

METHOD AND APPARATUS FOR ELIMINATING THE SPIRALITY IN KNITTED FABRIC

5 The present invention relates to a method for manufacturing and/or treating a fabric, whereby knitting in particular, preferably for producing a single-jersey fabric, a derivative thereof or a like, is carried out with a knitting machine, such as a circular, flat-bed, straight-bar, loop-wheel machine or a like, comprising
10 at least knitting elements, such as yarn supply elements and loop forming elements, such as needles, sinkers and/or the like, in cooperation therewith for producing a fabric from continuous yarn, such as one or a plurality of untwisted, S-, Z-twisted yarns and/or
15 a like, by knitting, and take-up elements for receiving the resulting fabric.

In global perspective, the production of single-jersey fabrics in particular is an industry of immense
20 dimensions. To mention just the production of circular-knitted cotton fabrics, which is one of the most important individual article categories in knitwear production, is several hundred thousand tons annually in global terms. However, the most difficult problem
25 encountered in single-jersey fabrics, which has not been resolved sufficiently well up until today, is still the spirality of fabrics. First of all, this is due to the fact that a single-jersey fabric is different in terms of its face and reverse side, resulting
30 in its "unbalanced" behaviour. An object of a finishing process after dyeing is to bring the fabric to an unshrinkable condition (dimensional stability) and to provide straight wales and courses therefor. When the fabric is further cut into portions of a garment
35 and those are sewn to each other, the article will be acceptable in terms of its appearance. However, almost without exception, the consequence of this is that, after the produced fabric has been subjected to a

first washing, the seams or wales of said article are no longer able to remain straight but are distorted. Thus, since distortion bears an essential significance on the quality of current fabrics, there are certain quality criteria imposed thereon and, thus, for example in Finland, one limit applied to the spirality of fabrics is that the distortion of a fabric may not exceed 10 % of the length or its angle of spirality may not be more than 6°. In practice, skewnesses of this magnitude are enough to raise complaints from customers.

Until now, however, solutions for eliminating distortion have mostly been efforts involving yarn technology or chemistry. The elimination of fabric distortion has been attempted e.g. by the following procedures:

1. The use of an S- and Z-twisted yarn alternately at successive feeds.

This solution involves a variety drawbacks, e.g. the yarn-related costs become considerably higher than in conventional knitting and, naturally, this increases further the price of resulting knitwear. In addition, there is a high probability of yarn blending of the yarn bobbin and, thus, the unacceptable production rises easily e.g. to 0,5 %, which for its part increases the cost factors and the price of a resulting fabric. Another drawback from the above arrangement is the disharmonious appearance of a fabric as the wales are skewing alternately to right and left (cockling).

2. Loop length as short as possible.

A short loop length eliminates the yarn-induced distortion of a fabric. Knitting with very small loops does not involve the use of that wider range of loop lengths, whereby the dimensional stability of a fabric

would be under control but the elimination of the distortion of a fabric requires that very small loops be knitted over a very narrow subdomain within the loop-length range. When striving for the same quadratic weight, if the yarn-induced spirality of a fabric were under control, the knitting could be done with a thicker yarn and longer loop lengths whereby the production of a knitting machine could increase substantially, in special cases up to 100 % over the present. Another drawback associated with a short loop length is that it limits possibilities of regulating the quadratic weight. In addition, the use of knitting machines employing a coarse and thick yarn causes problems as it is not possible to produce sufficiently long and loose loops for creating the softness inherent of coarse fabrics.

3. The use of a folded yarn or two thin yarns (S- and Z-twisted) to be knitted at a common feed.

A drawback associated with this solution is first of all that folded yarn is unacceptably expensive. Thin yarn is more expensive to spin than thick yarn. Neither can this particular solution be used for knitting thin fabrics, since the spinning of extremely thin or thin folded yarns is not possible at reasonable costs.

4. Untwisting in spinning or just before knitting, i.e. elimination of yarn snarling (15 - 25 %).

A drawback associated with this solution is first of all that a separate untwisting procedure is costly, which increases manufacturing costs and the price of a fabric. Furthermore, the yarn must be knitted quickly after the untwisting, which in practice may

cause special requirements in terms of process technology and require special arrangements increasing the costs even further.

5 It has been established in practice that the currently applied fabric distortion procedures only provide partial distortion and therefore primarily incur unreasonable additional costs for knitwear production as well as inhibit the improvement of productivity in
10 knitwear manufacturing and the fine regulation of quadratic weight. Naturally, as far as the end user of a fabric is concerned, the situation remains unacceptable, since even an unreasonably expensive fabric does not always meet the quality requirements as a
15 result of fabric distortion.

An object of a method of this invention is to provide a decisive improvement regarding the above drawbacks as the knitting can be effected even by using just a
20 single yarn type, either a Z- or S-twisted yarn depending on the rotational direction of a knitting machine, and hence it is possible to substantially raise the prior art and to substantially reduce the knitting costs. In order to achieve this object, a
25 method of the invention is principally characterized in that the spirality of an obtained fabric is eliminated at a first stage on the one hand by altering the number of twists/unit of length and/or the relative length of distortion-causing loop legs, whereafter
30 the obtained fabric is on the other hand at a second stage, preferably during the course of fabric finishing or a like operation, subjected to at least one after-treatment, wherein the fabric is straightened in terms of its wales and/or courses for resetting the
35 different-length loop legs to a substantially equal length.

The invention is based on the premise that, for example, when a circular machine is used for knitting, each yarn sets in the knitted fabric on a spiral, having a degree of pitch which depends on the number of feeds and the loop length. At the actual loop forming stage, both legs of a loop are of equal length. As the circular machine knits the following layer, with each feed knitting its own next wale, the originally horizontal wales will go askew as a result of the spiral pitch of the yarns. Thus, one of the loop legs becomes shorter, the twist therein being offset and the number of twists/unit of length increasing. Generally, in conventional production, the fabric remains in this state as it undergoes the conventional fabric pretreatment and dyeing processes. The fabric is subjected to wet and heat treatments, which enhance the "fixation" of this additional twist. In certain applications, an object of the present invention is simply to reduce further the length of one of the loop legs and hence to increase the number of twists over this leg whereby, in finishing the fabric when straightening the fabric in terms of its wales and courses, the loop leg shortened during knitting or pretreatment will be lengthened and its number of twists/unit of length will be reduced. Thus, it is possible to use such detwisting for avoiding the yarn snarling and, hence, for eliminating a torsion force produced by the twist.

The most important benefits gained by a method of the invention can be said to include the simplicity of its principle and practical constructions useful for its application. The inventive method eliminates one extremely essential problem associated with fabrics, thus providing a remarkable improvement over the current situation from the viewpoint of both fabric manufacturers and end users. It is possible to apply the inventive method by using systems which are highly

attractive in terms of total costs, whereby the already existing knitting machinery can be upgraded for implementing the principles of the present method. The investment costs incurred by a method of the invention are insignificant in comparison to what is spent at present in an effort to rectify spirality since, by virtue of the invention, the yarn-inflicted costs go down and, for example, the quantity of defective production falls and, respectively, the quality of production improves decisively, and in comparison to achievable returns as the productivity of knitting machines can be raised by using longer loop lengths. Regarding the investment costs, it is indeed the extra returns achieved by increased productivity which have a decisive influence on the adoption of investments, in addition to quality factors and cost factors. By virtue of the invention, it is also possible to regulate e.g. the quadratic weight of a fabric regardless, for example, of a yarn being used but by just using arrangements relating to knitting technology. What is also important is that the end users receive high-quality knitted articles, whereby the number of complaints also decreases in various instances as the distortion of fabrics is gradually eliminated.

The non-independent claims directed to a method set forth preferred embodiments for a method of the invention.

Another object of the invention is an apparatus operating on the inventive principle and defined in more detail in the preamble of the independent claim directed thereto. The principal characterizing features of the apparatus are set forth in the characterizing clause of the same claim.

