fabric and the general knitted fabric by sewing and splicing will form spliced edges, which will greatly reduce the comfort of clothes. In addition, clothing with thick pads is generally used as a close-fitting clothing, and the stuffiness caused by long-term wearing may produce qualitative changes in chemical adhesives, which may affect the wearer's skin. Furthermore, chemical adhesives are not natural products, using excessively will also affect the environment.

[0003] US 2020/181813 A1 discloses a method for knitting and forming a weft-knitted fabric with varying thickness according to the preamble of claim 1, comprising a first region and a second region having a double jersey knit structure. In the second region, during the formation of each course, including the interlocking process using spacer strand, the distance between a first needle bed and a second needle bed is gradually increased at a constant rate, or linearly, as the course is formed, thereby forming a slope, and a spacer knit fabric of variable thickness. In a third region in-between, the distance d remains constant during the formation of each course, thereby forming a plateau, and a spacer knit fabric of greater thickness than the other thickness regions. In the method a plurality of courses of a spacer knit construction are formed, the spacer knit construction comprising a first surface having a first set of loops formed on the first needle bed and a second surface having a second set of loops formed on the second needle bed, wherein the first surface is separate from the second surface. The method further includes interlocking at least one spacer strand with each of the first surface and the second surface, and adjusting the spacing between the first needle bed and the second needle bed while forming the plurality of courses of the spacer knit construction. However, when the first needle bed and

the second needle bed are spaced relative to one another in distances, a spacer strand is provided for connecting the first surface to the second surface. At least two spacer strands are provided for providing a support capability.

[0004] DE 10 2014 008725 A1 discloses a circular knitted textile fabric with at least one double-layered spacer structure and a method for its production, wherein a structural change from the double-layered spacer structure to a single-layered structure is completed, so that the circular-knit textile fabric has at least one structural change between the double-layered spacer structure and the single-layered structure. Although the knitted textile fabric is provided with a single-layered structure for connecting the double-layered spacer structures at both sides, the structure is not integrally formed.

[0005] US 2016/353810 A1 discloses a bras, comprising a first region having a three-dimensional structure and a first structural property, and a second region having a second structural property, the first and second regions being joined by a seamless transition, and wherein the three-dimensional structure is formed via a dual bed, V-bed knitting machine such that both front and back beds of the machine are used to knit the three-dimensional structure. The bras is provided with different numbers of yarns to form various thicknesses, but a supporting portion connected with the two surface layer portions and located between the two surface layer portions is not disclosed.

SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide a method for knitting and forming a weft-knitted fabric enabling a better formation of the three-dimensional form of a weft-knitted fabric with varying thickness. According to a further related aspect there is to be provided a corresponding weft-knitted fabric.

[0007] These problems are solved by a method for knitting and forming a weft-knitted fabric as claimed by claim 1 and by a weft-knitted fabric as claimed by claim 5. Further advantageous embodiments are the subject-matter of the dependent claims.

[0008] Accordingly, compared with the conventional techniques, the invention has the following features: the weft-knitted fabric of the invention has the basic structure and the three-dimensional structure during knitting, through the three-dimensional structure generating varying thickness, conventional processing procedure of pasting three-dimensional objects afterwards is eliminated; furthermore, a position where the weft-knitted fabric of the invention forms the three-dimensional structure is not limited, and can be adjusted according to design.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a structural diagram of a first embodiment of a weft-knitted fabric of the invention;
 Fig. 2 is a structural diagram of a flat knitting machine knitting the weft-knitted fabric;
 Fig. 3 is a flow chart of a method of the invention;
 Fig. 4 is a structural diagram of a second embodiment of the weft-knitted fabric of the invention;
 Fig. 5 is a structural diagram of a third embodiment of the weft-knitted fabric of the invention;
 Fig. 6 is a schematic diagram of a mouth of the flat knitting machine knitting the weft-knitted fabric;
 Fig. 7 is a schematic diagram of the flat knitting machine with the mouth capable of changing size;
 Fig. 8 is a structural diagram of a fourth embodiment of the weft-knitted fabric of the invention; and
 Fig. 9 is a plan view of the weft-knitted fabric of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] The detailed description and technical contents of the invention are described below with reference to the drawings.

[0011] Please refer to Fig. 1. The invention provides a weft-knitted fabric 10 with varying thickness. The weft-knitted fabric 10 is knitted by a flat knitting machine 30 (as shown in Fig. 2). The weft-knitted fabric 10 comprises at least one basic structure 11 and at least one three-dimensional structure 12. The basic structure 11 is a general fabric structure without support function. Specifically, the basic structure 11 can be a single-layer fabric or a double-layer fabric. Structures of the single-layer fabric and the double-layer fabric are known to those having ordinary skill in the art, and thus will not be described here. On the other hand, the three-dimensional structure 12 and the basic structure 11 are integrally knitted, that is, the three-dimensional structure 12 is not connected by splicing or other methods after the basic structure 11 is knitted. A thickness of the three-dimensional structure 12 is greater than a thickness of the basic structure 11, so when observing the weft-knitted fabric 10 laterally (as viewed from a visual angle in Fig. 1), changes in thickness can be found. It should be understood that varying thickness or changes in thickness referred to in this specification is not thickness formed by stacking yarn layers, but changes produced when being observed laterally. In addition, the three-dimensional structure 12 comprises two surface layer portions 121, 122 and a supporting portion 123 connected with the two surface layer portions 121, 122 and located between the two surface layer portions 121, 122, and a junction between the three-dimensional structure 12 and the basic structure 11 is without the supporting portion 123. Furthermore, in order to form a thickness of the three-dimensional structure 12, the three-dimensional structure 12 is formed by at least one supporting yarn 124, wherein the supporting yarn 124 deforms when at least one of the two surface layer portions 121, 122 is

pressed by force. The three-dimensional structure 12 can be regarded as a thick pad directly formed on the weft-knitted fabric 10. Therefore, the weft-knitted fabric 10 of the invention can be used as a breast pad in women's clothing or a cushion pad in sportswear.

[0012] Please also refer to Fig. 1, Fig. 2 and Fig. 3. In addition to the foregoing, the invention also provides a method 20. In the method 20, the flat knitting machine 30 knits the weft-knitted fabric 10. The method 20 comprises steps of

step 21: driving the flat knitting machine 30 to knit the basic structure 11 by at least one of two needle beds 31, 32 of the flat knitting machine 30; and
 step 22: controlling the two needle beds 31, 32 of the flat knitting machine 30 to knit the three-dimensional structure 12, wherein a thickness of the three-dimensional structure 12 is greater than a thickness of the basic structure 11, the three-dimensional structure 12 comprises the two surface layer portions 121, 122 and the supporting portion 123, and a junction between the three-dimensional structure 12 and the basic structure 11 is without the supporting portion 123.

