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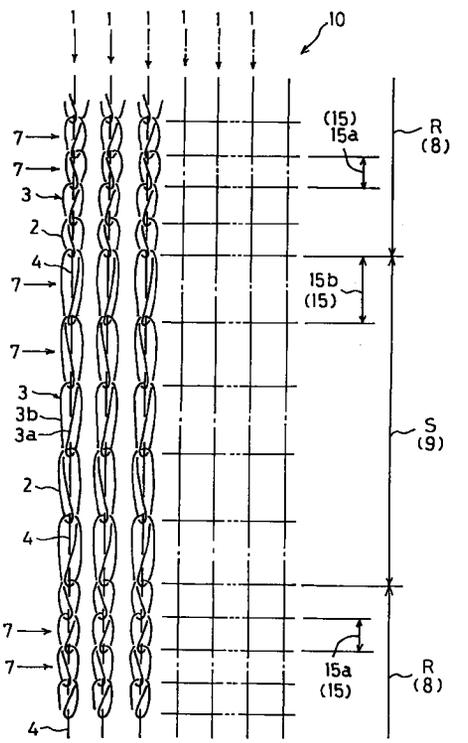
(54) Method of knitting lace fabric and lace fabric knitted by the method

(57) A method of manufacturing a lace fabric is disclosed. The method includes the steps of: forming, with each single knitting cycle, a course (7) including a plurality of loops (3) formed side by side by chain-stitching a plurality of warp yarns (2); repeating the knitting cycle to form a plurality of courses (7) continuously in the wale direction, thereby to form a plurality of wales (1) disposed side by side and formed of the chain-stitched warp yarns (2). The method further includes the steps of: knitting an expansion yarn (4) into each one of at least some of the plurality of wales (1). In this expansion yarn knitting step, the plurality of courses (7) are divided into a plurality of kinds of course groups whose expansion yarns (4) inserted therein have expansion degrees different from each other. The lace fabric manufactured by the method is also disclosed.

Fig. 1



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Description

BACKGROUND OF THE INVENTION

1 FILED OF THE INVENTION

The present invention relates to a lace fabric, typically a Raschel lace, including a plurality of wales formed of loop-knitted warps. The invention relates, more particularly, to a lace fabric having wale-wise stretchability.

2 DESCRIPTION OF THE RELATED ART

A lace fabric is formed by knitting yarns and therefore the fabric inherently has some degree of stretchability. Then, by utilizing this inherent stretchability, there is known a lace fabric provided with uniform wale-wise elastic stretchability along the entire length thereof by knitting an expansion yarn, e.g. a rubber yarn, into some or all of the wales of the lace fabric.

Fig. 4 shows a Raschel warp-knitting machine as an example of a lace knitting machine, for use in knitting such lace fabric as described above. This Raschel warp-knitting machine 20 includes a knitting head 24 for knitting a lace fabric 10, a fabric roll 25 for taking up the fabric 10 knitted by the knitting head 24, ground beams 21 for respectively threading ground yarns 11 including a warp yarn 2 and a weft yarn 5 and so on, an expansion yarn beam 22 for threading an expansion yarn 4 to the knitting head 24 to be knitted with the warp yarn 2, and an ornamental yarn beam 23 for threading an ornamental yarn 6a to the knitting head 24 to be inlaid among the ground yarns 11. The knitting head 24 includes a plurality of reeds having guide bars for guiding the ground yarns 11, the expansion yarn 4 and the ornamental yarn 6a, a plurality of knitting needles for chain-stitching the warps 2, and a needle guide for vertically guiding the knitting needles (not shown). The lace fabric 10 is formed at this knitting head 24 and then taken up about the fabric roll 25. With one vertical reciprocal movement of the knitting needles, loops 3 of the wales 1 of one course 7 are formed. These constructions and functions are well-known in the art and therefore will not be repeated herein.

Fig. 5 shows one example of the lace fabric 10 to be taken up about the fabric roll 25. With one reciprocal movement of the number of needles, the warps 2 of the ground yarns 11 are chain-stitched to form the loops 3 which constitute a plurality of wales 1. And, between a needle loop portion 3a and a sinker loop portion 3b of each loop 3, a weft yarn 5 is inserted to interconnect the wales 1 with each other, thus forming a foundation or ground 12. In this ground 12 knitted of these ground yarns 11, there are formed meshes 14 having shapes which differ according to the course pitches of inserting the weft yarns 5. The expansion yarn 4 is inserted among the needle loop portion 3a, the sinker loop portion 3b and the weft yarn 5, with one expansion yarn 4 being present within and along each wale 1. In the course of the knitting operation, a necessary and appropriate tension is applied to the ground yarns 11 and other yarns. And, the expansion yarn 4 too is subjected to the knitting tension. As this yarn has much greater expansivity, i.e. stretchability than the other yarns, the expansion yarn is knitted under an expanded condition. Then, by utilizing this elastic expansivity of the expansion yarn 4, the resultant lace fabric 10 obtains the substantially uniform stretchability in the wale direction along the entire length of the fabric.

In addition to the above, an inlay yarn 6 such as the ornamental yarn 6a, is inlaid among the needle loop portion 3a, the weft yarn 5, the expansion yarn 4 and the sinker loop portion 3b, so as to form an ornamental pattern 13. These ground yarns 11 and the inlay yarn 6 are knitted under the knitting tension, together with the expansion yarn 4 which is kept under the expanded condition. Thus, the knitted fabric has a constant course width on the knitting machine (i.e. while being knitted on the lace knitting machine). The fabric as a product (i.e. when removed from the machine) is elastically shrunk in the direction of wales 1 due to the elastic resilience of the expansion yarns 4. Then, this fabric product can be substantially uniformly stretchable to its maximum length corresponding to the length of the fabric when being knitted on the machine.

In the case of the lace fabric having the construction described above, although the fabric obtains the wale-wise stretchability due to the elastic resilience of the expansion yarn 4 by knitting this expansion yarn 4 into the wale 1 on the machine under the expanded condition, this stretchability is uniform along the entire wale of the fabric.

Accordingly, this lace fabric having such uniform stretchability is unsuitable for forming e.g. a girdle entirely of this fabric which is expected to tighten only some limited body portions of the wearer. If the fabric is to be used in such garment, the fabric, in the form of patches, would be sewn to the necessary portions of some other non-stretchable fabric. This impairs the aesthetic appearance of the garment.