The most important benefits gained by an apparatus of the invention can be said to include its simplicity and reliability in operation, whereby it is possible to manufacture, with quite insignificant additional costs, a high-quality fabric which does not distort. Hence, the apparatus of the invention enables the elimination of distortion in a manner that is remarkably more economical and reliable than the prior art solutions. The guidelines incorporated in the apparatus can of course be applied in association with new machinery but also by upgrading the already existing machinery with very simple arrangements. Since the inventive apparatus for eliminating the distortion of a fabric is essentially based on solutions involving knitting technology and/or finishing technology, there is no need for the present special arrangements as far as the yarn is concerned, which naturally simplifies and facilitates the manufacturing process in this respect as well. In principle, the inventive apparatus even enables e.g. the production of novel type of fabrics by employing combinations yarn type/knitting technique which are found "impossible" for current technology.

The non-independent claims directed to an apparatus set forth preferred embodiments for an apparatus of the invention.

In the following specification, the invention will be described in detail with reference made to the accompanying drawings, in which

figs. 1a and 1b

illustrate one preferred principle for a method of the invention applied particularly in association with a circular knitting machine,

figs. 2a and 2b

further illustrate one alternative principle for a method of the invention in association with a circular knitting machine,

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figs. 3a and 3b

depict a fabric stored on a winding roll according to the invention,

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fig. 4 shows by way of example six different options (a-f) for the deflection of wales implemented according to the invention,

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fig. 5 illustrates one preferred guide system included in an apparatus of the invention,

figs. 6a and 6b

illustrate a guide system alternative to fig. 5 in a side and plan view, respectively,

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fig. 7 shows one preferred embodiment of the invention in a plan and side view (a, b), applied particularly in association with a flat-bed machine,

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fig. 8 shows in a side and front view (a, b) one preferred principle for a method of the invention for treating a circular-knitted article in a tube shape by means of a spreader as well as a rotating take-down assembly and a winding roll,

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fig. 9 shows one preferred pre- or after-treatment according to the method in a front view and in a plan view (a, b), and

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fig. 10 shows two different work processes (a, b) in the adaptation of the method for treating a piece of fabric.

5 fig. 11 shows an advantageous embodiment of the method according to the invention as a longitudinal section (a) as an end view (b) and a socket being used therewith (c).

10 The invention relates to a method for manufacturing and/or treating a fabric, whereby knitting in particular, preferably for producing a single-jersey fabric, a derivative thereof or a like, is carried out with a knitting machine, such as a circular, flat-bed,
15 straight-bar, loop-wheel machine or a like, comprising at least knitting elements 1, such as yarn supply elements and loop forming elements 1a, such as needles, sinkers and/or the like, in cooperation therewith for producing a fabric from continuous yarn, such as
20 one or a plurality of untwisted, S-, Z-twisted yarns and/or a like yarn, by knitting, and take-up elements 2 for receiving the resulting fabric. The spirality of an obtained fabric is eliminated at a first stage A on the one hand by altering the number of twists/unit of
25 length and/or the relative length of distortion-causing loop legs, whereafter the obtained fabric is on the other hand at a second stage B, preferably during the course of fabric finishing or a like operation, subjected to at least one after-treatment, wherein the fabric is straightened in terms of its
30 wales and/or courses for resetting the loop legs, whose relative lengths were changed during the first stage A, to a substantially equal length.

35 At its simplest, the inventive method is in principle applied in the context of a knitted article produced e.g. as garment lengths. In this context, reference is first made to fig. 10, according to which a fabric

knitted as garment lengths is first placed e.g. on a pin frame F shown in fig. 10a, having a width, length and skewness which are adapted to be adjustable. The fabric is tensioned laterally and lengthwise, whereafter either the courses or wales are finally inclined at the first stage A e.g. to a configuration defined by the pin frame F, as shown in fig. 10b. In the skewed pin frame position, the fabric is subjected e.g. to a wet treatment, steaming and drying, resulting in the "fixation" of the extra twist/unit of length for shortened loop legs. Thereafter, the fabric knitted as garment lengths is straightened by means of the frame, thus forcing the wales and courses of the fabric to a position substantially perpendicular to each other (this is not shown in the drawing). At this point, the extra twist unravels and, respectively, the torsion force of the loop legs is neutralized. Finally, the fabric knitted as garment lengths is cut e.g. on a pin table.

In a further preferred application, the method is exploited in a special work process or during the course of actual knitting, which is carried out with a knitting machine provided with take-up elements 2, including a take-down assembly 2a and/or a spreading assembly 2b for drawing the knitted fabric to a storage assembly 2c, such as a winding roll or a like. Thus, the number of twists/unit of length and/or the relative length of distortion-causing loop legs are altered in a tensioned state at least partially by means of a pretreatment, involving knitting technology and effected as a first stage A during the course of fabric-forming, or by means of a pretreatment, involving finishing technology and effected as a first stage A during the course of fabric pretreatment, for feeding the produced fabric into the storage assembly 2c, e.g. as shown in figs. 3a and 3b, with the courses

inclined and the wales straight or vice versa or with both inclined, unlike what is shown in the drawing.

5 In one preferred application of the method, in a first-stage pretreatment A1' involving knitting technology, as shown e.g. in figs. 1a and 1b and as applied in connection with a circular machine, the fabric is drawn askew, such as in a drawing direction s1 deflected from a basic drawing direction s0 which is substantially perpendicular to the knitting plane, by adapting the take-up elements 2 to travel in front of the knitting elements 1, which application is shown in fig. 1b, or behind the same, which application is shown in fig. 1a.

15 In a further preferred application of the method, in a first-stage pretreatment A1" involving knitting technology, the fabric is inclined through the action of a guide assembly 3 fitted between the knitting elements 1 and the take-up elements 2 by pulling it in the drawing direction s1 substantially deflected from the basic drawing direction s0, this type of operating principles being disclosed as circular knitting machine configurations e.g. in figs. 2a and 2b, wherein the take-up elements 2 further include a spreading assembly 2b. A similar concept is disclosed as a flat-bed knitting machine configuration e.g. in figs, 7a and b, wherein the wales are inclined by elongating the fabric unilaterally. Fig. 4, points a-f, illustrates by way of example a variety of relevant deflection possibilities for changing the direction of courses.

30 In a yet another preferred application of the method, especially in a first-stage pretreatment A1'", involving finishing technology and relating to an a previously manufactured circular-machine knitted fabric in tubular form, which is carried out on a principle

shown in fig. 8 by using a guide surface arrangement 5 preferably prior to its process-technical treatment, such as washing, dyeing, steaming processes or the like, the number of twists/unit of length of shortening loop legs is increased by forcing the courses of the tubular-form fabric in a tensioned state to a spiral form, such as by distorting the courses into z-direction in fabric knitted with an S-twisted yarn and, respectively, into s-direction in a fabric knitted with a Z-twisted yarn or in a like manner.

In still a further preferred application of the method, especially in reference to figs. 9a and 9b, an open-knitted or coursewise open-cut tubular fabric is treated, preferably prior to a process-technical fabric treatment, such as washing, dyeing, steaming processes or the like, by increasing the number of twists/unit of length of loop legs or by shortening the distortion-causing loop legs. In this respect, it is possible to utilize e.g. a guide roll assembly 4a, as shown in figs. 9a and 9b, elongating a fabric in a plane which is substantially transverse to its traveling direction. On the other hand, the action can also be effected by providing a drying frame D with pin chains operating at mutually unequal velocities v' , v'' .

Furthermore, in a second-stage after-treatment B, effected on a fabric manufactured according a preferred application prior to the cutting thereof, the wales and courses of the fabric are forced in a tensioned state to a position substantially perpendicular to each other by lengthening the left-hand loop legs of an S-twisted yarn and respectively the right-hand loop legs of a Z-twisted yarn or in a like manner. In this respect, reference is made especially to figs. 9a and 9b, which illustrate in a front and plan view, respectively, one preferred tensioning or

stretching arrangement 4 of the invention for producing the above effect. At this time, generally after a fabric has been subjected to a conventional process-technical treatment, such as washing, dyeing, steaming processes or the like, in order to reduce the number of twists/unit of length included in the loop legs, the fabric is subjected to an after-treatment B, wherein an open knitted or a tube fabric, which is cut open in the course direction, is treated according to the principle shown e.g. in figs. 9a and 9b by stretching it with a stretching arrangement 4 unilaterally in a plane substantially transverse to its traveling direction by using a roll assembly 4a. Naturally, a corresponding result can be achieved in such a manner that a fabric is driven to a drying system, e.g. onto the pins of a drying frame D, e.g. by using pin chains drawing the fabric to the drying frame D at mutually unequal velocities v' , v'' .