[0013] Hereinafter, the basic structure 11 is used as the single-layer fabric to explain the method 20, and it is assumed that the flat knitting machine 30 is ready to knit the basic structure 11 (the step 21). A machine head 33 on the flat knitting machine 30 drives one of the two needle beds 31, 32 to knit the basic structure 11 based on setting of a knitting process. When entering a process for knitting the three-dimensional structure 12 of the knitting process, the machine head 33 drives the two needle beds 31, 32 to knit the two surface layer portions 121, 122. At this time, one of the two surface layer portions 121 (or 122) is continuously knitted and formed from the basic structure 11, the other of the two surface layer portions 122 (or 121) is knitted and formed at this point of time. When the surface layer portion 122 is formed initially, the flat knitting machine 30 is set to use transfer knitting technique or tuck knitting technique to connect the surface layer portion 121 with the basic structure 11. Further, the flat knitting machine 30 is controlled to be temporarily suspended from feeding the supporting yarn 124 at a junction 13 between the three-dimensional structure 12 and the basic structure 11, and the supporting yarn 124 is fed to form the supporting portion 123 after the two surface layer portions 121, 122 are knitted with a plurality of stitches. Therefore, the weft-knitted fabric 10 of the invention is a bag-like structure at the junction 13 between the three-dimensional structure 12 and the basic structure 11. A point of time of feeding the supporting yarn 124 is after several stitches of the two surface layer portions 121, 122 are knitted. A number of stitches temporarily suspended to be knitted can be adjusted based on characteristics of the weft-knitted fabric 10. After the supporting yarn 124

participates in the knitting process, the supporting portion 123 is formed between the two surface layer portions 121, 122. The supporting portion 123 prevents the two surface layer portions 121, 122 from being closely attached to each other, so that the three-dimensional structure 12 is visually thicker than the basic structure 11. It should be understood that the method 20 of the invention is not limited to be ended immediately after completion of knitting of the three-dimensional structure 12. According to fabric pattern design of the weft-knitted fabric 10, the basic structure 11 is knitted again after the three-dimensional structure 12 is completed with knitting, as shown in Fig. 4.

[0014] Please refer to Fig. 2, Fig. 3, Fig. 4 and Fig. 5. Hereinafter, the basic structure 11 is used as the double-layer fabric to explain the method 20, and it is assumed that the flat knitting machine 30 is ready to knit the basic structure 11 (the step 21). The machine head 33 simultaneously drives the two needle beds 31, 32 to knit the basic structure 11 based on setting of a knitting process and to produce two fabric surfaces 111, 112 that constitute the double-layer fabric. In the process of knitting the two fabric surfaces 111, 112, the flat knitting machine 30 is set to use transfer knitting technique, tuck knitting technique, or a method of additionally feeding a cross-linking yarn 113, so that the two fabric surfaces 111, 112 are cross-linked and closely attached to each other. When entering a process for knitting the three-dimensional structure 12 of the knitting process, the two surface layer portions 121, 122 are continuously knitted from the two fabric surfaces 111, 112. It should be noted that at a junction 13 of converting from the basic structure 11 to the three-dimensional structure 12 does not comprises any structure to connect the two surface layer portions 121, 122. In technical terms of the industry, the supporting portion 123 is implemented with drop stitches at a junction between the basic structure 11 and the three-dimensional structure 12. Afterwards, the supporting yarn 124 is fed to knit the three-dimensional structure 12, knitting of the three-dimensional structure 12 is the same as described above and thus will not be repeated.

[0015] A thickness of the three-dimensional structure 12 is determined by a length of the supporting yarn 124, and a length of the supporting yarn 124 during knitting process depends on a width of a mouth 34 (shown in Fig. 2 and Fig. 6) of the flat knitting machine 30. It should be understood that changes in a width of the mouth 34 also affect a forming size of yarn loops. When a width of the mouth 34 is larger, knitted yarn loops will become larger, and it will be difficult for excessively large sized yarn loops to form fabric surface structure. Therefore, if a size of the mouth 34 cannot be changed during knitting process, in designing a thickness of the three-dimensional structure 12, a size of yarn loops of the basic structure 11 and the two surface layer portions 121, 122 must be considered. Furthermore, if the flat knitting machine 30 is capable of changing a width of the mouth 34 without stopping knitting during knitting process, the problem that a thickness

of the three-dimensional structure 12 being limited by a single width of the mouth 34 can be tackled. The applicant of the invention has provided flat knitting machine structures with variable mouth width during knitting process as disclosed in Taiwan Patent No. TW 202028555A, TW 202028557A, TW 202028558A, and TW I707074. Please refer to Fig. 7. When the flat knitting machine 30 is controlled to knit the supporting portion 123 of the three-dimensional structure 12, the flat knitting machine 30 drives two knock-over bits 311, 321 of the two needle beds 31, 32 to displace to change a size of the mouth 34 of the flat knitting machine 30, until a size of the mouth 34 is adjusted to meet the knitting requirements, the flat knitting machine 30 performs knitting of the supporting portion 123. In this way, a height of the supporting portion 123 will no longer be a fixed value, and the three-dimensional structure 12 will no longer have a single thickness but is capable of varying in thickness, as shown in Fig. 8.

[0016] Please refer to Fig. 9. The three-dimensional structure 12 on the weft-knitted fabric 10 of the invention does not limit a knitting position, and a knitting position can be determined according to fabric design requirements of the weft-knitted fabric 10.

Claims

1. A method (20) for knitting and forming a weft-knitted fabric (10) with varying thickness by a flat knitting machine (30), the method (20) comprising steps of:

driving the flat knitting machine (30) to knit a basic structure (11) by at least one of two needle beds (31, 32) of the flat knitting machine (30), wherein the basic structure (11) is selected from a single-layer fabric or a double-layer fabric; and controlling the two needle beds (31, 32) on the flat knitting machine (30) to knit a three-dimensional structure (12) connected with the basic structure (11), wherein a thickness of the three-dimensional structure (12) is greater than a thickness of the basic structure (11), the three-dimensional structure (12) comprises two surface layer portions (121, 122) and a supporting portion (123) connected with the two surface layer portions (121, 122) and located between the two surface layer portions (121, 122);

characterized in that

the flat knitting machine (30) is controlled to be temporarily suspended from feeding a supporting yarn (124) at a junction (13) between the three-dimensional structure (12) and the basic structure (11) so that the junction (13) is without the supporting portion (123), and the supporting yarn (124) is fed to form the supporting portion (123) after the two surface layer portions (121, 122) are knitted with a plurality of stitches.