In view of the above-described state of the art, a primary object of the present invention is to provide a lace fabric having an uninterrupted ornamental pattern, yet providing elastic resilience at some predetermined portions alone for tightening corresponding body portions of the wearer in a localized manner.

SUMMARY OF THE INVENTION

For accomplishing the above-noted object, according to an appended claim 1 the present invention, a method of manufacturing a lace fabric, the method having the steps of:

forming, with each single knitting cycle, a course including a plurality of loops formed side by side by chain-stitching a plurality of warp yarns;

repeating the knitting cycle to form a plurality of courses continuously in the wale direction, thereby to form a plurality of wales disposed side by side and formed of the chain-stitched warp yarns;

characterized by the steps of

knitting an expansion yarn into each one of at least some of the plurality of wales; and

in the expansion yarn knitting step, the plurality of courses being divided into a plurality of kinds of course groups whose expansion yarns inserted therein have expansion degrees different from each other.

As described hereinbefore, the expansion yarn is knitted on the machine under the expanded condition. Then, in case this expansion yarn is knitted with a large expansion degree, the yarn provides a correspondingly large degree of elastic resilience. Conversely, if the yarn is knitted with a small expansion degree, the yarn provides a correspondingly small degree of elastic resilience. And, also, according to the fabric construction formed by the method according to claim 1 of the present invention, the expansion degrees of the expansion yarn differ from each other among the courses. Hence, the resultant fabric can provide different degrees of elastic resilience in the direction of wale. That is, the fabric, when stretched wale-wise, provides different degrees of elastic resilience in this direction.

As a result, if this lace fabric is provided as a lace fabric for a girdle having an ornamental pattern knitted therein, the fabric may be used not in the form of patches, but the girdle may be formed integrally and continuously of the fabric in an aesthetically advantageous manner. Still, this fabric can provide different tightening forces in the wale direction.

According to a further feature relating to claim 2 of the present invention, in the method described above, two kinds of course groups are formed, and the elastic yarn is knitted in one of the course groups, i.e. first course group, with a predetermined expansion degree or zero expansion degree while the elastic yarn is knitted in the other, i.e. second course group with an expansion degree greater than the predetermined expansion degree of the first course group. With this method too, it is possible to manufacture a lace fabric suitable for providing a tightening force only at some predetermined portions.

As a result, it is possible to provide a lace fabric, for use in e.g. a girdle, having a desired ornamental pattern while providing a tightening force only at predetermined portions.

According to a further feature of the present invention relating to claim 3, in the above method relating to claim 2, each course belonging in the second course group has a greater course width than each course belonging in the first course group. The lace fabric resulting from this method may be stretched by an amount corresponding to the course width (i.e. the intercourse distance corresponding to the take-up amount of the fabric on the fabric roll of the machine), and this fabric has the different expansion degrees (i.e. the degrees of the changes in the length of the ground of the lace fabric when the fabric is stretched wale-wise from the its natural condition) between the first course group and the second course group. Accordingly, as the elastic resilience results from the elastic stretchability, the elastic resilience is determined by the amount of stretching of the expansion yarn. Then, when the fabric is stretched beyond the limit of the stretchability of the smaller course width, the fabric may be further stretched at the wider course group portion thereof. Hence, the wider course group portion of the fabric can provide a different amount of elastic resilience than the rest of the fabric. Accordingly, this fabric will be suitable for use in an underwear which has an ornamental lace pattern and stretchability at locally limited desired portions thereof (e.g. the chest portion adjacent the collar or waist side portions) without forming any openings in the fabric or using any fasteners or hooks.

As a result, e.g. an underwear such as a girdle formed of this fabric may have a desired ornamental pattern while providing the adjustable tightening forces only at the necessary portions thereof. Incidentally, when the lace fabric manufactured by the above-described method of the invention is used in a garment having a lace-knitted waist portions, the portion of the fabric having the greater stretchability will be used in the waist side portions or the back side portion of the garment. With this, the user will find this garment easy to put on or take off, without forming any openings in the waist sides or back side in the garment. Also, the construction can improve the aesthetic appearance of the garment.

According to a further feature of the invention relating to claim 4, in the method relating to claim 1 or 2, the first course group and the second course group are formed alternately to each other. With this, the fabric may be provided with the portions having the different degrees of elastic resilience alternately to each other.

As a result, when this fabric is used in a girdle for example, if the fabric portions having different degrees of elastic resilience are provided in accordance with the size of the garment, this fabric may have a desired ornamental pattern while providing the adjustable tightening forces only at the necessary portions thereof.

According to a still further feature of the invention relating to claim 5, in the method relating to any one of claims 1 through 3, the expansion yarn is knitted into each and every one of the plurality of wales. With this, the lace fabric will obtain the partial, i.e. locally limited stretchability or different stretchabilities depending on the portions thereof over the entire width of the fabric.

As a result, when this fabric is used in e.g. a girdle, by knitting expansion yarn having a large amount of elastic resilience, the fabric may be provided with an ornamental pattern while providing tightening forces at the necessary portions alone.

According to a further aspect of the present invention relating to claim 6, there is provided a lace fabric comprising:

a plurality of wales formed in a longitudinal direction of a plurality of chain-stitched warp yarns;
a plurality of courses formed continuously in the longitudinal direction, each course being formed of a plurality of loops disposed side by side and belonging in the plurality of wales;
characterized by

an expansion yarn knitted into each one of at least some of the plurality of wales;
a plurality of kinds of course groups, each course group including at least one of said courses; and
the course groups providing different degrees of elastic resilience when the fabric is stretched in the longitudinal direction.

Accordingly, this fabric will be suitable for use in an underwear which has an ornamental lace pattern and also stretchability at only limited desired portions thereof (e.g. the chest portion adjacent the collar or the waist side portions) without forming any openings in the fabric or using any fasteners or hooks.

As a result, e.g. an underwear such as a girdle formed of this fabric may have a desired ornamental pattern while providing the adjustable tightening forces only at the necessary portions thereof. Incidentally, when the lace fabric of the invention is used in a garment having a lace-knitted waist portions, the portion of the fabric having the greater stretchability will be used in the waist side portions or the back side portion of the garment. With this, the user will find this garment easy to put on or take off, without forming any openings in the waist sides or back side in the garment. Also, the construction can improve the aesthetic appearance of the garment.