When knitting is performed, as shown e.g. in fig. 1a, with a circular machine, wherein the take-down roll 2a and the winding roll 2c follow after the needle cylinder 1, the resulting fabric will be provided with loop legs having the same number of twists/unit of length, but the lengths of said legs are unequal. Thereafter, in a first-stage pretreatment A1", involving knitting technology, the wales of e.g. an open-cut fabric are forced on a principle shown e.g. in figs. 7a and 7b in a tensioned state to a skewed position which is opposite the knitting position, thus increasing the number of twists/unit of length of shortened loop legs. This is followed by dyeing and possibly steaming the fabric. In after-treatment B (fig. 9), the wales and courses are driven to a position perpendicular to each other, some of the extra twists being unraveled from the loop-leg yarns, thus cancelling or neutralizing the torsion force produced by the loop leg.

For example, during the process of knitting as shown in fig. 1b, wherein the take-down roll 2a and the winding roll 2c rotate in front of the counter-clockwise rotating needle cylinder 1, the left-hand loop legs in a fabric have retracted and the right-hand ones have extended. However, both legs have the same number of twists/unit of length. The knitting is followed by subjecting the fabric to standard washing, dyeing and finishing processes, whereafter the tubular fabric is opened in the direction of courses. Thereafter, the wales of the open-cut fabric are forced in after-treatment B (fig. 9) in a tensioned state to a position perpendicular to the courses, thus reducing the number of twists/unit of length of the extending loop legs and diminishing the torsion force of these extended loop legs. The above type of knitting with a counter-clockwise rotating circular machine is particularly intended for knitting an S-twisted yarn. During the course of knitting with a clockwise rotating circular machine, wherein the take-down device 2a and the winding roll 2c rotate in front or first relative to the needle cylinder 1 and the yarn comprises a Z-twisted yarn, the knitted fabric will be stretched contrary to the previous example.

Furthermore, when knitting is performed with flat-bed or straight-bar machines, which principle is depicted in figs. 7a, 7b, the wales of a fabric are forced after the take-down in a tensioned state to an inclined or skewed position by means of a roll assembly 3b serving as a guide system 3, whereby one set of loop legs retract and the other loop legs extend and whereby the number of twists/unit of length of the retracted loop legs increases while the courses run direct or straight between the needle level and the take-down and while the take-down rolls 2a maintain the fabric in a tensioned state. As shown in fig. 7b, the roll assembly 3b includes a laterally tiltable

threaded roll 3b', which forces the wales to an inclined position for collecting the fabric on the winding roll 2c, according to the principle shown e.g. in fig. 3b. At this point, the "fixation" of an extra twist is effected e.g. by the mere accommodation on a winding roll or e.g. by means of a wet, heat and steam treatment. In after-treatment B, prior to cutting the fabric, the wales are straightened out in a tensioned state, thus unraveling the extra twist and cancelling a torsion force caused by the yarn twist.

Hence, an apparatus of the invention is adapted, on the one hand, at a first stage A to modify the number of twists/unit of length and/or the relative length of distortion-causing loop legs and, on the other hand, at a second stage B to subject the produced fabric to an after-treatment for straightening or aligning the fabric in terms of its wales and/or courses.

In a preferred embodiment, in view of modifying the number of twists/unit of length and/or the relative length of distortion-causing loop legs in a manner involving knitting technology, essentially during the process of knitting, the fabric is adapted to be drawn askew A1', such as from a drawing direction s1 deflected from a basic drawing direction s0 which is substantially perpendicular to the knitting plane, the knitting apparatus being adapted to operate e.g. on the principle shown in figs. 1a and 1b in such a manner that the take-up elements 2 travel in front of or behind relative to the knitting elements 1.

On the other hand, as another preferred option A1" in terms of knitting technology, it is also possible to have such an arrangement that the apparatus includes a guide system 3 operating between the knitting elements 1 and the take-up elements 2 for deflecting the traveling direction of a fabric to a drawing

direction s1 substantially different from a basic drawing direction s0 (e.g. figs. 2a and 2b) or for inclining the wales thereof (figs. 7a and 7b). In this context, as practical embodiments, reference is
5 further made to figs. 5 and 6, which by way of example illustrate solutions, wherein deflection of the direction of courses is effected by means of a guide system 3; 3a' by using a rotating ring fitted inside the tubular fabric. The ring 3a' rotating at a lower,
10 higher or equal velocity relative to the rotating speed of the needle cylinder 1 is provided with a surface made of e.g. a rubber-like or rough material. As a further preferred embodiment, under the rotating ring 3a' is mounted a disc, which is immobile or
15 rotates along with the ring and which makes sure that the fabric is pressed over every portion thereof at an equal strength against the surface of the rotating ring. Figs. 6a and 6b depict one alternative arrangement which is provided with a rotary ring 3a" consisting of rotating spiked rollers.
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Furthermore, figs. 7a and 7b illustrate a guide system 3; 3b, which is in principle suitable e.g. for flat-bed or straight-bar knitting and which consists of two
25 pairs of rolls 2a, between which is a laterally tiltable threaded roll 3b' or a like. The pairs of rolls 2a keep the fabric tight in both lengthwise and lateral direction. The threaded roll 3b' fitted between the pairs of rolls 2a, having its angle of
30 inclination adapted to be adjustable, forces the wales askew.

Especially in view of enabling the treatment of a previously knitted tubular form circular fabric, the
35 apparatus is provided with a guide surface system 5 for forcing the courses of said tubular fabric with a finish-technical pretreatment A'" in a tensioned state to a spiral. In this context, as shown e.g. in figs.

8a and 8b, it is possible to employ a spreader 5b fitted inside a tubular fabric. In order to keep the fabric tight, the spreader is provided on opposite sides thereof with pairs of rolls 5b2. In this case, a roll of fabric N in tubular form and a first pair of rolls 5b2' rotate around a longitudinal axis, whereby the courses are wound askew around a spreader 5b1. A second pair of rolls 5b2" unwinds the fabric from the roll of fabric N at an appropriate rate.

In this connection, the fabric courses are rotated in z-direction on a fabric which is knitted with an S-twisted yarn, whereby the left-hand loop legs receive extra twist/unit of length. Respectively, the fabric courses are rotated in s-direction on a fabric which is knitted with a Z-twisted yarn, whereby the right-hand loop legs receive extra twist/unit of length, respectively.

In yet another preferred embodiment, referring particularly to figs. 9a and 9b, the apparatus includes at least one expansion assembly 4, by means of which an open knitted or a tubular fabric, which is cut open in the direction of courses, is adapted to receive after-treatment B, which is preferably effected after a process-technical fabric treatment, such as washing, dyeing, steaming processes or the like, for reducing at this point the spirality given to the loop legs of the fabric. At this stage, it is possible to make use of a roll assembly 4a, as shown in figs. 9a and 9b and expanding a fabric in a plane substantially transverse to its traveling direction. On the other hand, this can also be effected by providing the drying frame D with pin chains operating at mutually unequal velocities v' , v'' .

Furthermore as an advantageous embodiment with reference particularly to fig. 11, the fabric, that has

5 been treated according to a pretreatment A involving
knitting technology or finishing technology, is being
wound in a tensioned state on a perforated socket 6
being placed on e.g. a metallic shaft xa, the socket
being made of metal, plastic or some other warm and
moisture durable material, which socket is being drawn
off from the shaft xa after winding. The roll of
fabric 2c existing on the perforated socket 6 may be
10 wet treated in a tensioned state at a high temperature
to stabilize the changes being achieved in the pretreatment A. In this case the hot washing liquid is
being led in the pressurize dyeing machine with
pressure through the roll of fabric 2c, whereby the
changes, that have been done during the pretreatment
15 A of the fabric, remain essentially permanent, because
setting of the achieved changes under stress introduces new intermolecular bonds within fibre structure
after breaking the previous ones.

20 The invention is not limited to the above-depicted or
described applications as there may be a wide range of
modifications within the scope of the fundamental
inventive idea. First of all, this is due to the fact
that there are an enormous number of various knitting
25 modes and techniques and, in addition to that, the
above-described inventive principles can be technically
carried out in most diversified ways. Hence, the
accompanying exemplary drawings only illustrate
instructional principles of implementation and operation,
30 although in terms of quite beneficial practical
solutions.

