



(51) International Patent Classification:

D04B 1/24 (2006.01) *A41D 1/06* (2006.01)
A41B 11/14 (2006.01)

(21) International Application Number:

PCT/IB2022/053996

(22) International Filing Date:

29 April 2022 (29.04.2022)

(25) Filing Language:

Italian

(26) Publication Language:

English

(30) Priority Data:

102021000012941 19 May 2021 (19.05.2021) IT

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(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, IT, JM, JO, JP, KE, KG, KH,
KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA,
MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,
NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,
RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM,
ZW.

(54) Title: METHOD FOR THE PRODUCTION OF AT LEAST ONE TEXTILE ARTICLE AND RELATED TEXTILE ARTICLE

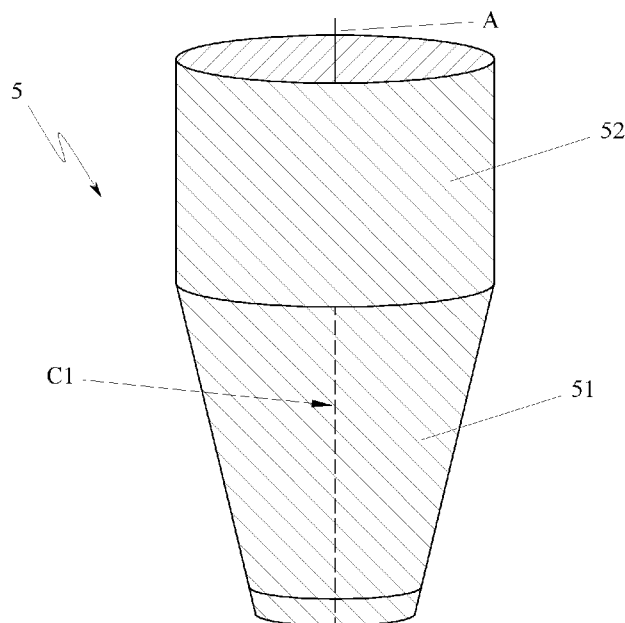


FIG. 2A

(57) Abstract: A method for making at least one textile article (10) which comprises: - forming a fabric tube (5) wound on itself around a longitudinal axis (A) by means of a circular knitting machine with seamless technology, wherein forming the fabric tube (5) comprises: o weaving a conical section (51) wound around the longitudinal axis of the fabric tube (5), wherein the conical section (51) is formed by a plurality of courses having an axially increasing number of stitches from a minimum number of stitches to a maximum number of stitches; the method further comprising: - cutting axially at least a portion of the conical section (51) along a pair of generatrices (C1,C2), so as to define for each generatrix (C1,C2) at least a first cut edge (C1.1, C2.1) and a second cut edge (C1.2, C2.2); and - joining together, preferably by sewing, the first cut edge (C1.1, C2.1) of each generatrix (C1,C2) with the second cut edge (C1.2, C2.2) of the other generatrix (C1,C2), so as to form two respective conical tubes (15).



(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *of inventorship (Rule 4.17(iv))*

Published:

- *with international search report (Art. 21(3))*
-

METHOD FOR THE PRODUCTION OF AT LEAST ONE TEXTILE ARTICLE
AND RELATED TEXTILE ARTICLE

TECHNICAL FIELD

The present invention relates to the field of clothing, in particular to a method for making
5 a textile article and the relative textile article, by means of so-called 'seamless' technology.

PRIOR ART

As is well known, "seamless" technology makes it possible to produce clothing articles
of fabric, e.g. stretch, with a reduced number of seams, starting from a fabric tube that
10 has no longitudinal (and circumferential) seams.

Generally, "seamless" technology includes weaving a cylindrical tube using circular knitting machines. This cylindrical tube is then used as a base for making various textile articles, such as skirts, trousers, jerseys, sleeves, muffs, legs and others.

For example, two cylindrical tubes are used in order to make a jersey (with sleeves),
15 one of which, after appropriate cuts and seams in the upper portion, will constitute the trunk of the jersey, and the other one, appropriately cut and stitched again, will define the sleeves which will then be joined to the trunk.

A fabric tube of a known type for making sleeves is shown in Figure 1B.

In order to make trousers (long, short or half-leg), on the other hand, it is started with a
20 single cylindrical tube, which is suitably cut in its lower part and then stitched together so as to have an upper bodice from which two lower legs are derived.

A fabric tube of a known type for making trousers is shown in Figure 1A.

As can be seen from Figures 1A and 1B, the production of a textile article according to
this known methodology involves the production of parts of the tube (defined by the portion
25 of the design without the hatching of the fabric tube) which are destined to be discarded (i.e. represent production scraps); such production waste represents a not negligible waste of raw material and colour (if the fabric is dyed), which impacts on the sustainability of the finished product and its production costs.

One need felt in the sector, therefore, is that of being able to minimise fabric waste and
30 the amount of production scraps in the making of a textile article, both with a view to reducing the production costs of such articles (in fact, the quantity of excess material, which is then discarded, as well as the disposal of scraps, affects the final cost of the

textile), and also with a view to activating a virtuous or "green" production circuit, i.e. one that is careful to reduce the waste of material and energy used to produce textile articles, as well as to optimise production resources.

One object of the present invention is to meet these needs of the prior art and other needs which will become apparent in the following, within the framework of a simple, rational and low-cost solution.

Such objects are achieved by the characteristics of the invention reported in the independent claims. The dependent claims outline preferred and/or particularly advantageous aspects of the invention.