2. The method as claimed in claim 1, wherein during a process of knitting the supporting portion (123), the flat knitting machine (30) drives two knock-over bits (311, 321) of the two needle beds (31, 32) to displace and change a size of a mouth (34) of the flat knitting machine (30), and a height of the supporting portion (123) is not a fixed value. 5
3. The method as claimed in claim 2, wherein when the basic structure (11) is the double-layer fabric, two fabric surfaces (111, 112) of the double-layer fabric are closely attached to each other by tuck knitting or transfer knitting through the flat knitting machine (30). 10
4. The method as claimed in claim 1, wherein when the basic structure (11) is the double-layer fabric, the flat knitting machine (30) feeds a cross-linking yarn (113) to enable two fabric surfaces (111, 112) of the double-layer fabric closely attaching to each other by an action of the cross-linking yarn (113), and the cross-linking yarn (113) is without supporting capability. 15 20
5. A weft-knitted fabric (10) with varying thickness, comprising: 25

at least one basic structure (11), selected from a single-layer fabric or a double-layer fabric; and at least one three-dimensional structure (12), connected with the basic structure (11), wherein a thickness of the three-dimensional structure (12) is greater than a thickness of the basic structure (11), the three-dimensional structure (12) comprising two surface layer portions (121, 122) and a supporting portion (123) connected with the two surface layer portions (121, 122) and located between the two surface layer portions (121, 122), 30

characterized in that

the supporting portion (123) is formed by at least one supporting yarn (124) which is temporarily suspended to be fed at a junction (13) between the three-dimensional structure (12) and the basic structure (11) so that the junction (13) is without the supporting portion (123). 35 40
6. The weft-knitted fabric as claimed in claim 5, wherein a height of the supporting portion (123) is not a fixed value. 45
7. A use of the weft-knitted fabric as claimed in claim 5 or 6 as a breast pad in women's clothing or as a cushion pad in sportswear. 50

Patentansprüche

1. Verfahren (20) zum Stricken und Formen eines Ge-

stricks (10) mit variierender Dicke durch eine Rundstrickmaschine (30), wobei das Verfahren (20) die folgenden Schritte umfasst:

Antreiben der Rundstrickmaschine (30), um eine Grundstruktur (11) durch mindestens eines von zwei Nadelbetten (31, 32) der Rundstrickmaschine (30) zu stricken, wobei die Grundstruktur (11) aus einem einlagigen Gestrick oder einem zweilagigen Gestrick ausgewählt ist; und Steuern der beiden Nadelbetten (31, 32) auf der Rundstrickmaschine (30), um eine dreidimensionale Struktur (12) zu stricken, die mit der Grundstruktur (11) verbunden ist, wobei eine Dicke der dreidimensionalen Struktur (12) größer ist als eine Dicke der Grundstruktur (11), die dreidimensionale Struktur (12) zwei Oberflächenschichtabschnitte (121, 122) und einen Stützabschnitt (123) aufweist, der mit den beiden Oberflächenschichtabschnitten (121, 122) verbunden ist und sich zwischen den beiden Oberflächenschichtabschnitten (121, 122) befindet;

dadurch gekennzeichnet, dass

die Rundstrickmaschine (30) so gesteuert wird, dass sie vorübergehend an einer Verbindungsstelle (13) zwischen der dreidimensionalen Struktur (12) und der Grundstruktur (11) kein Stützgarn (124) zuführt, so dass die Verbindungsstelle (13) ohne den Stützabschnitt (123) ausgebildet ist und das Stützgarn (124) zugeführt wird, um den Stützabschnitt (123) zu bilden, nachdem die beiden Oberflächenschichtabschnitte (121, 122) mit einer Vielzahl von Maschen gestrickt sind.

2. Verfahren nach Anspruch 1, wobei während eines Strickvorgangs des Stützabschnitts (123) die Rundstrickmaschine (30) zwei Abstreifnadeln (311, 321) der beiden Nadelbetten (31, 32) antreibt, um eine Öffnung (34) der Rundstrickmaschine (30) zu verschieben und ihre Größe zu verändern, und eine Höhe des Stützabschnitts (123) kein fester Wert ist.
3. Verfahren nach Anspruch 2, wobei, wenn die Grundstruktur (11) das zweilagige Gestrick ist, zwei Gestrickoberflächen (111, 112) des zweilagigen Gestricks durch Fangstricken oder Transferstricken durch die Rundstrickmaschine (30) eng aneinander liegend miteinander verbunden werden. 50
4. Verfahren nach Anspruch 1, wobei, wenn die Grundstruktur (11) das zweilagige Gestrick ist, die Rundstrickmaschine (30) ein Vernetzungsgarn (113) zuführt, so dass zwei Gestrickoberflächen (111, 112) des zweilagigen Gestricks durch die Wirkung des Vernetzungsfadens (113) eng aneinander liegend miteinander verbunden werden können, und der 55

Vernetzungsfaden (113) keine Stützfähigkeit aufweist.

5. Schussgestricktes Gestrück (10) mit variierender Dicke, umfassend:

mindestens eine Grundstruktur (11), ausgewählt aus einem einlagigen Gestrück oder einem zweilagigen Gestrück; und

mindestens eine dreidimensionale Struktur (12), die mit der Grundstruktur (11) verbunden ist, wobei die Dicke der dreidimensionalen Struktur (12) größer ist als die Dicke der Grundstruktur (11), wobei die dreidimensionale Struktur (12) zwei Oberflächenschichtabschnitten (121, 122) und einen mit den beiden Oberflächenschichtabschnitten (121, 122) verbundenen und zwischen den beiden Oberflächenschichtabschnitten (121, 122) angeordneten Stützabschnitt (123) umfasst,

dadurch gekennzeichnet, dass

der Stützabschnitt (123) durch mindestens ein Stützgarn (124) gebildet ist, dessen Zuführung an einer Verbindungsstelle (13) zwischen der dreidimensionalen Struktur (12) und der Grundstruktur (11) vorübergehend unterbrochen ist, so dass die Verbindungsstelle (13) ohne den Stützabschnitt (123) ausgebildet ist.

6. Schussgestrickte Gestrück nach Anspruch 5, wobei die Höhe des Stützabschnitts (123) ohne festen Wert ist.
7. Verwendung des schussgestrickten Gestrücks nach Anspruch 5 oder 6 als Brustpolster in Damenbekleidung oder als Polsterkissen in Sportbekleidung.