Claims

1. A method for manufacturing and/or treating a fabric, whereby knitting in particular, preferably for producing a single-jersey fabric, a derivative thereof or a like, is carried out with a knitting machine, such as a circular, flat-bed, straight-bar, loop-wheel machine or a like, comprising at least knitting elements (1), such as yarn supply elements and loop forming elements (1a), such as needles, sinkers and/or the like, in cooperation therewith for producing a fabric from continuous yarn, such as one or a plurality of untwisted, S-, Z-twisted yarns and/or a like yarn, by knitting, and take-up elements (2) for receiving the resulting fabric, characterized in that the spirality of an obtained fabric is eliminated at a first stage (A) on the one hand by altering the number of twists/unit of length and/or the relative length of distortion-causing loop legs, whereafter the obtained fabric is on the other hand at a second stage (B), preferably during the course of fabric finishing or a like operation, subjected to at least one after-treatment, wherein the fabric is straightened in terms of its wales and/or courses for resetting the loop legs, whose relative lengths were changed during the first stage (A), to a substantially equal length.

2. A method as set forth in claim 1 for treating a fabric, which is effected in a special work process or during the course of knitting with the use of a knitting machine provided with take-up elements (2), including a take-down assembly (2a) and/or a spreading assembly (2b) for drawing the knitted fabric to a storage assembly (2c), such as a winding roll or a like, characterized in that the number of twists/unit of length and/or the relative length of distortion-causing loop legs are altered in a tensioned state at least partially by means of a pretreatment, involving





knitting technology and effected as a first stage (A) during the course of fabric-forming, or by means of a pretreatment, involving finishing technology and effected as a first stage (A) during the course of fabric pretreatment.

3. A method as set forth in claim 2, characterized in that, in a pretreatment (A1') involving knitting technology, a fabric is drawn askew, such as in a drawing direction (s1) deflected from a basic drawing direction (s0) which is substantially perpendicular to the knitting plane, by adapting the take-up elements (2) to travel in front of or behind relative to the knitting elements (1).

4. A method as set forth in claim 2 or 3, characterized in that, in a pretreatment (A1'') involving knitting technology, the fabric is inclined through the action of a guide assembly (3) fitted between the knitting elements (1) and the take-up elements (2), such as by pulling it in the drawing direction (s1) substantially deflected from the basic drawing direction (s0) and/or, in a treatment involving finishing technology (A1'''), the fabric is inclined by stretching its wales unilaterally askew.

5. A method as set forth in claim 1 or 2, characterized in that, in a first-stage pretreatment (A1'''), involving finishing technology and relating to an a previously knitted circular fabric, prior to its process-technical treatment, such as washing, dyeing, steaming processes or the like, the number of twists/-unit of length of retracting loop legs is increased by forcing the courses of the tubular-form fabric in a tensioned state to a spiral form, such as by using a guide surface system (5) for distorting the courses into z-direction in a fabric knitted with an S-twisted





yarn and into s-direction in a fabric knitted with a Z-twisted yarn or respectively.

5 6. A method as set forth in any of preceding claims 1-5, characterized in that in a second-stage after-treatment (B), effected on a finished fabric preferably prior to the cutting thereof, the wales and courses of the fabric are forced in a tensioned state to a position substantially perpendicular to each
10 other, whereby the lengthening of the distortion-causing loop legs, such as the left-hand loop legs of an S-twisted yarn and respectively the right-hand loop legs of a Z-twisted yarn, is used for unraveling the distortion-causing twist.

15 7. A method as set forth in claim 6, characterized in that preferably after a process-technical fabric treatment, such as washing, dyeing, steaming processes or the like, in order to reduce the number
20 of twists/unit of length included in the loop legs, the fabric is subjected to an after-treatment (B), wherein an open knitted or a tube fabric, which is cut open in the course direction, is treated with an expansion system (4), such as by driving the same to
25 a drying assembly (D) at peripheral velocities (v' , v'') substantially unequal to each other, by expanding (4a) the same unilaterally in a plane substantially transverse to its traveling direction and/or respectively.

30 8. An apparatus for manufacturing and/or treating a fabric, which is adapted for treating or producing a preferably single-jersey fabric, a derivative thereof or a like with the use of a knitting
35 machine, such as a circular, flat-bed, straight-bar, loop-wheel machine or a like, said knitting machine comprising at least knitting elements (1), such as yarn supply elements and loop forming elements (1a),





such as needles, sinkers and/or the like, in cooperation therewith for producing a fabric from continuous yarn, such as one or a plurality of untwisted, S-, Z-twisted yarns and/or a like yarn, by knitting, and
5 take-up elements (2) for receiving the resulting fabric, characterized in that, in order to eliminate the distortion of a subsequently/previously manufactured fabric, said apparatus is adapted, on the one hand, at a first stage (A) to modify the number of
10 twists/unit of length and/or the relative length of distortion-causing loop legs and, on the other hand, at a second stage (B), to subject the produced fabric, preferably during the course of fabric finishing or the like, to at least one after-treatment for straightening the fabric in terms of its wales and/or courses
15 for returning the loop legs, which were changed in terms of their relative lengths during the first stage (A), to a substantially equal length and/or for extending particularly distortion-causing loop legs.

20 9. An apparatus as set forth in claim 8 especially for pretreating and/or knitting a fabric with the use of a knitting machine provided with take-up elements (2), including a take-down assembly (2a)
25 and/or a spreading assembly (2b) for drawing the knitted fabric to a storage assembly (2c), such as a winding roll or a like, characterized in that, in order to modify at least the number of twists/unit of length and/or the relative lengths of distortion-causing loop legs by means of a treatment involving
30 finishing technology and/or of a pretreatment involving knitting technology (A1" and/or A1'), effected essentially in the fabric pretreatment and/or during the course of knitting, the fabric is adapted to be drawn askew, such as in a drawing direction (s1)
35 deflected from a basic drawing direction (s0) which is substantially perpendicular to the knitting plane, such as by adapting the take-up elements (2) to travel





in front of or behind relative to the knitting elements (1) or respectively.

5 10. An apparatus as set forth in claim 8 or 9, characterized in that, in order to modify the number of twists/unit of length and/or the relative length of distortion-causing loop legs by means of a pretreatment (A1"), effected essentially during the course of knitting and involving knitting technology, said
10 apparatus includes a guide system (3) operating at least between the knitting elements (1) and the take-up elements (2) for inclining the fabric, such as for deflecting its traveling direction into the drawing direction (s1) substantially other than the basic
15 drawing direction (s0), for skewing its wales by expanding it in lateral direction and/or respectively.

20 11. An apparatus as set forth in claim 8, characterized in that, in order to subject a knitted circular fabric to a pretreatment involving finishing technology (A1'"), preferably prior to its process-technical treatment, such as washing, dyeing, steaming processes or the like, said apparatus includes a guide
25 surface system (5), such as a spreader (5b1) or a like fitted inside the fabric, for forcing the courses of a tubular-form fabric in a tensioned state to a spiral.

30 12. An apparatus as set forth in any of preceding claims 8-11, characterized in, that the apparatus includes at least one expansion assembly (4), by means of which an open knitted or a tubular fabric, which is cut open in the direction of courses, is adapted to receive an after-treatment (B), which is preferably
35 effected after a process-technical fabric treatment, such as washing, dyeing, steaming processes or the like, for reducing at this point the spirality given to the loop legs of the fabric, such as by controlling





5 the same by means of a drying assembly (D) operating at mutually unequal and preferably variable peripheral velocities (v' , v''), by guiding the same through a roll assembly (4a) expanding it unilaterally in a plane substantially transverse to its traveling direction, and/or respectively.