DISCLOSURE OF THE INVENTION

The invention particularly makes available a method for making at least one textile article which comprises:

- forming a fabric tube wound on itself around a longitudinal axis by means of a circular knitting machine with seamless technology, wherein forming the fabric tube comprises:
 - o weaving a conical section wound around the longitudinal axis of the fabric tube, wherein the conical section is formed by a plurality of courses having an axially increasing number of stitches from a minimum number of stitches to a maximum number of stitches;

the method further comprising:

- cutting axially at least a portion of the conical section along a pair of generatrices, so as to define for each generatrix at least a first cut edge and a second cut edge; and
- joining together, preferably by sewing, the first cut edge of each generatrix with the second cut edge of the other generatrix so as to form two respective conical tubes.

Thanks to this solution, it is possible to achieve the intended objects, in particular it is possible to reduce, or even eliminate, the production of waste material, i.e. production scraps, waste of material and, at the same time, it makes it possible to form only the fabric needed to make the textile article.

Therefore, thanks to this solution it is possible to adopt a manufacturing method with a low environmental impact, with a lower production cost and lower cost for the disposal

of waste material.

According to one aspect of the invention, the generatrices can be diametrically opposed.

In addition, the step of forming the fabric tube can comprise:

- 5 ○ weaving at least one cylindrical section wound around the longitudinal axis of the fabric tube consecutive to the conical section, wherein the cylindrical section is formed by a plurality of courses having a number of stitches equal to at least one between the maximum number of stitches the minimum number of stitches of the conical section, preferably equal to the
10 maximum number of stitches.

Thanks to this solution it is possible to obtain a fabric tube of a shape suitable for the making garments (finished or semi-finished) or parts of garments.

According to a further aspect of the invention, the method may comprise:

- cutting the cylindrical section along two cutting lines, wherein each cutting line
15 has a first end joining the first cut edge of one of the generatrices and a second end joining the second cut edge of the other of the generatrices.

Thanks to this it is possible to obtain sleeves with appropriately shaped joining brims for joining to the bodice of a jersey.

Advantageously, moreover, it is possible to provide that the step of weaving the conical
20 section precedes the step of weaving the cylindrical section.

Within the context of this solution, the step of weaving the conical section can begin by weaving the courses having the minimum number of stitches.

In addition, when weaving courses having the minimum number of stitches, a number of needles equal to half of the total number of needles of the circular machine may be
25 used, wherein the used needles are interspersed with the unused needles, and when weaving the courses having the maximum number of stitches a number of needles equal to the total number of needles of the circular machine may be used.

For the same purposes as above, the invention makes available a textile article obtained by means of the method as described above.

30 Advantageously, the textile article may be a pair of trousers and comprise a bodice formed by the cylindrical section of the fabric tube and a pair of legs, wherein each leg is formed by a respective conical fabric tube formed/obtained from the conical section of

the fabric tube.

Alternatively, the textile article may be at least one between a pair of tubes forming legs, sleeves or muffs, wherein each tube of the pair of tubes is formed by a respective conical tube formed/obtained starting from the conical section of the textile tube.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the invention will become clear from reading the following description provided by way of non-limiting example, with the aid of the figures illustrated in the accompanying tables.

Figure 1A and Figure 1B are schematic views of a known fabric tube respectively used
10 to make a pair of trousers (Figure 1A) and a pair of sleeves (Figure 1B, representing front and back views of the same fabric tube).

Figure 2A and Figure 2B are schematic views of a fabric tube according to the invention, respectively used to make a pair of trousers (Figure 2A) and a pair of sleeves (Figure 2B).

15 Figure 3A and Figure 3B are views of the in-plane developments of the fabric tubes in Figure 2A and Figure 2B, respectively.

Figure 4A and Figure 4B are schematic axonometric views, respectively, of a pair of trousers obtained starting from a fabric tube of Figure 2A, and a pair of sleeves obtained starting from a fabric tube of Figure 2B.

20 Figure 5 is a view of a flow chart of the method for making a textile article according to the invention.

BEST MODE OF THE INVENTION

With particular reference to Figures 2 to 5, a method for making a textile article, e.g. a complete garment or part of a garment, and the textile article, e.g. obtained by means of
25 the aforesaid method, are described.

The (finished) textile article is globally indicated by the reference number 10 and is illustrated in Figures 4A and 4B.

The manufacturing method is based on the use of a circular knitting textile machine with “seamless” technology.

30 The textile machine comprises at least one supporting structure, a cylinder rotatably mounted in the supporting structure, and a plurality of needles supported by the cylinder and movable parallel to an axis of rotation of the cylinder to produce a knitted fabric in

the form of a "seamless" fabric tube 5, better described below. In this text, the term "circular knitting textile machine" means a circular textile machine suitable for the production of seamless knitted textile articles having at least one drop.

Such textile machines can be, for example, of the single-needle or double-needle type (i.e., for example with a needle plate or with a double cylinder). These machines may be with continuous or reciprocating motion.

The circular textile machine also comprises one or more devices for feeding a yarn, for example an elastic or stretch yarn (e.g. Lycra).

The circular textile machine further comprises an electronic control unit operatively connected to the needles (i.e. the needle operating mechanisms) to control the operation of the textile machine.

The electronic control unit is programmable to carry out the steps of the method for making the "seamless" fabric tube 5, described below.

The textile machine is not described in more detail as it is of a known type.

The method according to the invention includes forming (block S1) a fabric tube 5 wound on itself (in a loop) around a longitudinal axis A, by means of the circular textile machine.

The step of forming the fabric tube 5 comprises weaving (block S1.1), for example first, a conical section 51 (i.e. truncated conical) wound around the longitudinal axis A, wherein the longitudinal axis is the central axis of the conical section 51 of the fabric tube 5.

The conical section 51 is formed by a plurality of courses having an axially increasing number of stitches (in a continuous or discontinuous manner) from a minimum number of stitches, for example at a free end of the conical section 51, to a maximum number of stitches, for example at an opposed end of the conical section 51.

The free end of the conical section 51 defines a tapered free end of the fabric tube 5.

Preferably, but not limited to, the weaving of the free end of the conical section 51 includes making a closing flap (anti-unravelling).