Revendications

1. Un procédé (20) de tricotage et de formation d'un tricot à mailles croisées (10) d'épaisseur variable par une machine à tricoter plate (30), le procédé (20) comprenant des étapes consistant à :

commander la machine à tricoter plate (30) pour tricoter une structure de base (11) par au moins une des deux lits d'aiguilles (31, 32) de la machine à tricoter plate (30), dans laquelle la structure de base (11) est sélectionnée parmi un tissu à une couche ou un tissu à deux couches ; et contrôler les deux lits d'aiguilles (31, 32) sur le métier à tricoter plat (30) pour tricoter une structure tridimensionnelle (12) reliée à la structure de base (11), dans laquelle une épaisseur de la structure tridimensionnelle (12) est supérieure à une épaisseur de la structure de base (11), la structure tridimensionnelle (12) comprend deux

parties de couche de surface (121, 122) et une partie de support (123) reliée aux deux parties de couche de surface (121, 122) et située entre les deux parties de couche de surface (121, 122) ;

caractérisé par le fait que

la machine à tricoter à plat (30) est commandée de manière à être temporairement suspendue pour alimenter un fil de soutien (124) à une jonction (13) entre la structure tridimensionnelle (12) et la structure de base (11) de sorte que la jonction (13) soit dépourvue de la partie de soutien (123), et le fil de soutien (124) est alimenté pour former la partie de soutien (123) après que les deux parties de la couche de surface (121, 122) ont été tricotées avec une pluralité de mailles.

2. Le procédé selon la revendication 1, dans lequel, au cours d'un processus de tricotage de la portion de support (123), le métier à tricoter plat (30) entraîne deux mèches knock-over (311, 321) des deux lits d'aiguilles (31, 32) pour déplacer et modifier une taille d'une embouchure (34) du métier à tricoter plat (30), et une hauteur de la portion de support (123) n'est pas une valeur fixe.

3. Le procédé selon la revendication 2, dans lequel lorsque la structure de base (11) est le tissu double couche, deux surfaces de tissu (111, 112) du tissu double couche sont étroitement attachées l'une à l'autre par tricotage tuck ou tricotage transfert à travers la machine à tricoter plate (30).

4. Le procédé selon la revendication 1, dans lequel, lorsque la structure de base (11) est le tissu à double couche, le métier à tricoter plat (30) alimente un fil de réticulation (113) pour permettre aux deux surfaces de tissu (111, 112) du tissu à double couche de s'attacher étroitement l'une à l'autre par une action du fil de réticulation (113), et le fil de réticulation (113) est dépourvu de capacité de support.

5. Un tissu tricoté à mailles croisées (10) d'épaisseur variable, comprenant

au moins une structure de base (11), choisie parmi un tissu à une couche ou un tissu à deux couches ; et

au moins une structure tridimensionnelle (12), reliée à la structure de base (11), dans laquelle une épaisseur de la structure tridimensionnelle (12) est supérieure à une épaisseur de la structure de base (11), la structure tridimensionnelle (12) comprenant deux parties de couche de surface (121, 122) et une partie de support (123) reliée aux deux parties de couche de surface (121, 122) et située entre les deux parties

de couche de surface (121, 122),

caractérisé par le fait que

la partie de support (123) est formée par au moins un fil de support (124) qui est temporairement suspendu pour être alimenté à une jonction (13) entre la structure tridimensionnelle (12) et la structure de base (11) de sorte que la jonction (13) soit dépourvue de la partie de support (123).

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6. Le tissu tricoté à mailles croisées selon la revendication 5, dans lequel une hauteur de la portion de support (123) n'est pas une valeur fixe.

7. L'utilisation de l'étoffe tricotée à trame selon la revendication 5 ou 6 comme coussin mammaire dans un vêtement féminin ou comme coussin dans un vêtement de sport.

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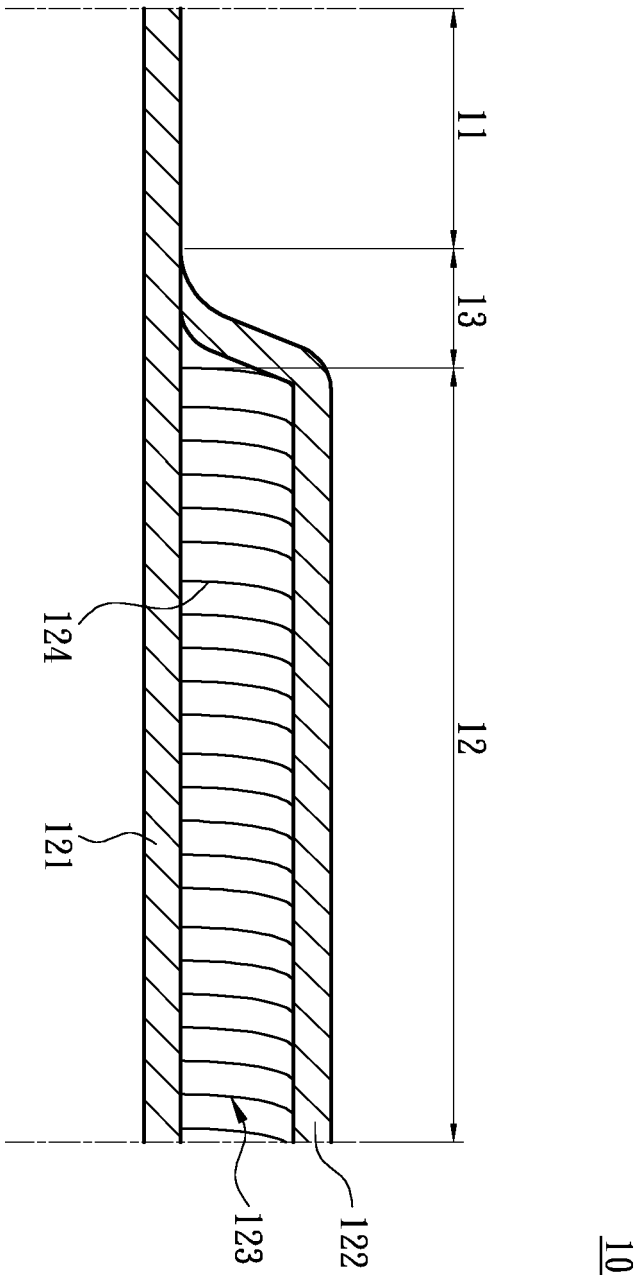