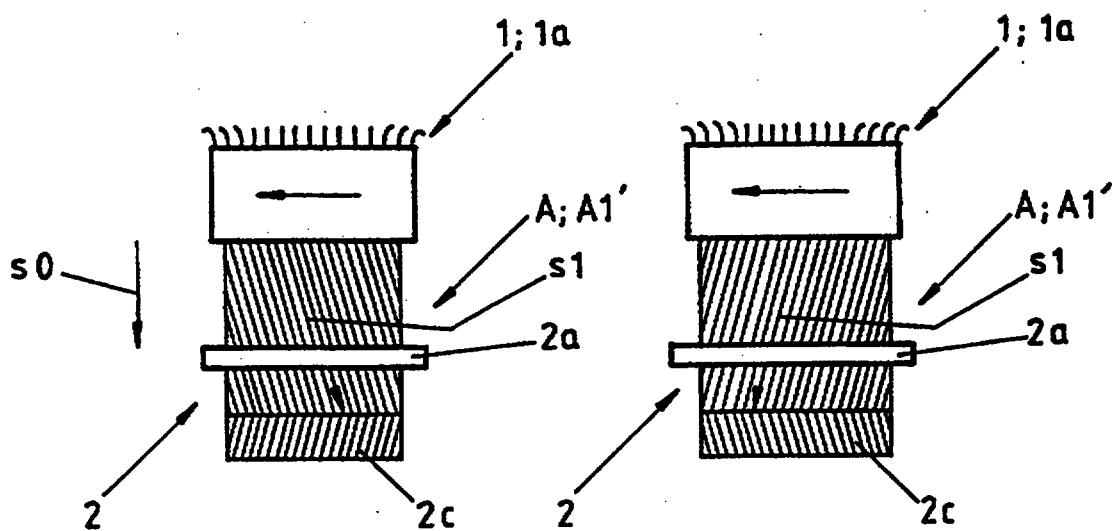


FIG. 1a

FIG. 1b

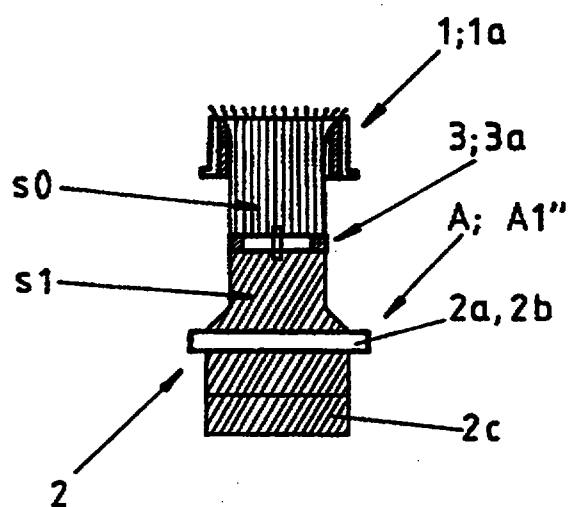


FIG. 2a

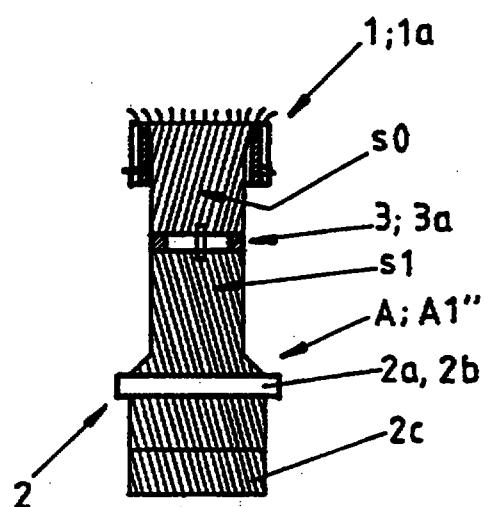


FIG. 2b

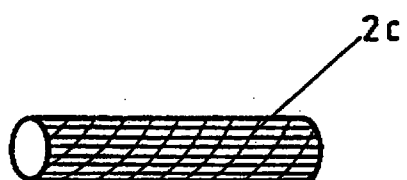


FIG. 3a

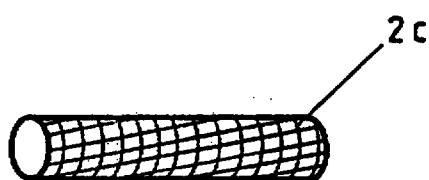


FIG. 3b

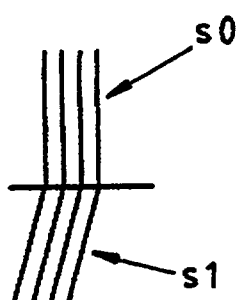
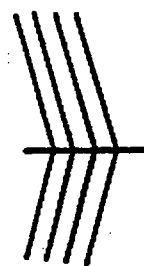
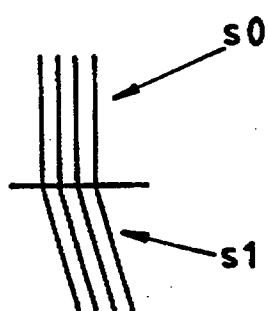
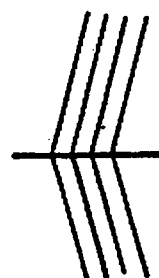
abcdef

FIG. 4

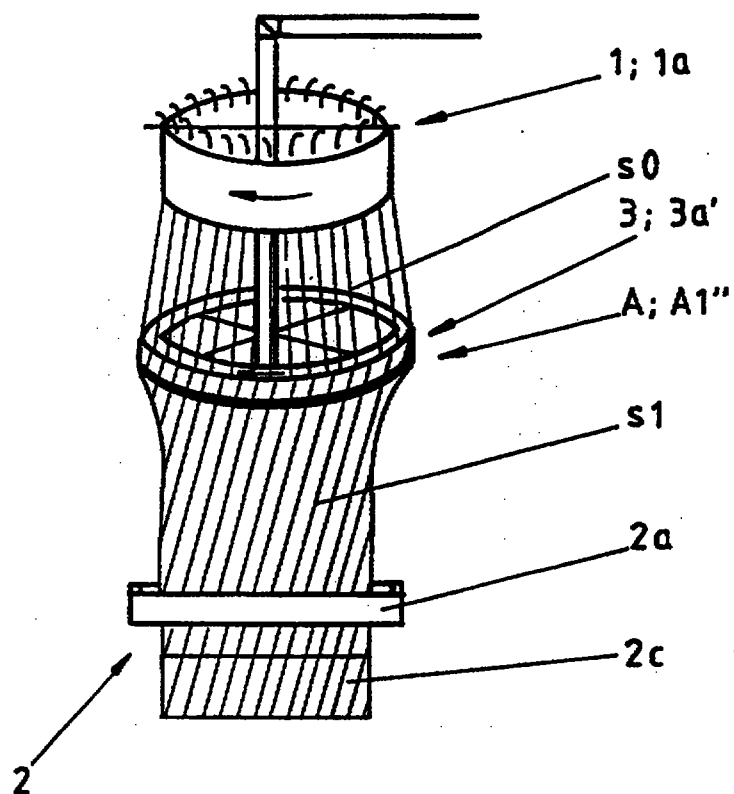


FIG. 5

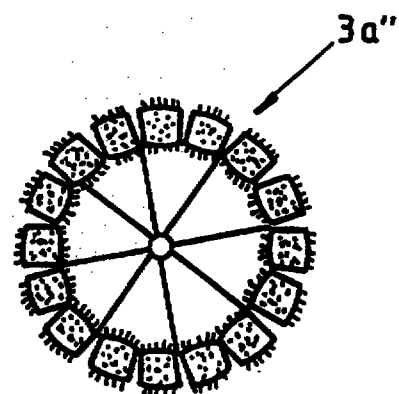
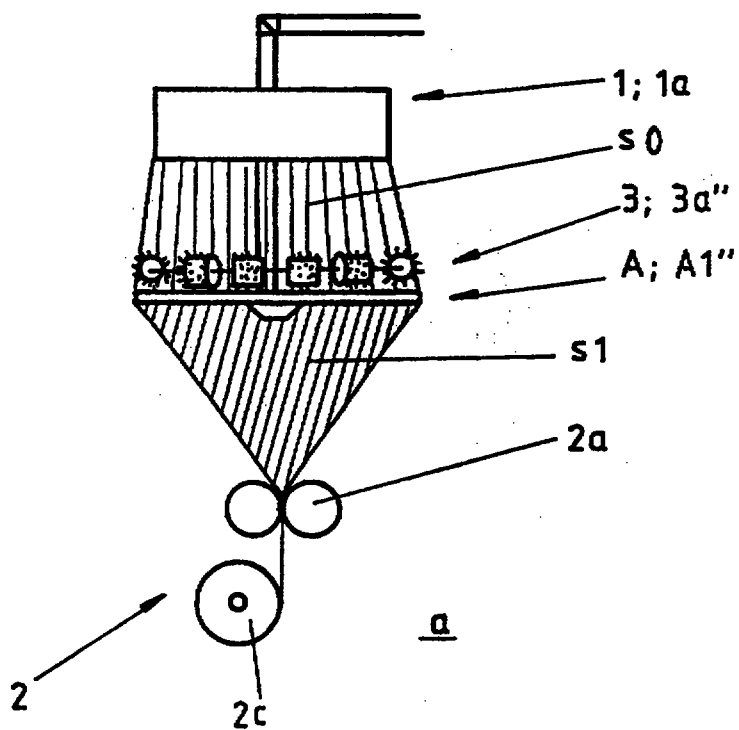