Preferably, in order to weave the conical section 51 the circular textile machine is programmed to start by weaving the courses having the minimum number of stitches (i.e. starting the production of the fabric tube 5 from the free end of the conical section 51).

When weaving the courses having the minimum number of stitches, the method in-

cludes (programming the circular textile machine so as to) use a number of needles equal to half of the total number of needles of the circular textile machine, whereby the used needles are interspersed (alternated) with the unused needles.

In practice, the textile machine, in order to weave the courses having the minimum number of stitches, is programmed to work with only the odd numbered needles or only with the even numbered needles of the plurality of needles.

The method further includes increasing the number of stitches (and hence of needles used) as the weaving of the conical section 51 of the fabric tube 5 progresses from the free end (having one or more courses with minimum stitch number) towards the opposed end (having one or more courses with maximum stitch number).

In detail, the increase of the stitches is programmed according to a predefined growth trend depending on the conical shape to be assumed by the conical section 51.

For example, the conical section 51 may be formed by a plurality of concentric and consecutive (cylindrical) course bands (from the free end to the opposed end of the conical section 51), wherein between two consecutive course bands the one closest to the free end of the conical section 51 has a smaller number of stitches than the one closest to the opposed end of the conical section 51.

When weaving the courses having the maximum number of stitches, the method includes (programming the circular textile machine so as to) use a number of needles equal to the total number of needles of the circular textile machine.

In practice, the textile machine, in order to weave the courses having the maximum number of stitches, is programmed to work with all odd numbered needles and with all the even numbered needles of the plurality of needles.

The step of forming the fabric tube 5 comprises weaving (block S1.2), for example subsequently and consecutively to weaving the conical section 51, a cylindrical section 52 wound around the longitudinal axis A, wherein the longitudinal axis is the central axis of the cylindrical section 52 and is coaxial to the central axis of the conical section 51 of the fabric tube 5.

The cylindrical section 52 is formed by one or more courses having an axially constant number of stitches, for example equal to the maximum number of stitches.

In practice, the cylindrical section 52 has a free end (opposed to the free end of the conical section 51), which defines an enlarged free end of the fabric tube 5, and an op-

posed end, which is connected (or interconnected) to the opposed end of the conical section 51.

Preferably, in order to weave the cylindrical section 52 the circular textile machine is programmed to start by weaving the courses from the opposed end (continuing with those of the opposed end of the conical section 51, towards the free end).

When weaving the courses of the cylindrical section 52 (having the maximum number of stitches), the method includes (programming the circular textile machine so as to) use a number of needles equal to the total number of needles of the circular textile machine.

Preferably, but not limited to, the weaving of the free end of the cylindrical section 52 may include making an additional closing flap (anti-ravelling).

The fabric tube 5 may have (at one between the conical section 51 and the cylindrical section 52) structured areas (not illustrated) with particular compression and/or elasticity characteristics such as to give the fabric tube a particular anatomical shape depending on the area of the body it is intended to cover.

Once the fabric tube 5 has been formed, the method includes manufacturing (block S2) a textile article 10, for example as described below.

The textile article 10 may be a garment (finished or semi-finished), such as for example illustrated in Figure 4A, or a part of a garment intended to define a finished garment, such as for example illustrated in Figure 4B.

With particular reference to Figures 2A, 3A and 4A, the following is a description of the step of manufacturing a garment (finished or semi-finished), such as a pair of trousers, starting from a (single) fabric tube 5 (as described above).

In particular, the pair of trousers will have a (upper) bodice and two (lower) legs joined at the top of the bodice.

The bodice of the pair of trousers is defined (exclusively) by (all of) the cylindrical section 52 of the fabric tube 5 and the legs are defined (exclusively) by (all of) the conical section 51 of the same fabric tube 5, as better described below.

The axial length of the conical section 51 defines the length of the legs.

The manufacturing step, in particular, comprises cutting (block S2.1) axially at least a portion of the (only) conical section 51 along a pair of generatrices C1 and C2.

Preferably, the step of cutting along each of the generatrices C1 and C2 produces a (straight) cut involving all (and only) of the conical section 51 (from the free end to the

opposed end thereof).

Preferably, furthermore the generatrices C1 and C2 along which the cut develops are diametrically opposed.

The cut along each generatrix C1 and C2 defines/generates a first cut edge C1.1 and C2.1 (straight) and a second cut edge C1.2 and C2.2 (straight).

In practice, the conical section 51, by means of the two cuts along the generatrices C1 and C2 is subdivided into two half-cones, each of which is delimited in the circumferential direction by a first cut edge C1.1 or C2.1 and by a second cut edge C2.2 and C1.1 (wherein the opposed end of each half-cone is joined to the opposed end of the cylindrical section 52).

The manufacturing step, then, includes joining (block S.2.3) together, preferably by sewing, the first cut edge C1.1 and C2.1 of each generatrix C1 and C2 respectively with the second cut edge C2.2 and C1.2 of the other generatrix C2 and C1, so as to form two respective (identical) conical tube 15.

In practice, each seam develops longitudinally along a generatrix of the respective conical tube 15.

For example, the upper end of the seams joins together to define a crotch area of the trousers.

With particular reference to Figures 2B, 3B and 4B, the following is a description of the step of manufacturing a part of a garment, such as a pair of sleeves (to be joined to a bodice (not illustrated), e.g. made starting from a further fabric tube, for example, according to a traditional method) from a (single) fabric tube 5 (as described above).

Each sleeve of the pair of sleeves includes a muff (tube) associated with a joining brim (delimiting the shoulder), for joining the sleeve with the bodice.

The joining brim of each sleeve is defined (exclusively) by (a portion of) the cylindrical section 52 of the fabric tube 5 and the muff of each sleeve is defined (exclusively) by (a portion, i.e. half, of) the conical section 51 of the same fabric tube 5, as further described below.

