Title: DEVICE AND METHOD FOR FLATTENING AND IDENTIFYING THE ENDS OF A TEXTILE ARTICLE, IN PARTICULAR A SOCK

Abstract: The device (3) comprises a path for the textile article (M), which develops across a variable cross section, defined by a member (33) movable between at least one first position of maximum cross section and one second position of reduction of the cross section, in which the cross section assumes a narrow and elongated shape transversely with respect to the direction of feed of the articles along the path. To the path is associated a discriminating device for distinguishing the first end from the second end of the article.
before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))
"DEVICE AND METHOD FOR FLATTENING AND IDENTIFYING THE ENDS OF A TEXTILE ARTICLE, IN PARTICULAR A SOCK"

DESCRIPTION

Technical Field

The present invention relates to a device for flattening and identifying the ends of a tubular knitted article, or a textile article in general, and more particularly of a sock.

The invention also relates to a method for flattening and identifying the ends of an article of this type.

State of the Art

In the production of knitted articles, in particular socks and stockings, it is normally provided for the production on knitting machines (generally circular machines) of tubular knitted articles, which have two ends: an elastic edge and an end for forming the closed toe of the finished article. In some textile knitting machines the toe is closed directly inside the machine by means of more or less complex sewing or linking systems. In other known devices, the single tubular article is picked up from the needles cylinder and transferred to a linking group adjacent to the knitting machine. These systems are particularly complex and are used only in particular cases and preferably for articles of high cost.

In the production of articles of lower cost, for example sport socks and the like, the tubular articles knitted on the knitting machine are discharged with the open toe and collected in a basket or other similar accumulation system, where usually the articles produced by several textile machines are collected, for examples through a pneumatic transport system. The single articles are taken from the basket and delivered to sewing or linking machines. These machines perform the closing of the toe of the socks.

One of the problems occurring during the insertion of the individual articles in the sewing machine is the need of distinguishing, i.e. of identifying the toe from the edge. In many cases, this operation is still today performed manually. The operator takes manually individual articles from the basket, identifies which is the end to be sewn (toe), flattens the article transversely and inserts it inside a guillotine of a sewing machine, or on a transport member which subsequently feeds the single articles positioned thereon to the sewing machine.

Several attempts have been made in order to produce machines, which
automatize these operations. A complex system for identifying the ends to be 
sewn of the knitted tubular articles is disclosed in US-A-5040475.

Devices for handling tubular articles, for example for flattening the toe 
and/or for identifying the toe relative to the edge are disclosed in: WO-A- 

WO-A-2007/000782 discloses a device particularly suitable for flattening 
the end of a tubular article, in particular a sock, in order to prepare it for the 
subsequent sewing. This device includes a path for the textile article, which ex-
tends across a variable cross section, defined by a member movable between 
at least a first position of maximum cross section and a second position of re-
duced cross section. In this second position of the movable member, the cross 
section takes a narrow shape, which is elongated transversally with respect to 
the direction of feed of the articles along said path.

Other devices for orienting tubular knitted articles, such as socks and 

In general, the known devices are suitable to perform only one of the 
various operations necessary for preparing the tubular article for the sewing 
and, in order to perform more operations, it is necessary to arrange more de-
vices in series. In particular, it is normally necessary to provide for a device, 
which performs flattening of the ends of the tubular knitted article and for a 
separated device, which performs the reading of the ends, in order to identify 
the orientation of the article and therefore to direct it in a correct manner to-
wards the subsequent sewing station.

Similar problems of correctly orienting the articles may occur not only for 
the sewing, but also for example for the subsequent packaging.

Summary of the Invention

According to one aspect, the invention provides a particularly efficient 
and compact device for performing the flattening and the identification of the 
orientation of the textile article, for example and in particular a sock, in order to 
direct it subsequently to the sewing operations or to other operations which re-
quire a given orientation of the article. Hereunder, reference will be often made 
to the need of orienting tubular knitted articles, open at the toe, in order subse-
quently to perform the sewing thereof on the correct end. However, it should be understood that similar problems of orientation could occur also for example for finished articles, i.e. for articles in which the toe is already sewn. In particular, it should be necessary to identify the orientation of an already finished sock so as to direct it correctly towards subsequent operations, for example to the packaging.

Substantially, the invention provides for combining the path, in which the variable cross section is provided, for performing the flattening of the article, together with a discriminating device in order to distinguish, i.e. to identify the end of the article, which is moving along the path. In this way a compact and simple device is obtained, which performs an extremely fast handling of the articles and which therefore allows for increasing the productivity of the line in which it is inserted.

According to a different aspect, the invention relates to a method for flattening and identifying the orientation of a textile article comprising a first end and a second end, different from each other, comprising the steps of:
- inserting a textile article in a feeding path;
- narrowing a cross section of said feeding path so as to form a narrow cross section transversally elongated with respect to the feeding direction of the articles in said feeding path, when said article is at least partially in said cross section;
- moving at least one end of said article through said narrow and elongated cross section, transversally flattening said end;
  - during the movement, identifying whether at least one end is the first end or the second end of said textile article.