According to a further feature of the invention relating to claim 7, in the fabric of claim 6, the expansion yarn is knitted into each and every one of the plurality of wales. With this, the lace fabric will obtain the localized stretchability or different stretchabilities depending on the portions thereof over the entire width of the fabric.

As a result, when this fabric is used in e.g. a girdle, by knitting expansion yarn having a large amount of elastic resilience, the fabric may be provided with an ornamental pattern while providing tightening forces at the necessary portions alone.

According to a still further feature of the invention relating to claim 8, in the fabric relating to claim 6 or 7, the plurality of course groups are provided in two kinds of a first course group and a second course group, with the first and second course groups being provided alternately to each other. In this case, the fabric includes the portions having different degrees of elastic resilience provided alternately to each other.

As a result, when this fabric is used in a girdle for example, if the fabric portions having different degrees of elastic resilience in accordance with the size of the garment, this fabric may have a desired ornamental pattern while providing the adjustable tightening forces only at the necessary portions thereof. Also, when this fabric is used in an under wear made of e.g. tricot having stretchability over the entire wear, the fabric may provide such wear having good aesthetic appearance without using collar openings, fasteners or hooks or the like.

According to a still further feature of the invention relating to claim 9, in the fabric relating to claim 8, the expansion yarns are knitted into the wales such that the expansion yarn knitted into the first course group provides no elastic resilience while the expansion yarn knitted into the second course group provides elastic resilience. With this fabric, no elastic resilience is provided at the first course group, while elastic resilience is provided at the second course group alone. Accordingly, this fabric is suitable for providing the elastic resilience, i.e. tightening force only at some predetermined portions. Further, if the elastic resilience of the expansion yarn is varied course-wise, this fabric will be warped at its stretchable portions, thus providing the course-wise elastic resilience also.

As a result, when this fabric is used in e.g. a girdle, the fabric will be provided with a desired ornamental pattern while effectively tightening the necessary body portions in a localized manner. Further, if this fabric is used in an under wear not having much stretchability as a whole, no ground fabric will be provided at portions thereof where a collar opening, side hooks or the like are to be provided, and the stretchable portions of the fabric of the invention will be provided there instead. With this, the under wear will obtain good aesthetic appearance.

Further and other objects, features and effects of the invention will become more apparent from the following more detailed description of the embodiments of the invention with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic descriptive view showing a lace fabric relating to the present invention mounted on a knitting machine,
Fig. 2 is a descriptive view illustrating a knitting condition of a portion of the lace fabric relating to the invention,
Fig. 3 is a descriptive view illustrating expansive changes in the lace fabric of the invention,
Fig. 4 is a side view of a Raschel warp lace knitting machine for describing a conventional lace knitting method, and
Fig. 5 is a descriptive view illustrating a knitting condition of principal portions of a conventional lace fabric.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described in details with reference to the accompanying drawings.

Fig. 1 is a schematic view of a portion of a lace fabric 10 taken up about a fabric roll 25 from a knitting head 24 of such a Raschel warp-knitting machine as shown in Fig. 4. In Fig. 1, an inlay yarn 6 is not shown. The construction of the Raschel warp-knitting machine used in the embodiments of the invention is not shown, but the construction is substantially identical to that of the conventional machine of Fig. 4. The construction of the machine is characterized in that an expansion yarn 4 extending between an expansion yarn beam 22 to a knitting head 24 is threaded via a tension adjusting means (not shown) to the knitting head 24. A lace fabric 10 has a construction generally shown in Fig. 2. A ground 12, an ornamental pattern 13 and a mesh 14 of this fabric 10 are same as those of the conventional lace fabric. Namely, a plurality of warp yarns 2 are formed into loops 3 together constituting a plurality of wales 1 disposed side by side, and a weft yarn 5 is inserted between a needle loop portion 3a and a sinker loop portion 3b of each of the loops 3, thereby to inter-connect the wales 1 to form the ground 12. In this ground 12 knitted of these warp yarns 2 and weft yarns 5, there are formed the meshes 14 having different shapes depending on e.g. change in the course pitch for inserting the weft yarn 5. Further, among the needle loop portion 3a, the expansion yarn 4 and the sinker loop portion 3b, the inlay yarn 6 comprised of e.g. an ornamental yarn 6a is inserted together with the weft yarn 5, so that the ornamental yarns 6a together form an ornamental pattern 13.

The expansion yarn 4 comprised of e.g. a rubber yarn, is knitted into and along the wale 1 among e.g. the needle loop portion 3a, the sinker loop portion 3b, the weft yarn 5 and the inlay yarn 6. That is to say, while the other yarns are knitted with varying the take-up speed of the fabric roll 25 while the yarns are being maintained under a fixed degree of expansion, the expansion yarn 4 is knitted with a greater degree of expansion than the other yarns. Further, the warp yarn 2, the weft yarn 5 and the ornamental yarn 6a are knitted together with the rubber yarn 4 under the stretched condition of this rubber yarn 4. As the result, the lace fabric 10 obtains elastic stretchability by utilizing the stretchability of the rubber yarns 4. Namely, when this lace fabric 10 is stretched in the longitudinal direction, i.e. in the direction of wales, the rubber yarns 4 are stretched, so that the elastic resilience of the rubber yarns 4 are provided to the respective wales 1. In this manner, the lace fabric 10 provides the elastic resilience as soon as the fabric is stretched.

The rubber yarn 4 includes a first rubber filament 4a and a second rubber filament 4b. The first rubber filament 4a is inserted between the needle loop portion 3a and the sinker loop portion 3b of each and every loop 3. Whereas, the second rubber filament 4b is inserted intermittently, that is, into the needle loop portion 3a and the sinker loop portion 3b of some of the loops 3 only. As a result, the loops 3 are divided into three kinds, i.e. one kind in which both the first and second rubber filaments 4a, 4b are inserted in one same direction, another kind in which these first and second rubber filaments 4a, 4b are inserted in directions crossing each other, and the other kind in which only the first rubber filament 4a is inserted. For this reason, when heat is applied to the lace fabric in the course of its finishing step, at those loops 3 in which both the first and second rubber filaments 4a, 4b are inserted, the first and second rubber filaments 4a, 4b become partially heat-fused to each other, so that these filaments are fixed in position in the ground 12 along the length of the wales 1. As a result, when this lace fabric is cut off at a longitudinal end thereof, there occurs no possibility of both the rubber filaments 4a, 4b being elastically retracted into the lace fabric. Moreover, as some of the loops 3 contain only the first rubber filaments 4a, the inlay yarns may be inserted into these loops with sufficient gaps therebetween. Therefore, this lace fabric has sufficient amount of stretchability.