FIG. 6

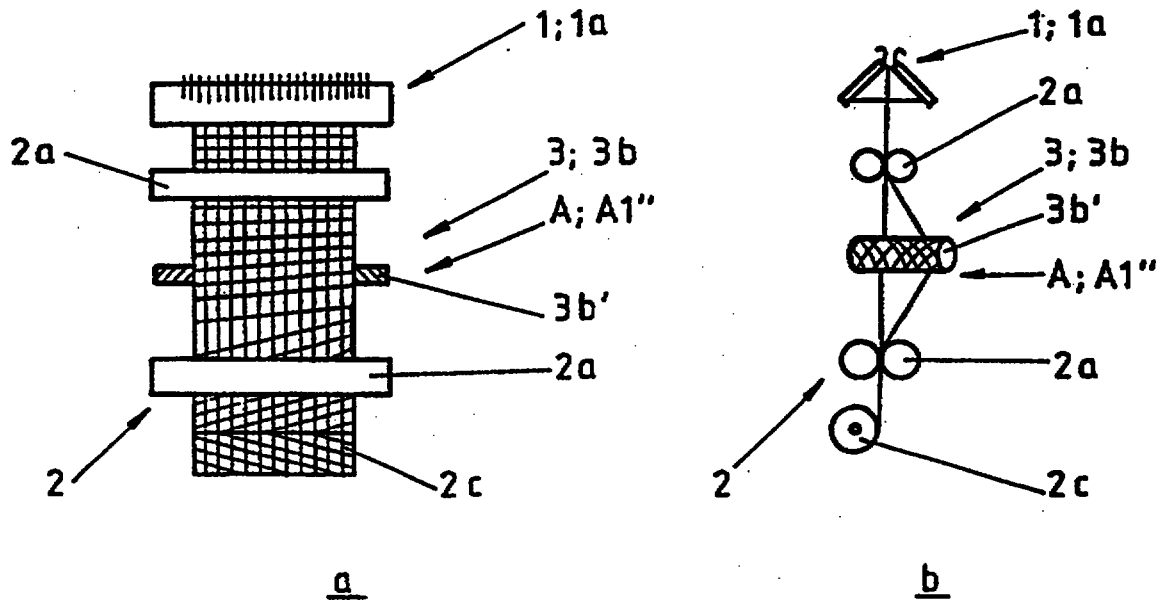


FIG. 7

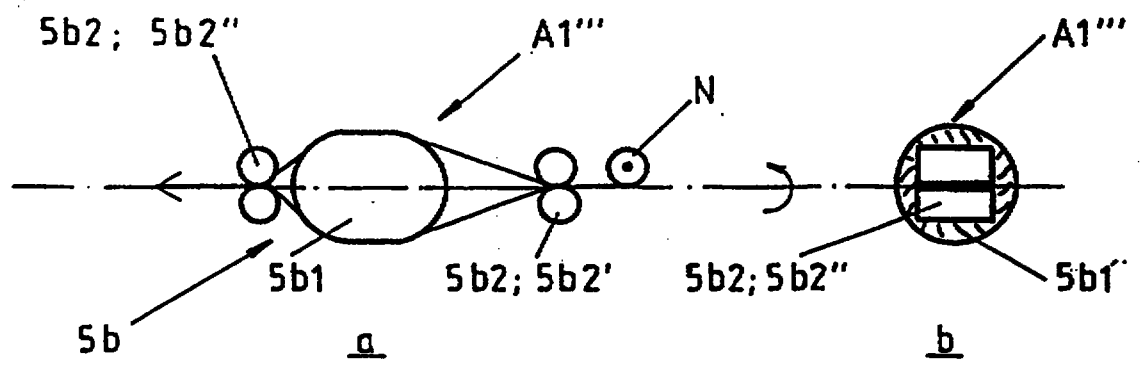


FIG. 8

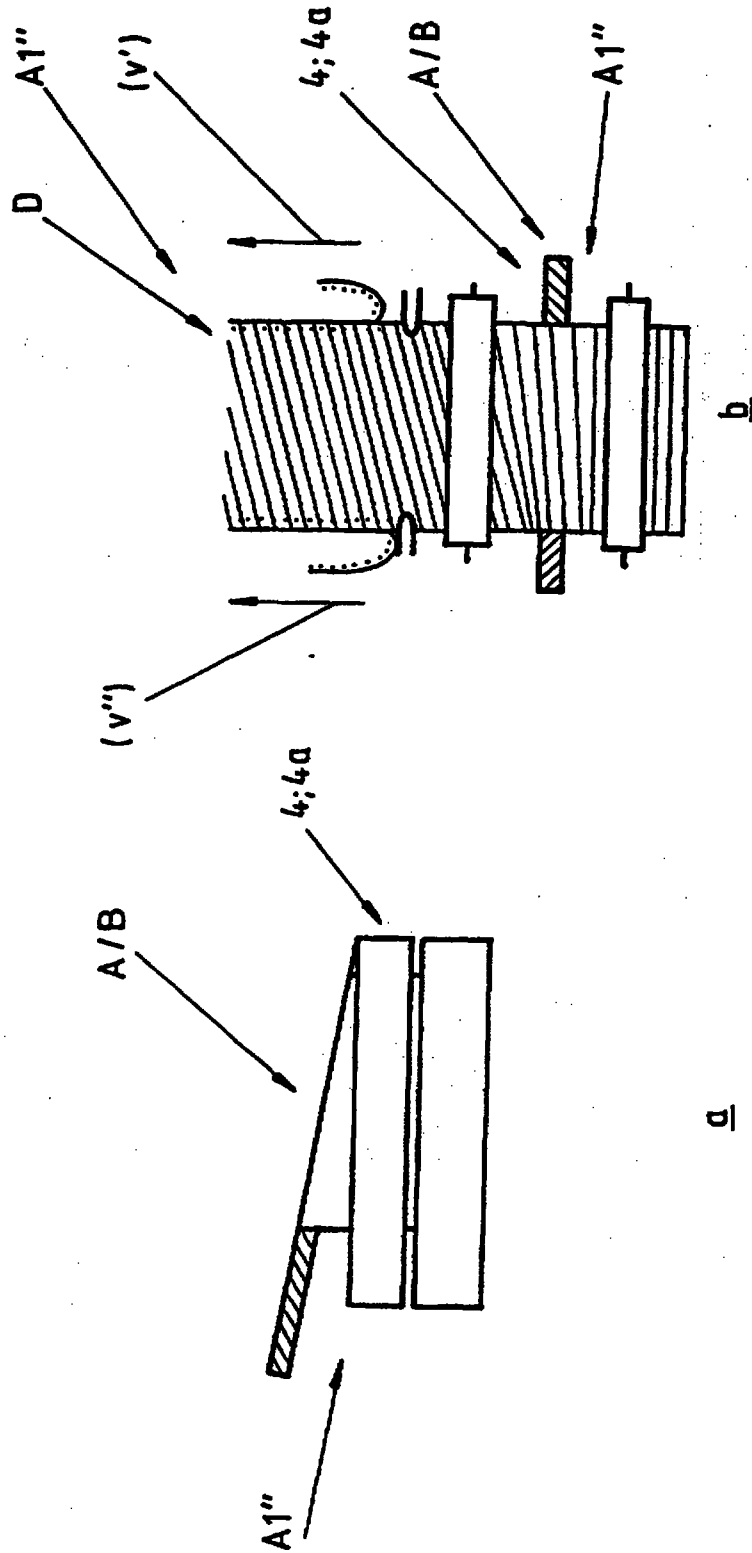
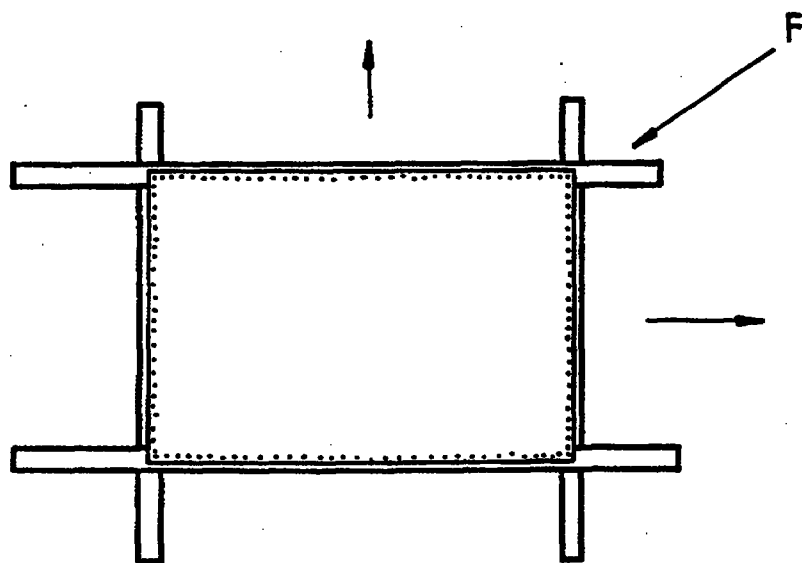
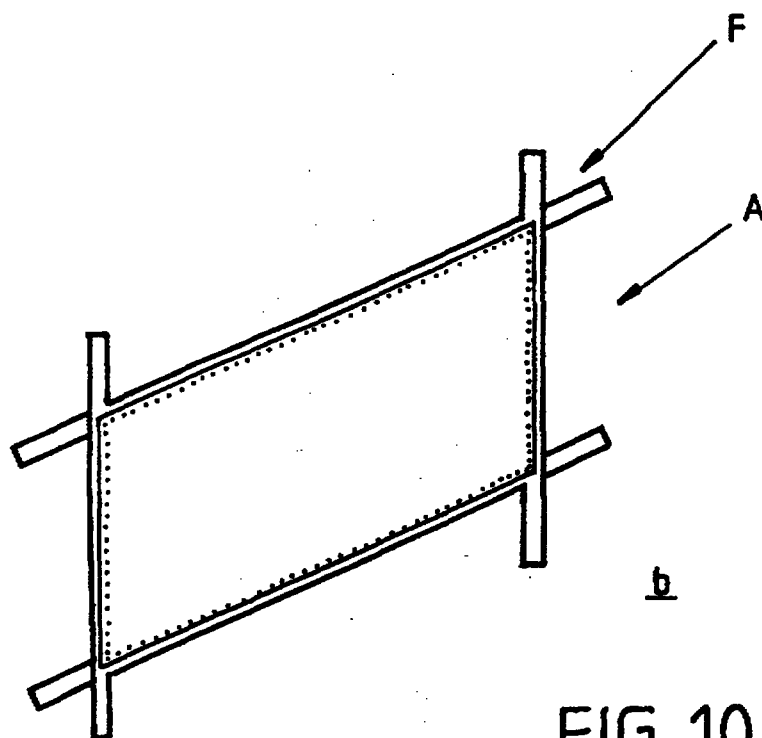