The axial length of the conical section 52 defines the length of the muff of each sleeve.

The manufacturing step, in particular, comprises cutting (block S2.1) axially at least a portion of the (only) conical section 51 along a pair of generatrices C1 and C2.

Preferably, the step of cutting along each of the generatrices C1 and C2 produces a

(straight) cut involving all (and only) of the conical section 51 (from the free end to the opposed end thereof).

Preferably, furthermore the generatrices C1 and C2 along which the cut develops are diametrically opposed.

- 5 The cut along each generatrix C1 and C2 defines/generates a first cut edge C1.1 and C2.1 (straight) and a second cut edge C1.2 and C2.2 (straight).

In practice, the conical section 51, by means of the two cuts along the generatrices C1 and C2 is subdivided into two half-cones, each of which is delimited in the circumferential direction by a first cut edge C1.1 or C2.1 and by a second cut edge C2.2 and C1.2
10 (wherein the opposed end of each half-cone is joined to the opposed end of the cylindrical section 52).

Furthermore, in such a case, the manufacturing step comprises cutting (block S2.2) the cylindrical section 51 along two (distinct) cutting lines C3, wherein each cutting line C3 has a cusp-like or variously conformed shape (defined by a conformed broken line) and
15 has a first end (at the opposed end of the cylindrical section 52) joining the upper end of the first cut edge C1.1 or C2.1 of one of the generatrices C1 or C2, and a second end (also at the opposed end of the cylindrical section 52) joining the second cut edge C2.2 and C1.2 of the other of the generatrices C2 or C1.

In practice, the cut along the cutting line C3 separates the fabric tube 5 into two separate portions, each of which consisting of the aforesaid half-cone and a joining brim circumscribed perimetrically between (the cut edge along) the cutting line C3 and the (half of) the end course defining the opposed end of the cylindrical section 52 and/or the conical section 51.
20

The manufacturing step, then, includes joining (block S.2.3) together, preferably by sewing, the first cut edge C1.1 and C2.1 of each generatrix C1 and C2 respectively with the
25 second cut edge C2.2 and C1.2 of the other generatrix C2 and C1, so as to form two respective (identical) conical tube 15 defining the aforesaid muff of each sleeve.

In practice, each seam develops longitudinally along a generatrix of the respective conical tube 15.

- 30 At this point it is sufficient to join, by sewing, (the long cut edge) the cutting line C3 with a corresponding cutting line made in the bodice to obtain a (finished) jersey.

Furthermore, the aforesaid method, in a simplified form, can lead to the formation of a

garment such as a pair of muffs or a pair of legs.

For example, in such a case, making the fabric tube 5 may not include the step of weaving the cylindrical section 52, i.e. the fabric tube 5 may consist of (entirely) only the conical section 51 (without the need to include any cylindrical section 52).

- 5 In such a case, the manufacturing step (e.g. for making the pair of sleeves) can be carried out following the steps described with reference to blocks S2.1 and S.2.3.

In particular, with particular reference to the comparison between Figures 1A and 1B with Figures 2A or 3A and 2B or 3B, it can be noted that the amount of production scraps is significantly reduced with the method for making the object of the present invention, whereby a reduction of about 10% or more (by weight) of textile material (and colour, where provided) is observed, practically eliminating the production of waste and scrap, for making a pair of trousers (or a pair of muffs or a pair of legs), compared to the traditional methods illustrated in the preamble, and a reduction of about 23% or more (by weight) of textile material (and colour, where provided) for making a pair of sleeves.

- 10 15 The invention thus conceived is susceptible to several modifications and variations, all falling within the scope of the inventive concept.

Moreover, all the details can be replaced by other technically equivalent elements.

- In practice, the materials used, as well as the contingent shapes and sizes, can be whatever according to the requirements without for this reason departing from the scope of protection of the following claims.
- 20

CLAIMS

1. A method for making at least one textile article (10) which comprises:

- forming a fabric tube (5) wound on itself around a longitudinal axis (A) by means of a circular knitting machine with seamless technology, wherein forming the fabric tube (5) comprises:

- o weaving a conical section (51) wound around the longitudinal axis of the fabric tube (5), wherein the conical section (51) is formed by a plurality of courses having an axially increasing number of stitches from a minimum number of stitches to a maximum number of stitches;

the method further comprising:

- cutting axially at least a portion of the conical section (51) along a pair of generatrices (C1,C2), so as to define for each generatrix (C1,C2) at least a first cut edge (C1.1, C2.1) and a second cut edge (C1.2, C2.2); and
- joining together, preferably by sewing, the first cut edge (C1.1, C2.1) of each generatrix (C1,C2) with the second cut edge (C1.2, C2.2) of the other generatrix (C1,C2), so as to form two respective conical tubes (15).

2. The method according to the preceding claim, wherein the generatrices (C1,C2) are diametrically opposed.

3. The method according to claim 1, wherein forming the fabric tube (5) comprises:

- o weaving at least one cylindrical section (52) wound around the longitudinal axis (A) of the fabric tube (5) consecutive to the conical section (51), wherein the cylindrical section (52) is formed by a plurality of courses having a number of stitches equal to at least one between the maximum number of stitches the minimum number of stitches of the conical section (51), preferably equal to the maximum number of stitches.

4. The method according to preceding claim, which comprises:

- cutting the cylindrical section (52) along two cutting lines (C3), wherein each cutting line (C3) has a first end joining the first cut edge (C1.1, C2.1) of one of the generatrices (C1,C2) and a second end joining the second cut edge (C1.2,C2.2) of the other of the generatrices (C1,C2).

5. The method according to claim 3, wherein weaving the conical section (51) precedes weaving the cylindrical section (52).

6. The method according to the preceding claim, wherein weaving the conical section (51) starts from weaving the courses having the minimum number of stitches.