Fig. 1 schematically shows a lace fabric portion as mounted and extended between the knitting head 24 and the fabric roll 25. In this figure, the above-described knitting arrangement or the number of the rubber yarns 4 are not shown. Further, of the ground yarns 11, only the warp yarns 2 are shown. The lace fabric 10 includes a plurality of non-stretchable zones R (i.e. zones having substantially no stretchability) each comprised of a 'first course group' for providing substantially no elastic resilience and a plurality of stretchable zones S (i.e. zones having a large degree of stretchability) each comprised of a 'second course group' for providing elastic resilience, with the non-stretchable zones R and stretchable zones S being provided continuously with and alternately to each other. Those un-illustrated yarns, such as the weft yarn 5, the inlay yarn 6, are knitted with a same, i.e. fixed course pitch in both the non-stretchable zones R and stretchable zones S. In the stretchable zone S, each course thereof has a course width 15b which is greater than a course width 15a of each course member of the non-stretchable zone R, so that the rubber yarn 4 provides a greater amount of elastic resilience at this stretchable zone S. Then, by varying the course width 15 in the above-described manner, the elastic resilience of this lace fabric 10 differs in the longitudinal direction. Further, in the non-stretchable zone R, the rubber yarn 4 is fixedly provided with substantially same small degree of expansion as that provided to the other yarns such as the ground yarns 11. On the other hand, in the stretchable zone S, the rubber yarn 4 is provided with the large and variable degree of expansion varying in accordance with the variation in the course width 15. With this, in the lace fabric 10, as a condition thereof used in a product, the loops 3 are capable of expansion

as much as allowed by the course width 15. Thus, when this lace fabric 10 is stretched, in the non-stretchable zone R, the rubber yarn 4 can be expanded only to the substantially same degree as the the ground; while, in the stretchable zone S, the rubber yarn 4 can be expanded by a greater degree substantially corresponding to the course width 15. Hence, this lace fabric has the locally limited stretchability. Incidentally, as shown in Fig. 2, if the rubber yarns 4, as the first and second rubber filaments 4a, 4b, are knitted in such manner as to cross each other at the portions thereof inserted into the wales 1; then, this will limit the displacement of the two rubber filaments 4a, 4b relative to the loops 3. As a result, this arrangement will advantageously restrict displacement of the rubber yarns 4 between the non-stretchable zone R and the stretchable zone S, and these zones R and S may be formed reliably in the fabric. Incidentally, in Fig. 1, the weft yarns 5, the inlay yarns 6 and so on are not shown, also, a smaller number of the second course groups 9 than used in the actual product are shown.

Next, a method of knitting the lace fabric having the above-described construction will be described in details with reference to Fig. 4.

The ground yarns 11 and the inlay yarn 6 are threaded in the same manners as those of the conventional method. Whereas, the rubber yarn 4 is fed from the expansion yarn beam 22 via the tension adjusting means (not shown) to the knitting head 24. The tension adjusting means, though the specific construction thereof is not shown, is capable of varying the threading length of the rubber yarn 4 from the expansion yarn beam 22 to the knitting head 24. More particularly, the rubber yarn 4 is applied with a degree of expansion due to and corresponding to a difference between the feeding speed of the expansion yarn bean 22 and the take-up speed of the fabric roll 25 for taking up the lace fabric 10. Then, as the course width 15 is determined by the inter-course take-up amount of the fabric roll 25, the expansion yarn beam 22 is controlled in association with the feeding speed of the roll 25. In this, if the threading length from the expansion yarn beam 22 to the knitting head 24 were fixed, there would occur a significant delay in the change of expansion degree to be applied to the rubber yarn 4 in the course of transition from the non-stretchable zone R to the stretchable zone S and also from the stretchable zone S to the non-stretchable zone R. Then, in order to reduce this delay, the tension adjusting means is employed.

This tension adjustment is done by varying the extension length of the rubber yarn from the expansion yarn beam 22 to the knitting head 24. For instance, a plurality of guides will be provided and an passage of the rubber yarn 4 will be formed across these guides. Then, by moving these guides relative to each other, the length of the passage, i.e. the threading length, may be varied. That is, in the course of the transition from the non-stretchable zone R to the stretchable zone S, the threading length will be increased. Conversely, in the course of the transition from the stretchable zone S to the non-stretchable zone R, the threading length will be reduced to the original length. And, this change of the passage length will be effected within about 3 seconds (e.g. while knitting about 10 courses). With these, the lace fabric will obtain stretchability which varies continuously across very narrow widths. Fig. 3 is a descriptive view for illustrating the stretchability of the lace fabric 10 knitted as described above. In the figure, a mark (a) denotes an outer appearance of the lace fabric 10 as in a product, i.e. in a non-stretched natural state. Whereas, a mark (b) denotes an outer appearance of the fabric 10 under a longitudinally, i.e. wale-wise, stretched condition. Incidentally, in this figure, the outer appearances are simplified so as to render the change in the appearance more conspicuous, and the ornamental pattern formed in the fabric is not shown. In the condition of (a), there is no change in the pattern in either the non-stretchable zone R or the stretchable zone S. Whereas, in the condition of (b), substantially no change is seen in the non-stretchable zone R, while the stretchable zone S is elastically stretched and the ornamental pattern at this zone too is stretched in the same direction.

Some other embodiments of the invention will be described next.

〈1〉 In the foregoing embodiment, two expansion yarns or filaments 4 are knitted into one wale 1. However, the number of expansion yarns may vary conveniently. For instance, only one expansion yarn or more than three expansion yarns may be used.

〈2〉 In the foregoing embodiment, the expansion yarns are caused to cross each other at some of the portions thereof inserted into the wales. Although this construction is preferred, it is also conceivable to cross the yarns at all of the portions inserted into the wales or not to cross each other at all. Further, in the foregoing embodiment, one of the expansion yarns is inserted into each and every loop while the other is inserted intermittently into some of the loops only. In this case too, it is also conceivable to insert both of the yarns into each and every loop or to insert both of these intermittently into some of the loops only.