Fig. 1

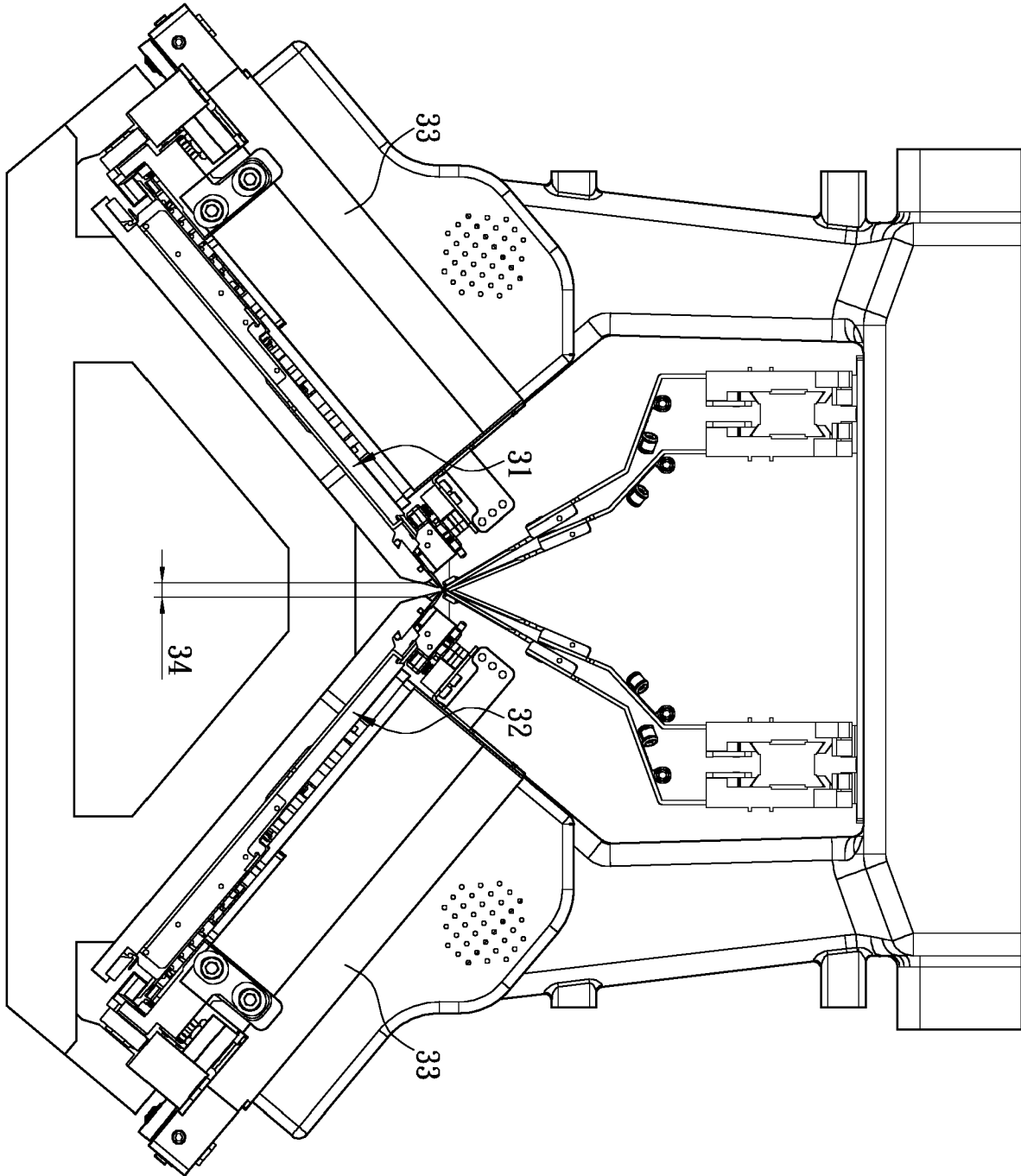


Fig. 2

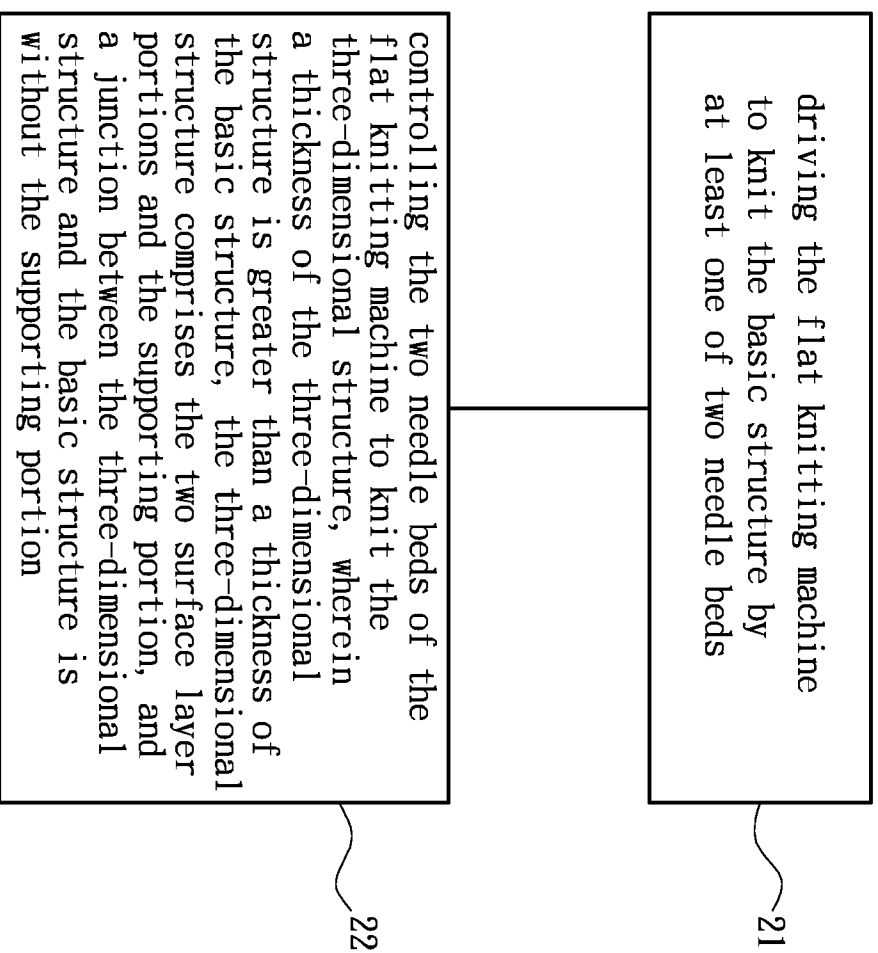


Fig. 3