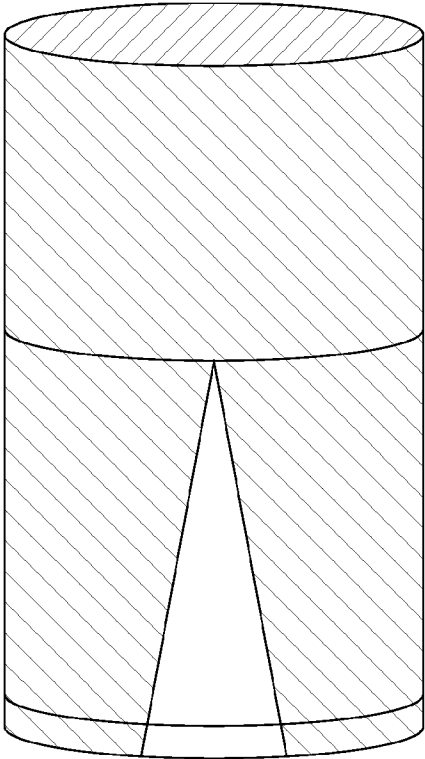
7. The method according to the preceding claim, wherein when weaving the courses having the minimum number of stitches a number of needles equal to half of the total number of needles of the circular machine is used, wherein the used needles are interspersed with the unused needles, and when weaving the courses having the maximum number of stitches a number of needles equal to the total number of needles of the circular machine is used.

8. A textile article (10) obtained by means of the method according to any one of the preceding claims.

9. The textile article (10) according to the preceding claim in relation to claim 3, wherein the textile article is a pair of trousers and comprises a bodice formed by the cylindrical section (52) of the fabric tube (5) and a pair of legs, wherein each leg is formed by a respective conical tube (15) formed by the conical section (51) of the fabric tube (5).

10. The textile article (10) according to claim 8, wherein the textile article (10) is at least one between a pair of tubes forming legs, sleeves or muffs, wherein each tube of the pair of tubes is formed by a respective conical tube (15) formed by the conical section (51) of the textile tube (5).