〈3〉 In the foregoing embodiment, the expansion yarns are inserted into all the wales. Instead, it is also conceivable to insert only some of the same, while not inserting the others. Further, in the foregoing embodiment, the two expansion yarns have the same degree of elastic resilience. Instead, these yarns may have different degrees of elastic resilience. Incidentally, if the elastic resilience provided to each wale by the expansion yarn is caused to vary course-wise, the resultant lace fabric will be warped course-wise at the stretchable zones thereof.

〈4〉In the foregoing embodiment, there are provided the two zones consisting of the stretchable zones S comprised of the second course groups 9 and the non-stretchable zones R comprised of the first course groups R. In case of similarly providing two different zones, it is also conceivable to provide the first course groups 8 too with some degree of elastic resilience which is different from that of the second course groups 9, thereby to forming two zones of different degrees of elastic resilience. Also, the lace fabric may be provided with more than three zones of different degrees of elastic resilience.

〈5〉 In the foregoing embodiment, between the stretchable zone S and the non-stretchable zone R, the course width differs from each other. Although this construction is preferred, the course width may not be varied. Further, instead of the non-stretchable zone R, another kind of stretchable zone having a smaller degree of elastic resilience than the stretchable zone S may be provided.

〈6〉 In the foregoing embodiment, the stretchable zones S and the non-stretchable zones R are provided continuously with alternately to each other in the lace fabric. Instead, these non-stretchable zones R and stretchable zones S may be provided discontinuously. Further alternatively, more than three kinds of zones having different degrees of elastic resilience may be provided. With this, it becomes possible, with one preparatory operation, to knit a non-stretchable lace fabric having no or substantially no elastic resilience and also a stretchable lace fabric having elastic resilience. As a result, the efficiency of the lace knitting operation will be improved. This also means the possibility of knitting more than two kinds of lace fabrics of different stretchability characteristics with one preparatory operation. Hence, this method will be useful in production of many kinds of lace products in small lot for each kind. More particularly, in knitting lace fabrics having different stretchability characteristics from a same lace fabric, it sometime happens that the lot may be too small to be knitted by using the entire width of the knitting machine. In such case, it becomes necessary to reduce the take-up length of one unit fabric. Then, by using the knitting method of the invention described above, it is possible to knit another lot in continuous manner. And, by just replacing the pattern plate, another lot may be knitted, so that the troublesome inserting operations of the yarns to the guides may be avoided. As a result, the method can improve the production efficiency. Incidentally, in the above case of continuously knitting a plurality of kinds of lace fabric, the tension adjusting mechanism described in the foregoing embodiment will not be absolutely necessary.

As described above, according to the present invention, there has been provided a lace fabric which may be provided with an ornamental knitting pattern while providing stretchability at some predetermined necessary portions alone. And, this fabric, when used in a garment product, can be stretched only at the predetermined portions for providing the elastic resilience for tightening corresponding limited body portions of the wearer.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Claims

1. A method of manufacturing a lace fabric, the method having the steps of:

   forming, with each single knitting cycle, a course (7) including a plurality of loops (3) formed side by side by chain-stitching a plurality of warp yarns (2);
   repeating the knitting cycle to form a plurality of courses (7) continuously in the wale direction, thereby to form a plurality of wales (1) disposed side by side and formed of the chain-stitched warp yarns (2);
   characterized by the steps of

   knitting an expansion yarn (4) into each one of at least some of the plurality of wales (1); and
   in the expansion yarn knitting step, the plurality of courses (7) being divided into a plurality of kinds of course groups whose expansion yarns (4) inserted therein have expansion degrees different from each other.

2. A method according to claim 1,
   characterized in that

   two kinds of course groups (8), (9) are formed, and the elastic yarn (4) is knitted in the first course group (8) with a predetermined expansion degree or zero expansion degree while the elastic yarn (4) is knitted in the second course group (9) with an expansion degree greater than the predetermined expansion degree of the first course group (8).

3. A method according to claim 2,
   characterized in that

each course (7) belonging in the second course group (9) has a greater course width than each course (7) belonging in the first course group (8).

4. A method according to claim 2 or 3, characterized in that

the first course group (8) and the second course group (9) are formed alternately to each other.

5. A method according to any one of claims 1 through 3, characterized in that

the expansion yarn (4) is knitted into each and every one of the plurality of wales (1).

6. A lace fabric having:

a plurality of wales (1) formed in a longitudinal direction of a plurality of chain-stitched warp yarns (2);
a plurality of courses (7) formed continuously in the longitudinal direction, each course (7) being formed of a plurality of loops disposed side by side and belonging in the plurality of wales (1);
characterized by

an expansion yarn (4) knitted into each one of at least some of the plurality of wales (1);
a plurality of kinds of course groups, each course group including at least one of said courses (7); and
the course groups providing different degrees of elastic resilience when the fabric is stretched in the longitudinal direction.

7. A lace fabric according to claim 6, characterized in that

the expansion yarn (4) is knitted into each and every one of the plurality of wales (1).

8. A lace fabric according to claim 6 or 7, characterized in that

the plurality of course groups are provided in two kinds of a first course group (8) and a second course group (9), with the first and second course groups (8), (9) being provided alternately to each other.

9. A lace fabric according to claim 8, characterized in that

the expansion yarns (4) are knitted into the wales (1) such that the expansion yarn (4) knitted into the first course group (8) provides no elastic resilience while the expansion yarn (4) knitted into the second course group (9) provides elastic resilience.