FIG. 9



a



b

FIG. 10

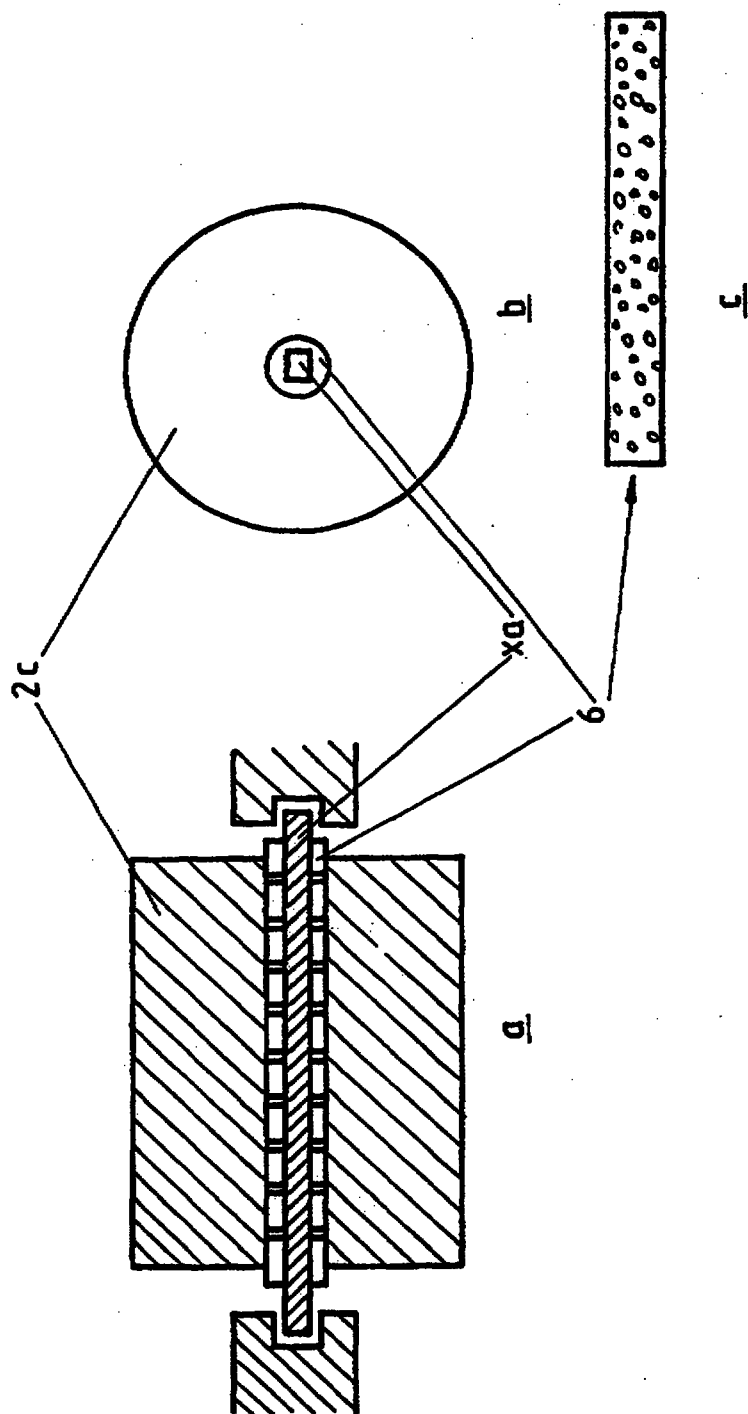
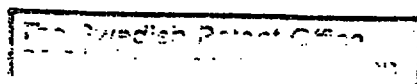


FIG. 11

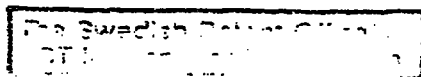


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Claims

1. A method for manufacturing and/or treating a fabric, whereby knitting in particular, preferably for producing a single-jersey fabric, a derivative thereof or a like, is carried out with a knitting machine, such as a circular, flat-bed, straight-bar, loop-wheel machine or a like, comprising at least knitting elements (1), such as yarn supply elements and loop forming elements (1a), such as needles, sinkers and/or the like, in cooperation therewith for producing a fabric from continuous yarn, such as one or a plurality of untwisted, S-, Z-twisted yarns and/or a like yarn, by knitting, and take-up elements (2) for receiving the resulting fabric, **characterized** in that the spirality of an obtained fabric is eliminated at a first stage (A) on the one hand by altering the number of twists/unit of length and/or the relative length of distortion-causing loop legs, whereafter the obtained fabric is subjected to a process-technical fabric treatment, such as washing, dyeing, steaming processes and/or the like to stabilize the changes being achieved in the first stage (A) and thereafter on the other hand at a second stage (B), preferably during the course of fabric finishing or a like operation, subjected to at least one after-treatment, wherein the fabric is straightened in terms of its wales and/or courses for resetting the loop legs, whose relative lengths were changed during the first stage (A), to a substantially equal length.