FIG.1A



Prior Art

Prior Art

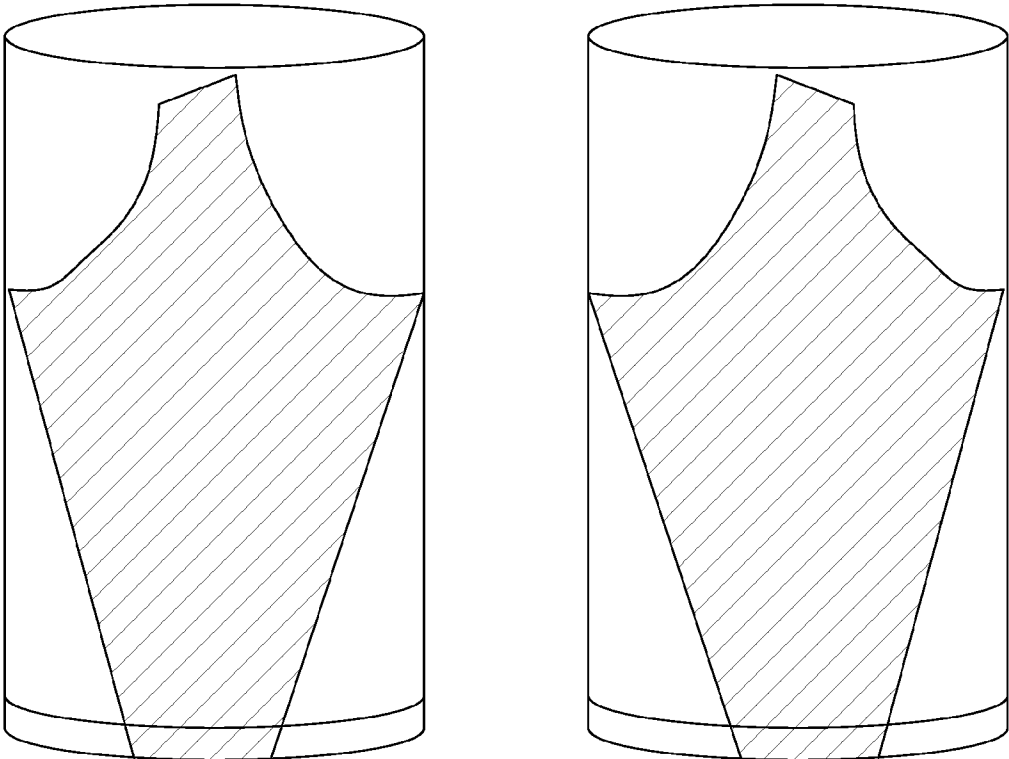


FIG.1B

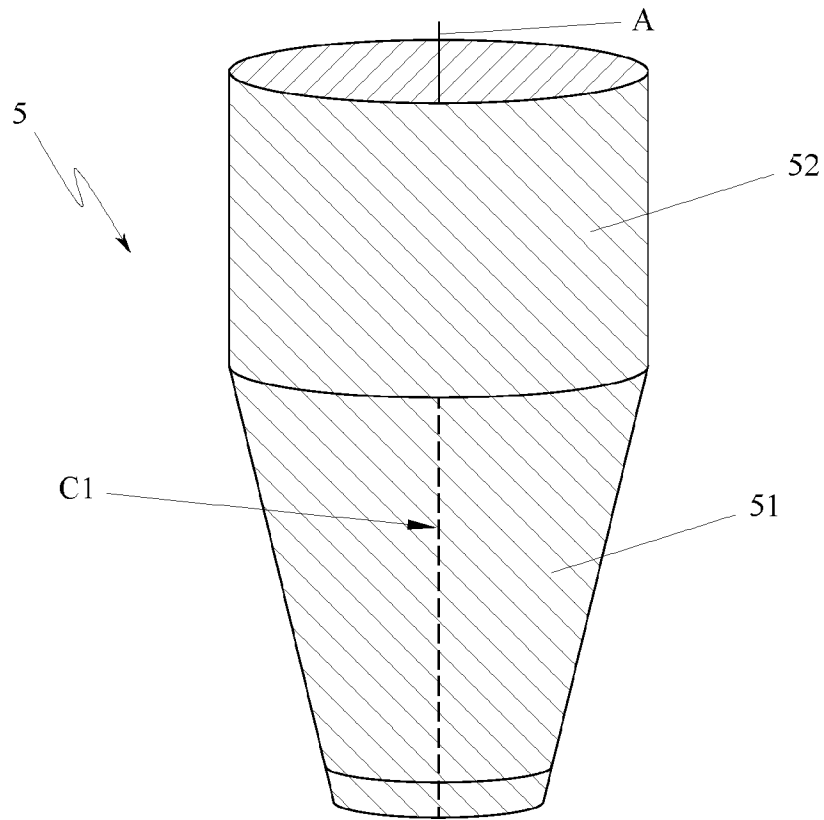


FIG.2A

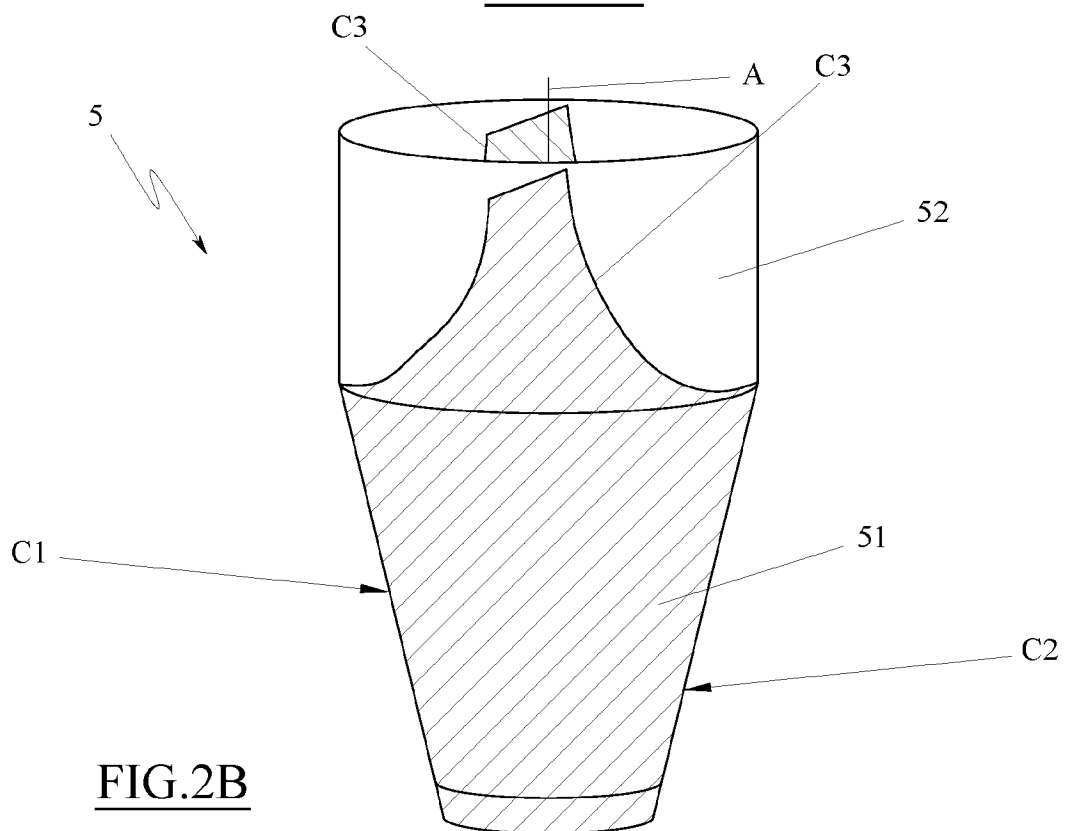


FIG.2B

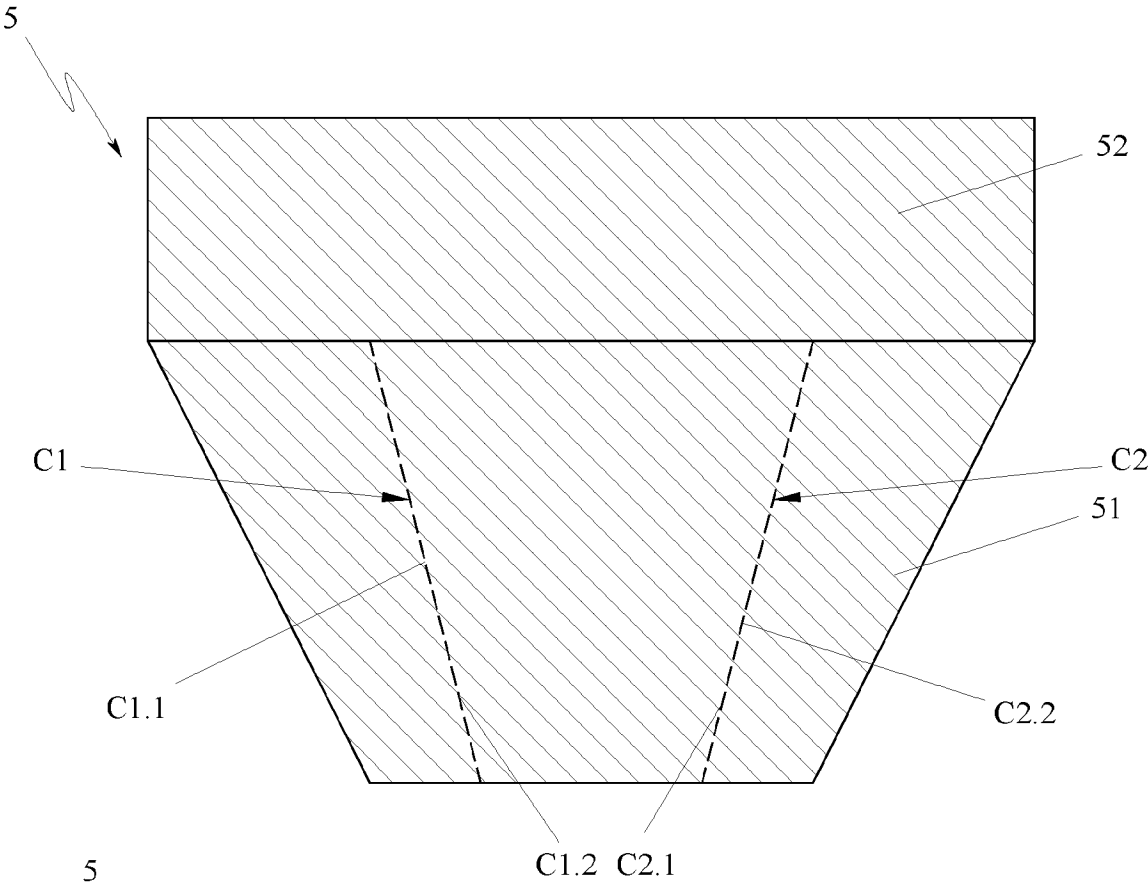


FIG.3A

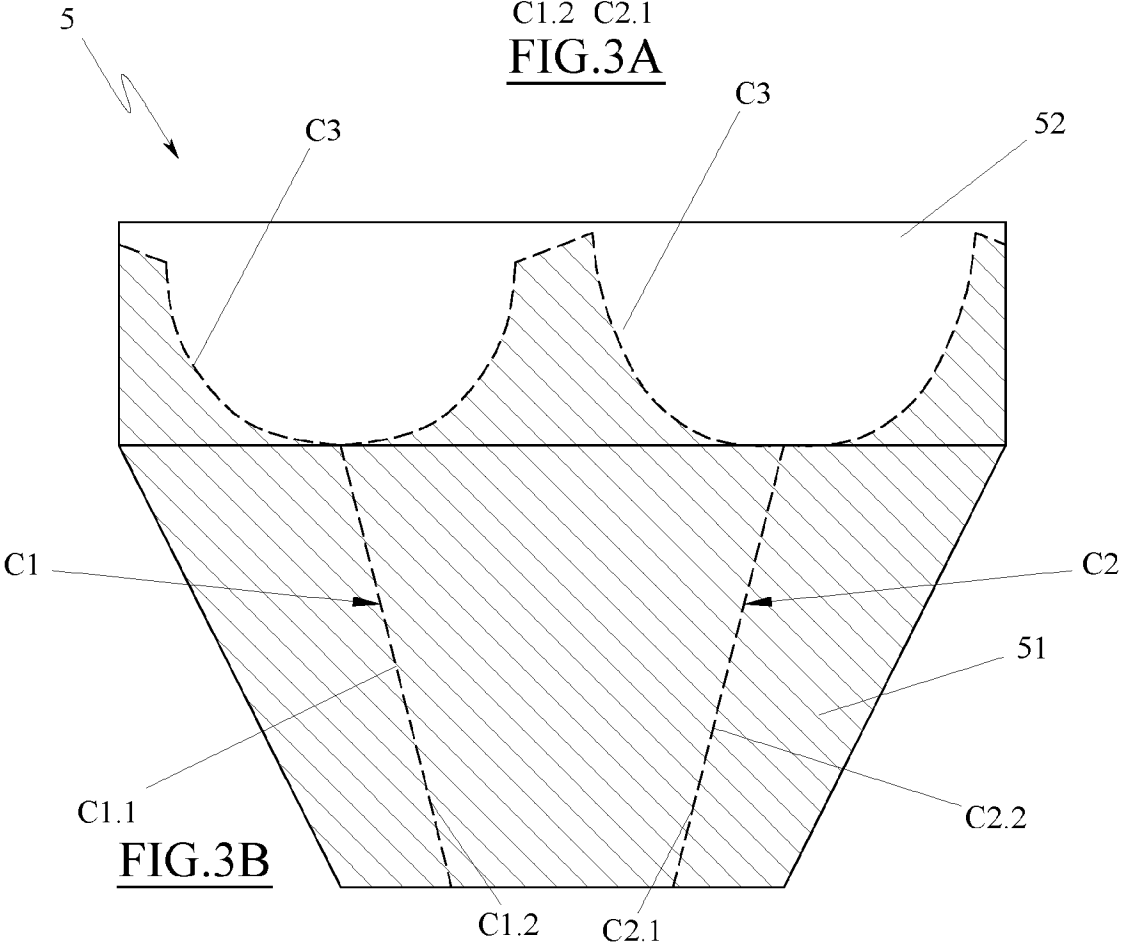


FIG.3B

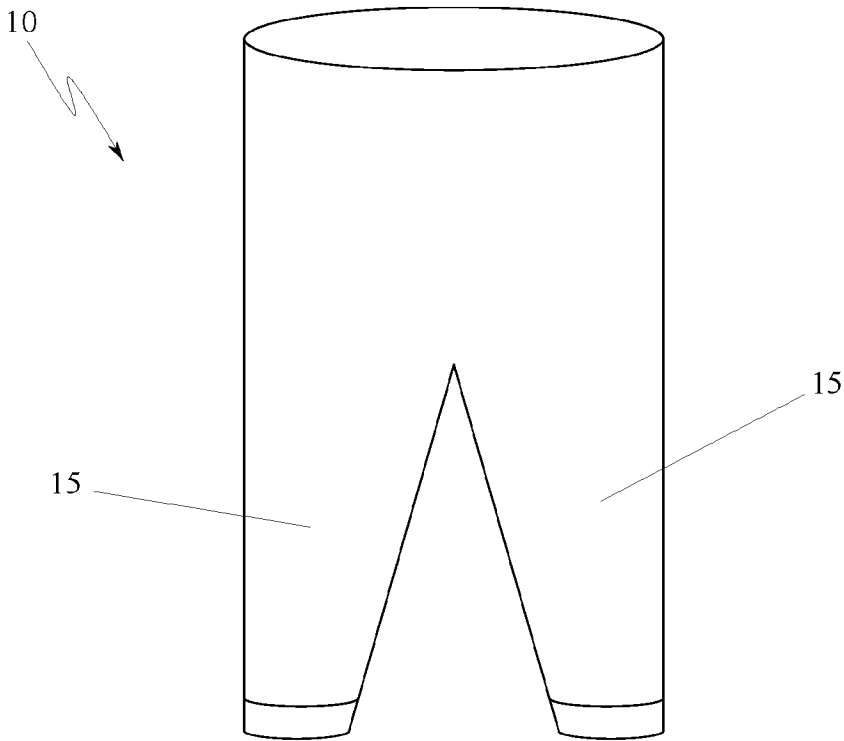


FIG. 4A

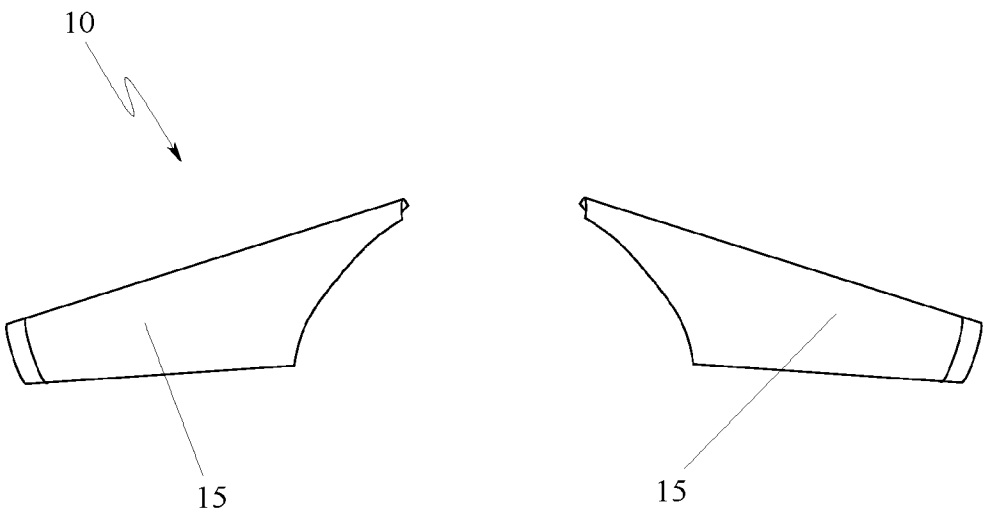