Fig. 1

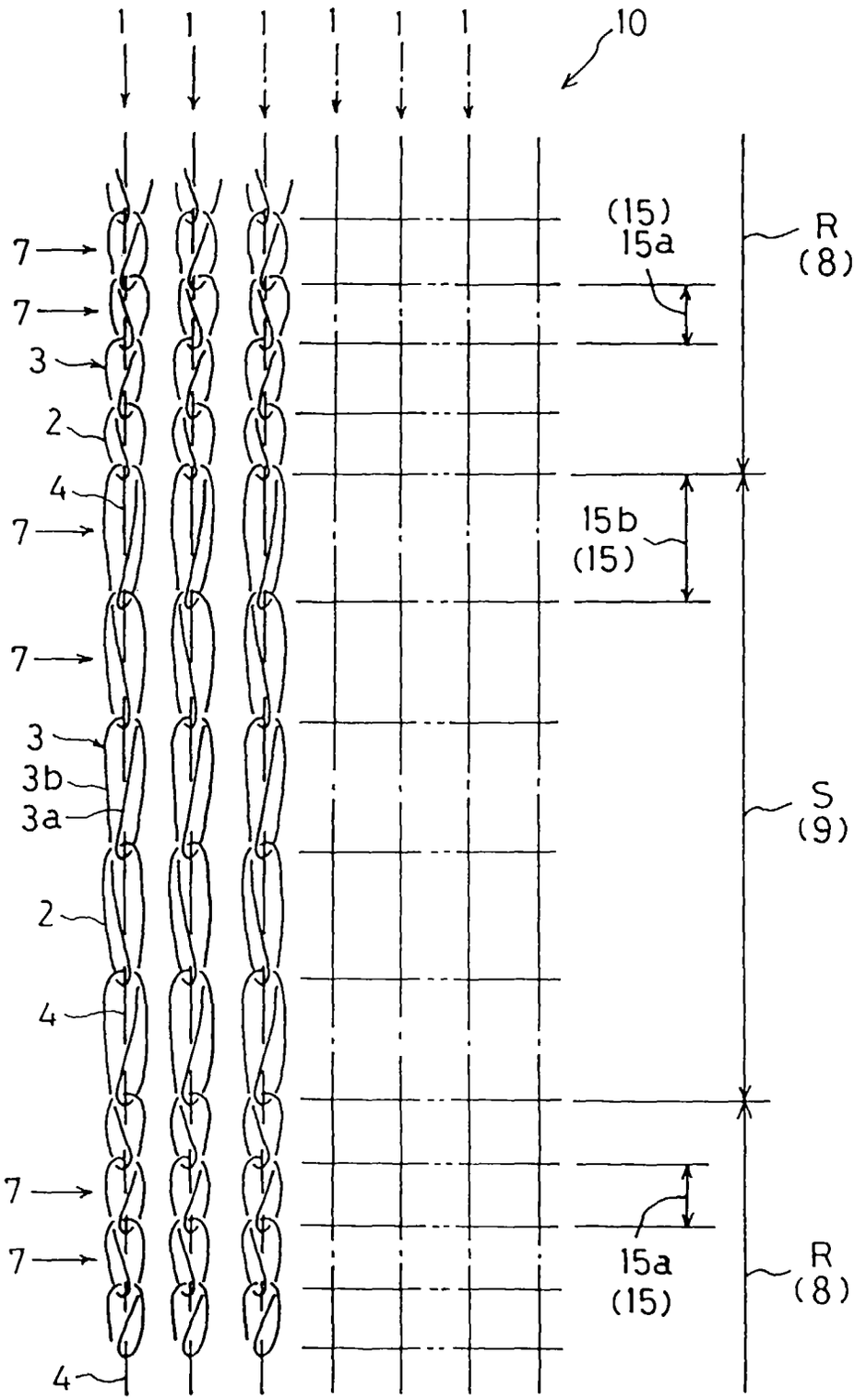


Fig. 2

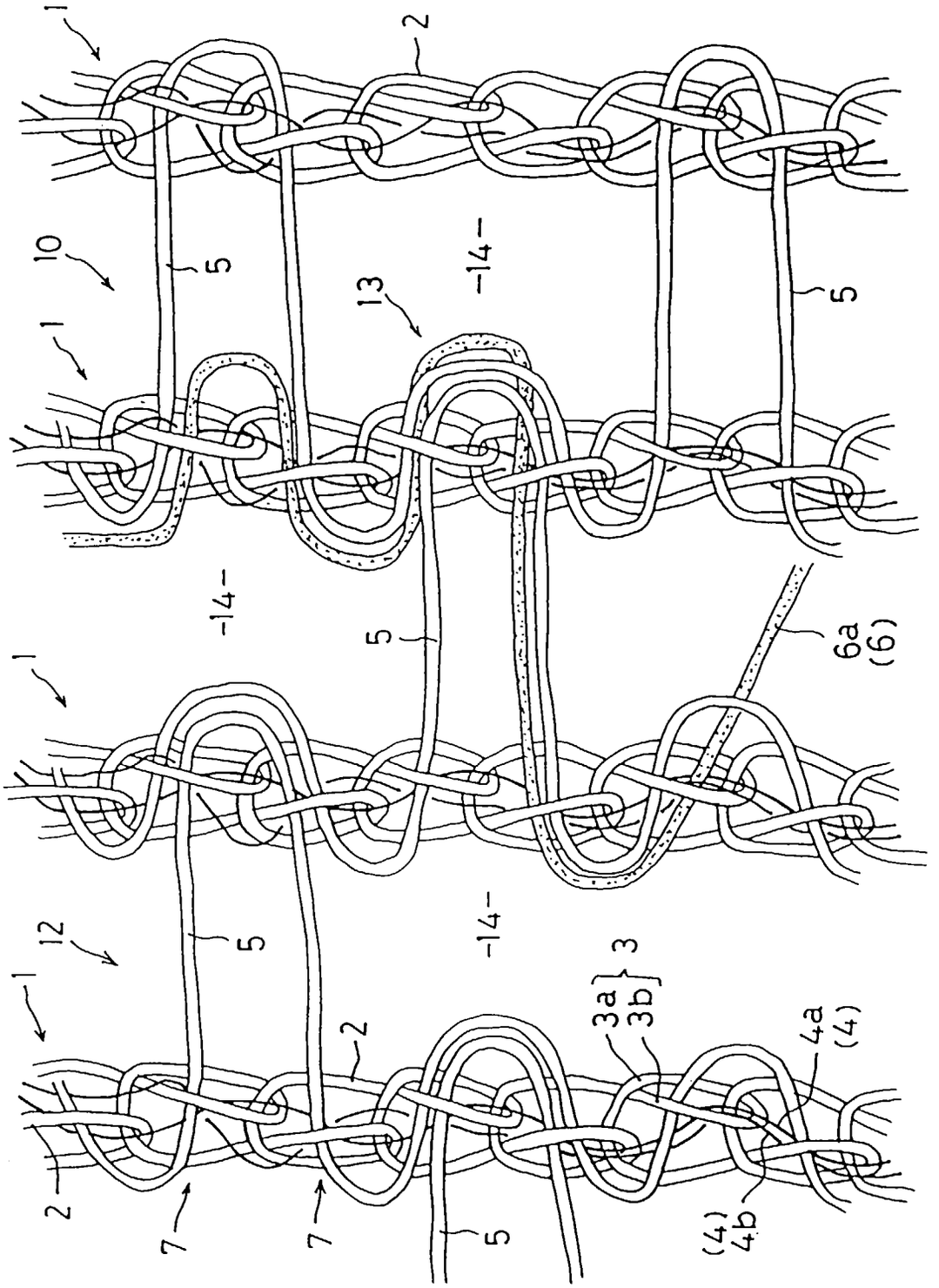
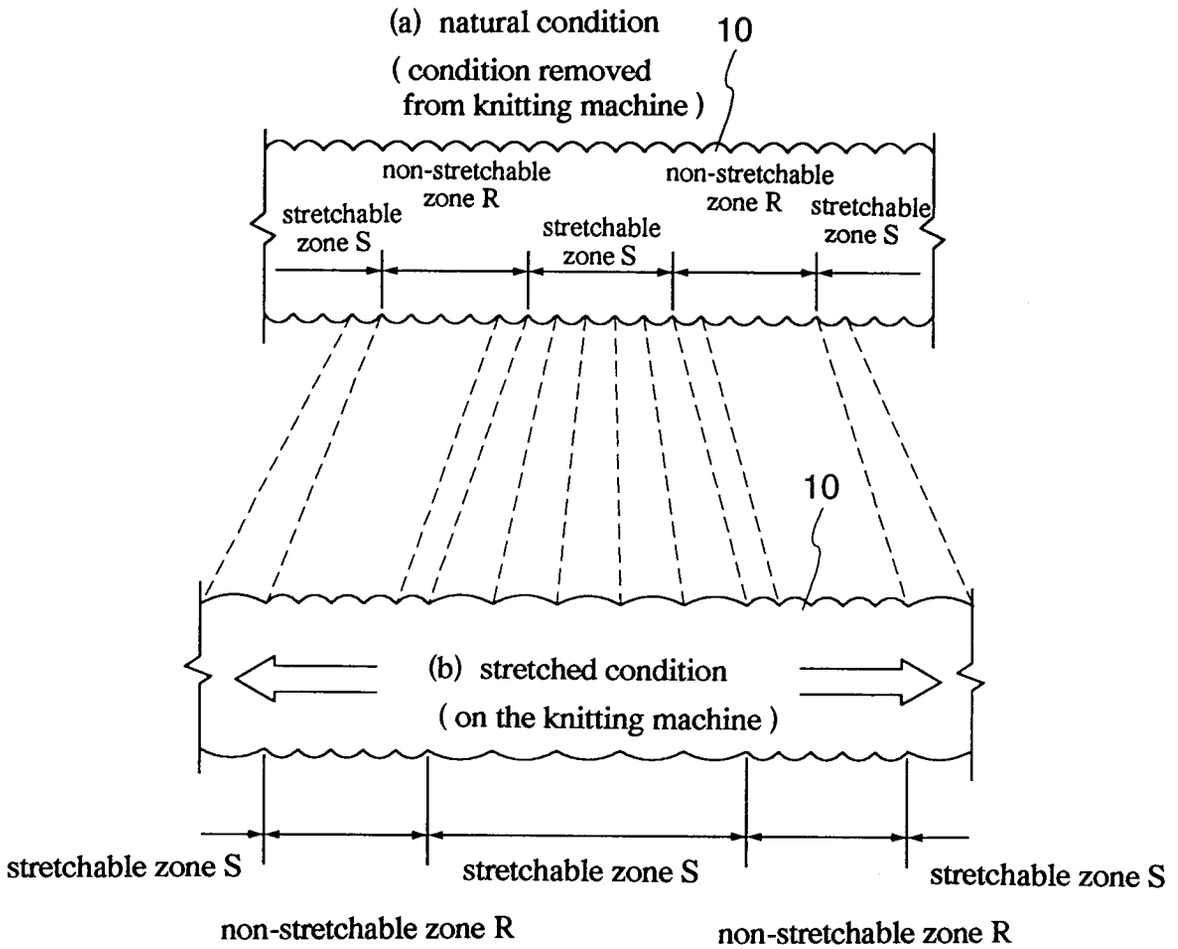


Fig. 3


(a) natural condition
(condition removed
from knitting machine)
10
non-stretchable
zone R
non-stretchable
zone R
stretchable
zone S
stretchable
zone S
stretchable
zone S
10
(b) stretched condition
(on the knitting machine)
stretchable zone S
stretchable zone S
stretchable zone S
non-stretchable zone R
non-stretchable zone R