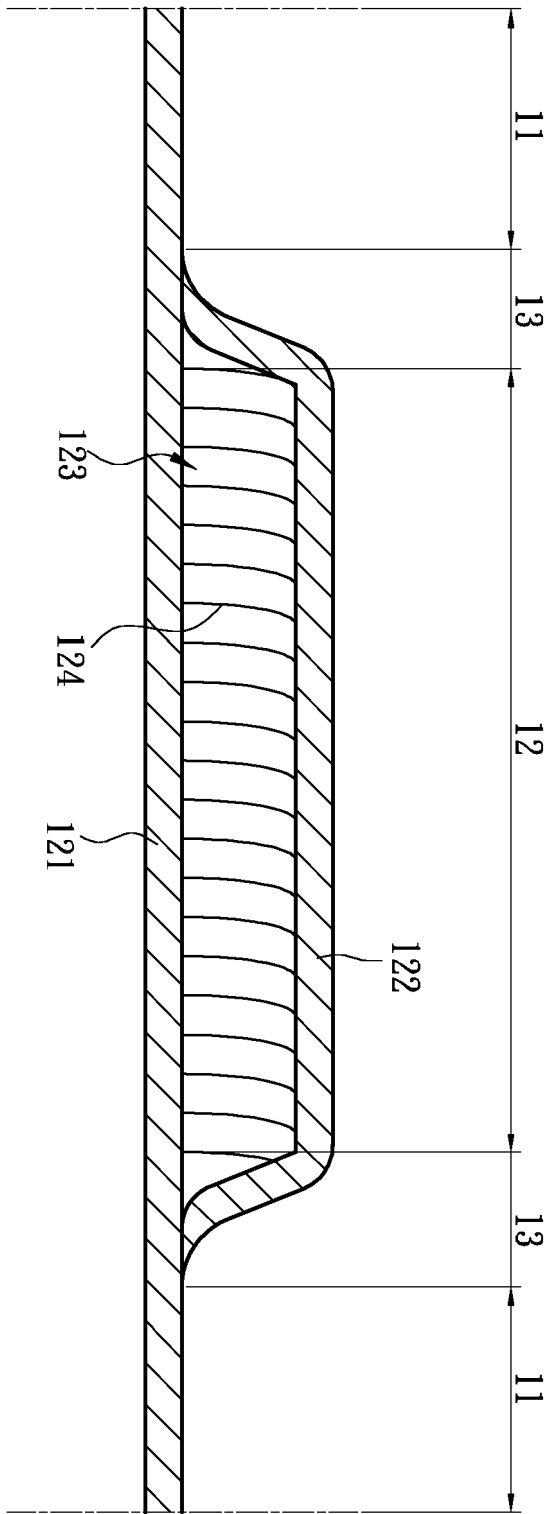


Fig. 4

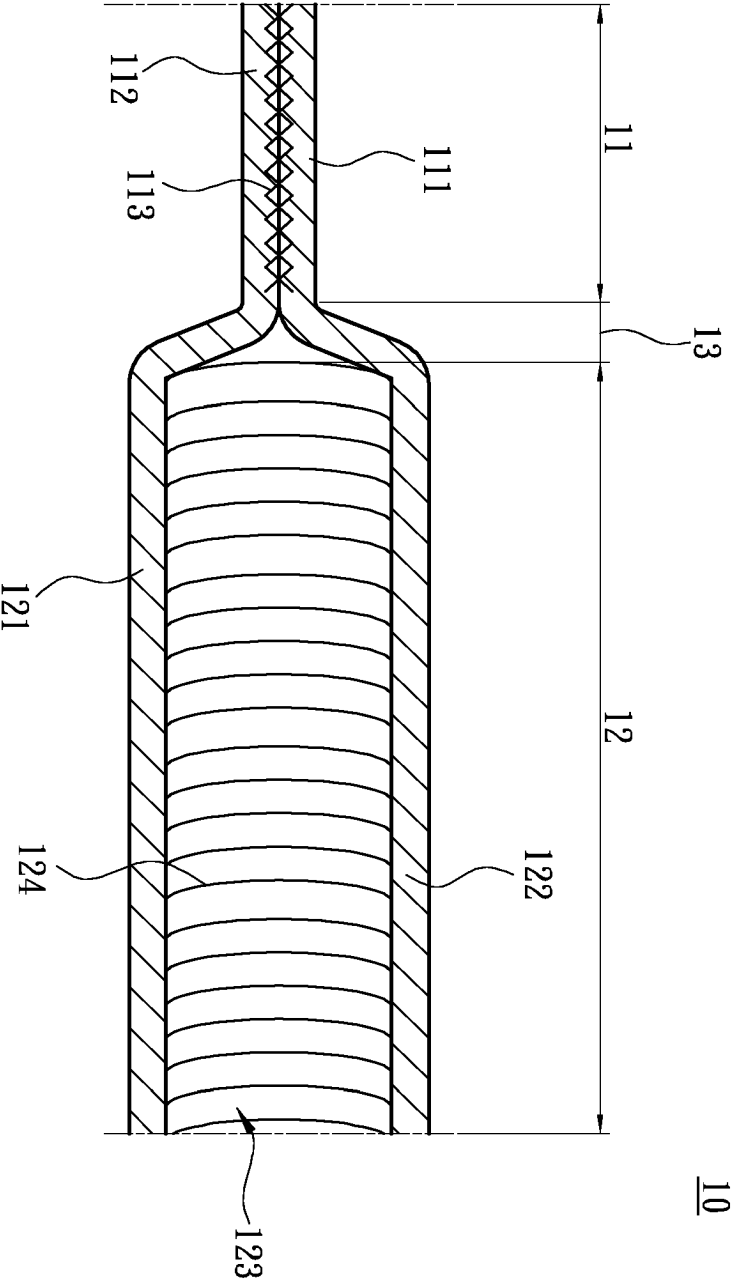


Fig. 5

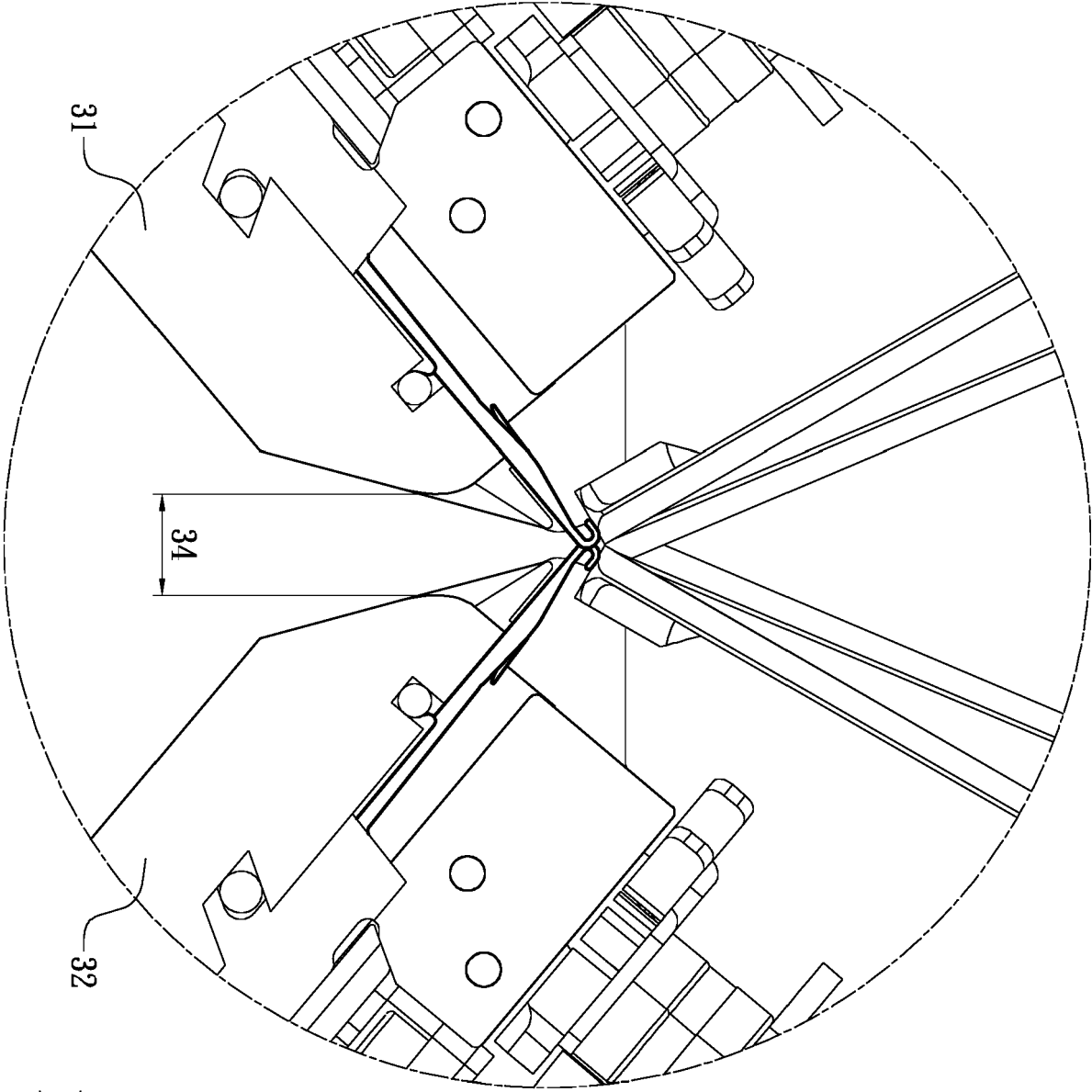