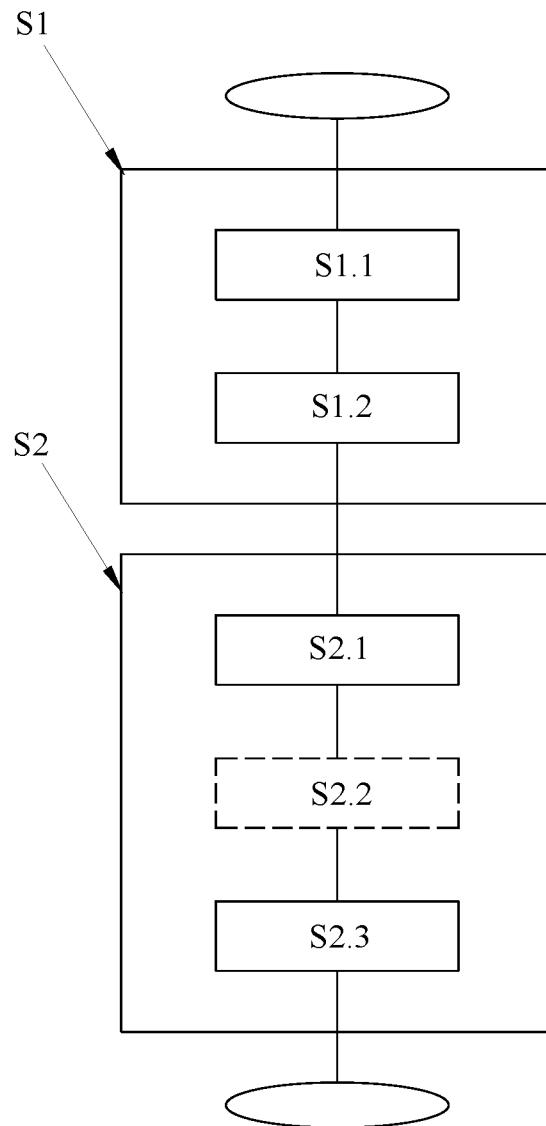


FIG. 4B

FIG.5

International application No
PCT/IB2022/053996

A. CLASSIFICATION OF SUBJECT MATTER INV. D04B1/24 A41B11/14 A41D1/06 ADD. 		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) D04B A44C A41B A41D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2 837 904 A (SCRIGGINS EDWIN P) 10 June 1958 (1958-06-10) col.2, 1.9; col.2, 1.19-23; col.4, 1.56-64; figures 1,3,7 -----	1-3, 5-10 4
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 8 June 2022		Date of mailing of the international search report 22/06/2022
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Messai, Sonia

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2022/053996

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2837904	A	10-06-1958	NONE