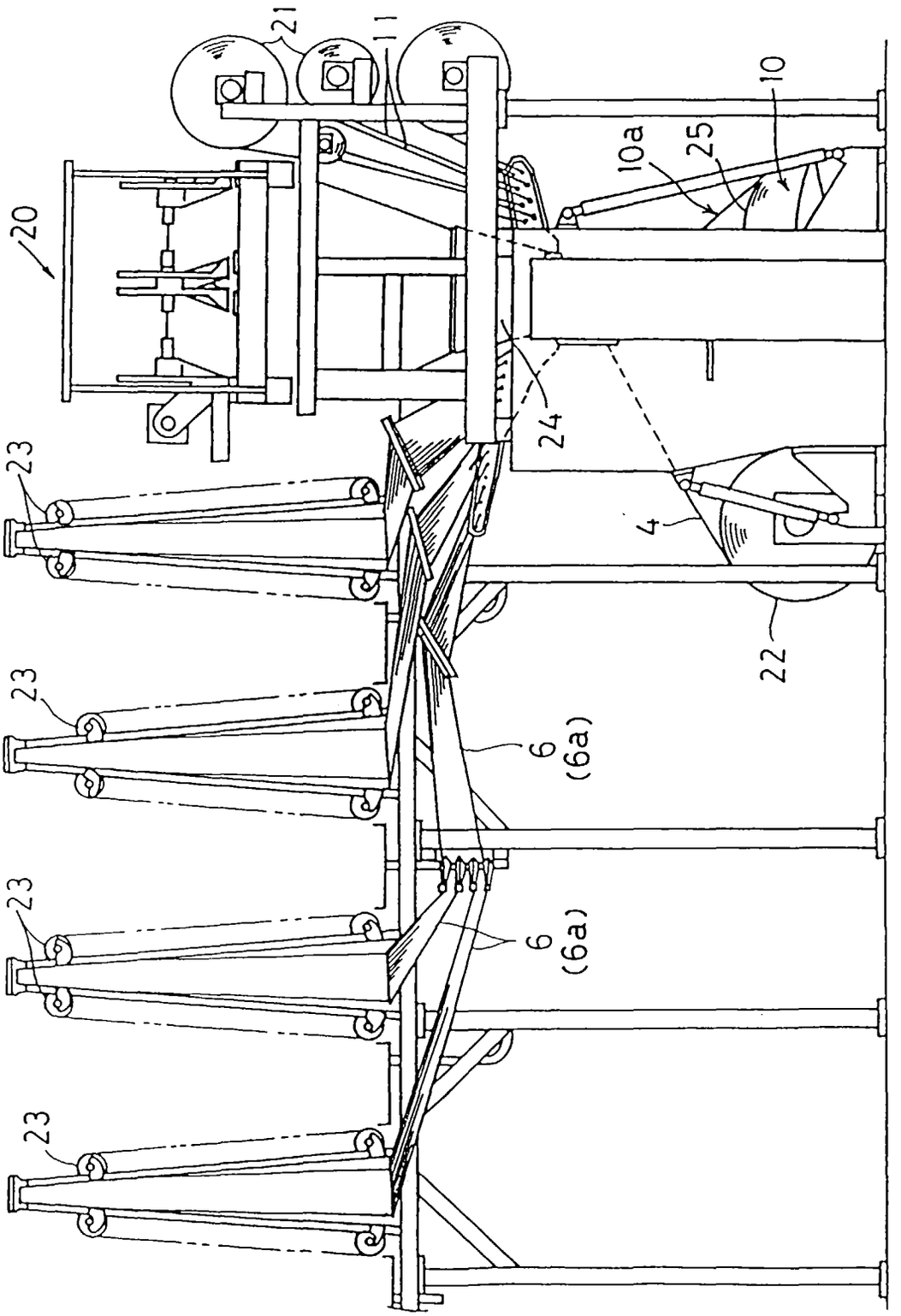
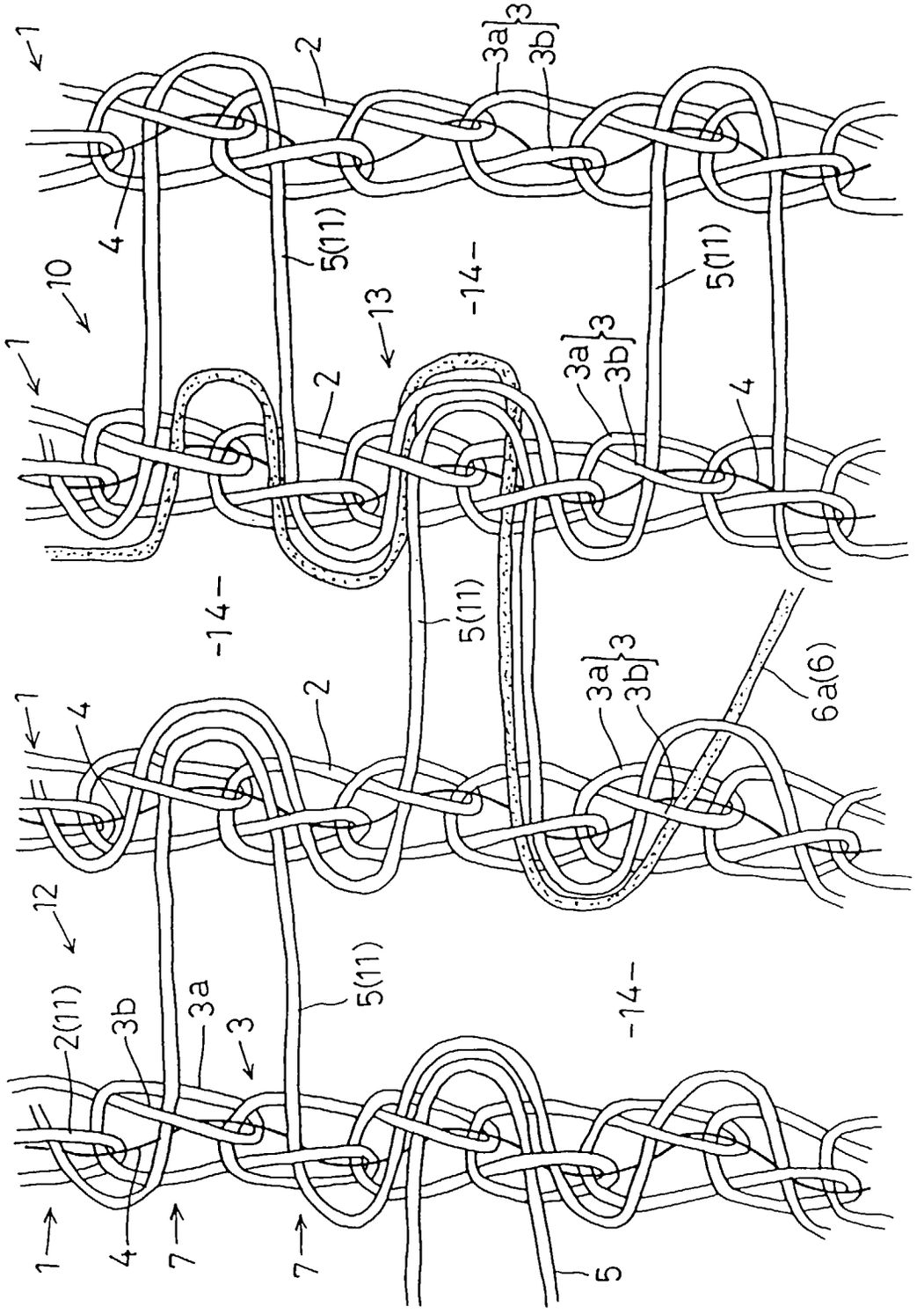


Fig. 4

Fig. 5


1
2
3a
3b
3
4
5(11)
10
13
-14-
5(11)
3a
3b
3
4
1
2
-14-
5(11)
3a
3b
3
6a(6)
1
4
2
12
2(11)
3b
3a
3
5(11)
-14-
1
4
7
7
5