Fig. 6

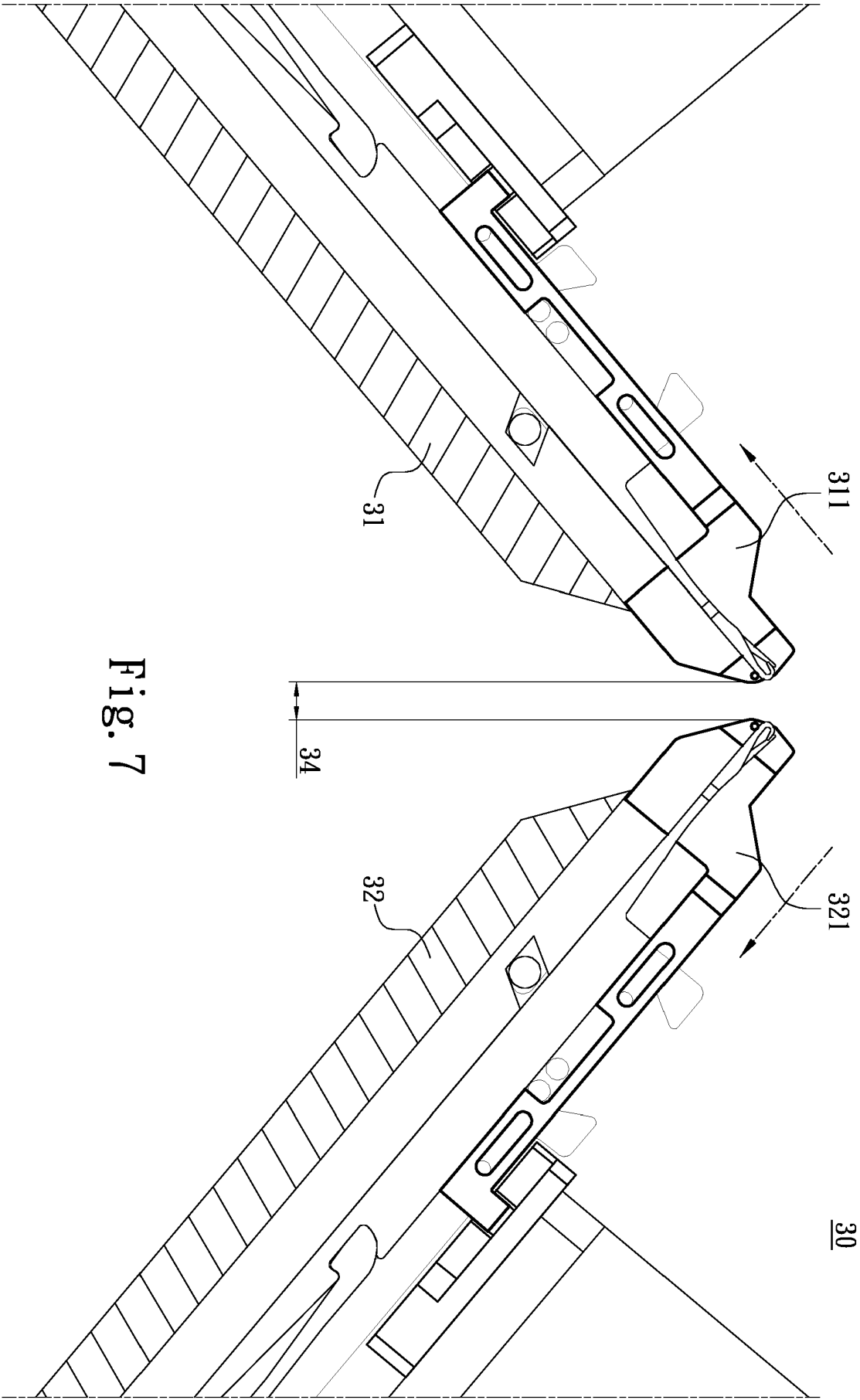


Fig. 7

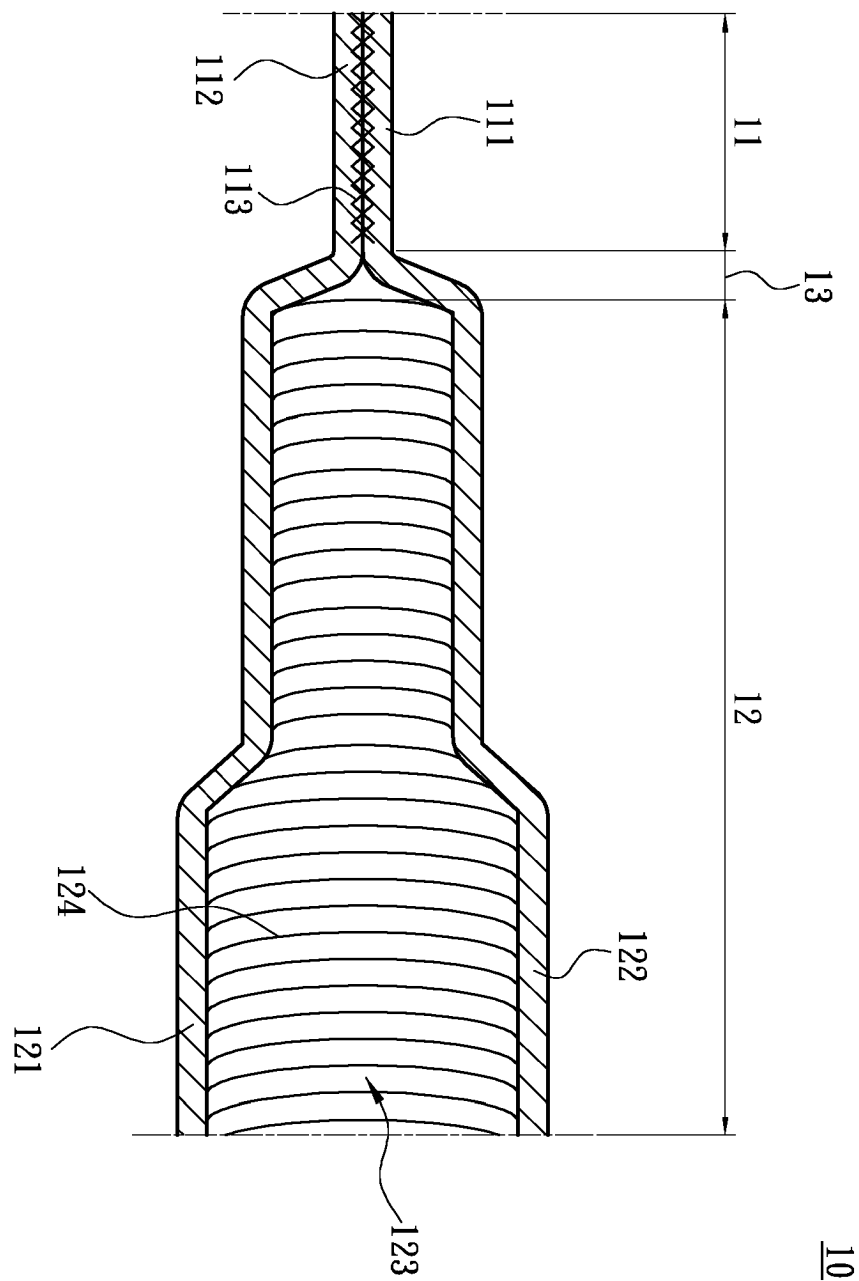


Fig. 8