2. A method as set forth in claim 1 for treating a fabric, which is effected in a special work process or during the course of knitting with the use of a knitting machine provided with take-up elements (2), including a take-down assembly (2a) and/or a spreading assembly (2b) for drawing the knitted fabric to a storage assembly (2c), such as a winding roll or a



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like, characterized in that the number of twists/unit of length and/or the relative length of distortion-causing loop legs are altered in a tensioned state at least partially by means of a pretreatment, involving knitting technology and effected as a first stage (A) during the course of fabric-forming, or by means of a pretreatment, involving finishing technology and effected as a first stage (A) during the course of fabric pretreatment.

3. A method as set forth in claim 2, characterized in that, in a pretreatment (A1') involving knitting technology, a fabric is drawn askew, such as in a drawing direction (s1) deflected from a basic drawing direction (s0) which is substantially perpendicular to the knitting plane, by adapting the take-up elements (2) to travel in front of or behind relative to the knitting elements (1).

4. A method as set forth in claim 2 or 3, characterized in that, in a pretreatment (A1'') involving knitting technology, the fabric is inclined through the action of a guide assembly (3) fitted between the knitting elements (1) and the take-up elements (2), such as by pulling it in the drawing direction (s1) substantially deflected from the basic drawing direction (s0) and/or, in a treatment involving finishing technology (A1''), the fabric is inclined by stretching its wales unilaterally askew.

5. A method as set forth in claim 1 or 2, characterized in that, in a first-stage pretreatment (A1'''), involving finishing technology and relating to an a previously knitted circular fabric, prior to its process-technical treatment, such as washing, dyeing, steaming processes or the like, the number of twists/unit of length of retracting loop legs is increased by forcing the courses of the tubular-form fabric in a



5 tensioned state to a spiral form, such as by using a
 guide surface system (5) for distorting the courses
 into z-direction in a fabric knitted with an S-twisted
 yarn and into s-direction in a fabric knitted with a
 Z-twisted yarn or respectively.

10 6. A method as set forth in any of preceding
 claims 1-5, characterized in that in a second-stage
 after-treatment (B), effected on a finished fabric
 preferably prior to the cutting thereof, the wales and
 courses of the fabric are forced in a tensioned state
 to a position substantially perpendicular to each
 other, whereby the lengthening of the distortion-
 causing loop legs, such as the left-hand loop legs of
15 an S-twisted yarn and respectively the right-hand loop
 legs of a Z-twisted yarn, is used for unraveling the
 distortion-causing twist.

20 7. A method as set forth in claim 6, characteri-
 zed in, that in order to reduce the number of twists-
 /unit of length included in the loop legs, the fabric
 is subjected to an after-treatment (B), wherein an
 open knitted or a tube fabric, which is cut open in
 the course direction, is treated with an expansion
25 system (4), such as by driving the same to a drying
 assembly (D) at peripheral velocities (v' , v'') sub-
 stantially unequal to each other, by expanding (4a) the
 same unilaterally in a plane substantially transverse
 to its traveling direction and/or respectively.

30 8. An apparatus for manufacturing and/or trea-
 ting a fabric, which is adapted for treating or
 producing a preferably single-jersey fabric, a deriva-
 tive thereof or a like with the use of a knitting
35 machine, such as a circular, flat-bed, straight-bar,
 loop-wheel machine or a like, said knitting machine
 comprising at least knitting elements (1), such as
 yarn supply elements and loop forming elements (1a),



such as needles, sinkers and/or the like, in cooperation therewith for producing a fabric from continuous yarn, such as one or a plurality of untwisted, S-, Z-twisted yarns and/or a like yarn, by knitting, and
5 take-up elements (2) for receiving the resulting fabric, **characterized** in that, in order to eliminate the distortion of a subsequently/previously manufactured fabric, said apparatus comprises primary means, on the one hand, at a first stage (A) to modify the
10 number of twists/unit of length and/or the relative length of distortion-causing loop legs and, on the other hand secondary means, at a second stage (B), to subject the produced fabric, preferably during the course of fabric finishing or the like, to at least
15 one after-treatment for straightening the fabric in terms of its wales and/or courses for returning the loop legs, which were changed in terms of their relative lengths during the first stage (A), to a substantially equal length and/or for extending
20 particularly distortion-causing loop legs.

9. An apparatus as set forth in claim 8 especially for pretreating and/or knitting a fabric with the use of a knitting machine provided with take-up
25 elements (2), including a take-down assembly (2a) and/or a spreading assembly (2b) for drawing the knitted fabric to a storage assembly (2c), such as a winding roll or a like, **characterized** in that, in order to modify at least the number of twists/unit of
30 length and/or the relative lengths of distortion-causing loop legs by means of a treatment involving finishing technology and/or of a pretreatment involving knitting technology (A1" and/or A1'), effected essentially in the fabric pretreatment and/or during
35 the course of knitting, the fabric is adapted to be drawn askew, such as in a drawing direction (s1) deflected from a basic drawing direction (s0) which is substantially perpendicular to the knitting plane,

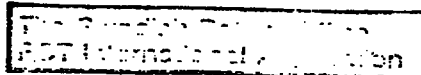


such as by adapting the take-up elements (2) to travel in front of or behind relative to the knitting elements (1) or respectively.

5 10. An apparatus as set forth in claim 8 or 9,
characterized in that, in order to modify the number
of twists/unit of length and/or the relative length of
distortion-causing loop legs by means of a pretreat-
ment (A1"), effected essentially during the course of
10 knitting and involving knitting technology, said
apparatus includes a guide system (3) operating at
least between the knitting elements (1) and the take-
up elements (2) for inclining the fabric, such as for
deflecting its traveling direction into the drawing
15 direction (s1) substantially other than the basic
drawing direction (s0), for skewing its wales by
expanding it in lateral direction and/or respectively.

20 11. An apparatus as set forth in claim 8, charac-
terized in that, in order to subject a knitted circu-
lar fabric to a pretreatment involving finishing
technology (A1'"), preferably prior to its process-
technical treatment, such as washing, dyeing, steaming
processes or the like, said apparatus includes a guide
25 surface system (5), such as a spreader (5b1) or a like
fitted inside the fabric, for forcing the courses of
a tubular-form fabric in a tensioned state to a
spiral.

30 12. An apparatus as set forth in any of preceding
claims 8-11, characterized in, that the apparatus
includes at least one expansion assembly (4), by means
of which an open knitted or a tubular fabric, which is
cut open in the direction of courses, is adapted to
35 receive an after-treatment (B), which is preferably
effected after a process-technical fabric treatment,
such as washing, dyeing, steaming processes or the
like, for reducing at this point the spirality given



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5 to the loop legs of the fabric, such as by controlling the same by means of a drying assembly (D) operating at mutually unequal and preferably variable peripheral velocities (v' , v''), by guiding the same through a roll assembly (4a) expanding it unilaterally in a plane substantially transverse to its traveling direction, and/or respectively.

AMENDED SHEET



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(54) Title: METHOD AND APPARATUS FOR ELIMINATING THE SPIRALITY IN KNITTED FABRIC

(57) Abstract

The invention relates to a method for manufacturing and/or treating a fabric, knitting in particular, preferably for producing a single-jersey fabric, a derivative thereof or the like, is carried out with a knitting machine, such as a circular, flat-bed, straight-bar, loop-wheel machine or the like, comprising at least knitting elements (1), such as yarn supply elements and loop forming elements (1a), such as needles, sinkers and/or the like, in cooperation therewith for producing a fabric from continuous yarn, such as one or a plurality of untwisted, S-, Z-twisted yarns and/or alike yarn, by knitting, and take-up elements (2) for receiving the resulting fabric. The spirality of an obtained fabric is eliminated at a first stage (A) on one hand by altering the number of twists/unit of length and/or the relative length of distortion-causing loop legs, whereafter the obtained fabric is on the other hand at a second stage (B), preferably during the course of fabric finishing or alike operation, subjected to at least one after-treatment, wherein the fabric is straightened in terms of its wales and/or courses for resetting the loop legs to a substantially equal length. The invention also relates to an apparatus for implementing the method.