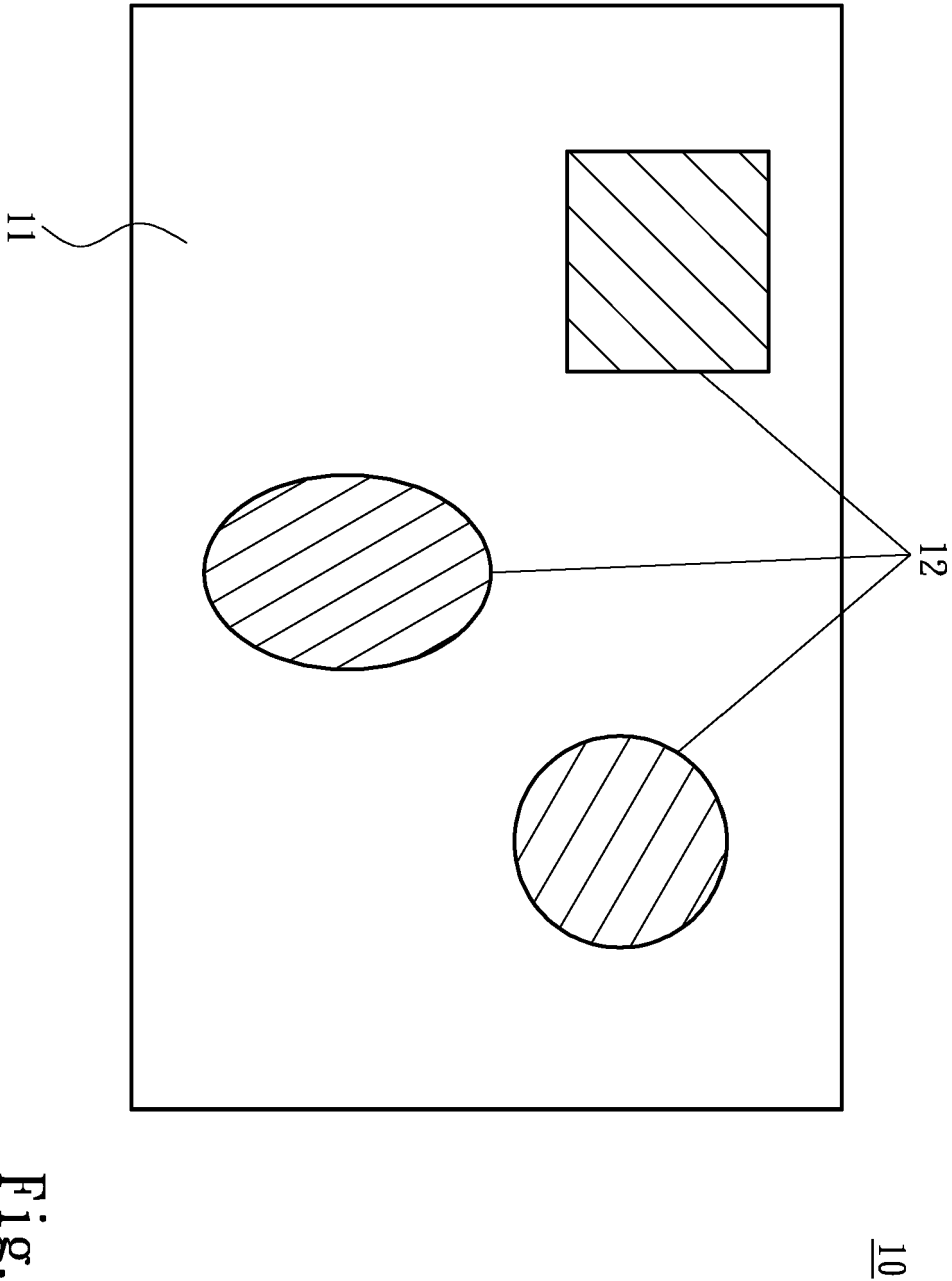


Fig. 9

REFERENCES CITED IN THE DESCRIPTION

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