Further advantageous characteristics and possible embodiments of the invention are indicated in the appended claims and will be described hereunder with reference to an example of embodiments.

**Brief description of the drawings**

The invention will be better understood by following the description below and the attached drawing, which shows a non-limiting practical embodiment of the invention. More in particular, in the drawing:
- figure 1 shows an axonometric view of the device according to the invention, partially sectioned;
figure 2 shows an axonometric view of a machine incorporating two devices according to the invention, which are arranged adjacent to a single common conveyor;

figure 3 shows a detail of the engaging system for engaging the articles at the entry of the device;

figures from 4A to 4G show an operative sequence of the device according to the invention in a section according to a vertical plane;

figure 5 shows a diagram relating to the discrimination algorithm; and

figures from 6A to 6D show an operative sequence in the case of not reading of the end of the article.

Detailed description of an embodiment of the invention

Figure 2 shows a machine, indicated as a whole with the number 1, to which two devices are associated indicated with number 3 and positioned opposite to each other at the sides of a conveyor 5. The devices 3 are substantially identical or symmetrical to each other, one of them is illustrated in detail in figure 1 and its operative sequence is schematically represented in the series of figures from 4A to 4G.

Substantially each of the two devices 3 of figure 2 receives, in the manner which will be described hereunder, single textile articles, for examples socks, from a container below, for example a rotating basket, not shown in the figure, and from which the single articles can be picked up in a known manner, for example through a gripper which grips single articles from the basket and brings them to the height of a suction duct associated, by means of a branch, to the two devices 3. The single articles, which are flattened and whose orientation is identified through alternatively one or the other of the devices 3, are placed on the conveyor 5 which, moving according to the arrow f5, transfers them towards a downstream machine, not shown, which provides for engaging one of the two ends of each article in order to perform subsequent operations, for example the sewing of the toe. The downstream machine is not described and is known per se. As it has been observed above, actually the operations performed on articles handled by the machine 1 can be various and not necessary sewing operations. Therefore, the nature and the structure of the downstream machine do not have relevance in the present description.

With particular reference to figure 1, wherein a single device 3 is shown
in an axonometric view with a flank removed in order to show the internal element thereof, comprises (see also the sections of figures from 4A to 4G) a path 11 for the articles which are sucked through a suction duct 13 connected to a pneumatic conveyor 13A represented with a dotted line in figure 1, which could be fed directly from the basket or other container mentioned above.

The suction through the duct 13 is obtained by means of a suction tube 13B connected at the top with the suction duct 13. In order to avoid the accidental entry of articles inside the duct 13B, in front of its entrance and therefore in front of the entrance of the articles inside the device 3, a double grid 15 is arranged, shown in greater detail in the axonometric view of figure 3. To the two V-inclined walls forming the double grid 15 are respectively associated two punches 17A, 17B, controlled by actuators 19A, 19B to move according to the double arrow f33. The punches 17A, 17B can penetrate the walls of the double grid 15 thanks to the presence of windows 21A and 21B. In this way, through the simultaneously actuated punches 17A, 17B it is possible to grip single tubular articles which are sucked through the suction duct 13B inside the entry duct 13 and which stop against the double grid 15. The number 23 indicates a photocell associated to the double grid 15, in order to verify the presence of an article close to the double grid 15 and therefore to give the consent for the actuation of the punches 17A, 17B.

The suction duct 13 is in connection with the feeding path 11 for feeding the articles across the device 3. The connection between the entry suction duct 13 and the path 11 is provided at correspondence of a passage area 25, which has a variable cross section for the purposes described above. The variation in the cross section is obtained by means of a reducing element 27 for reducing the passage cross-section. The element 27 is engaged to a cylinder-piston actuator 29, which causes the lifting and lowering movement thereof according to the double arrow f33 according to the sequence which will be described with references to the figures 4A - 4F.

Downstream to the passage area 25 the path 11 of the articles extends across a transit area with a variable cross section. In some embodiments this area is defined by a fixed lower block 31 and by a movable member 33 provided with a lifting and lowering movement according to the double arrow f33. The movement is controlled by a cylinder-piston actuator 35 or other actuator.
suitable for this purpose, for example a linear motor, an electrical gear motor or the like.

Between the variable cross section, defined by the fixed block 31 and by the movable member 33, and the area 25, a pair of rollers 37, 39 is arranged, forming part of a feeding system for feeding the articles through the device. In some embodiments, the lower roller 39 is mounted idle on a support 41 vertically movable according to the double arrow f41, whose movement is controlled by a cylinder-piston actuator 43 or other actuator suitable for this purpose. The actuator 43 can be fixed on a bracket 45 integral with the frame of the machine 1 and also supporting advantageously the cylinder-piston actuator 29. The upper roller 37 can be advantageously a roller motorized through a motor not shown. In some embodiments the roller 37 can be coated with a material with high friction coefficient, for example rubber or the like.

The surface of the movable member 33 facing the pair of rollers 37, 39, indicated with the number 33A, is advantageously inclined, similarly to the surface 31A of the fixed block 31, that is also facing the roller 37, 39. The surfaces 33A and 31A define a facilitation and a guide for the articles which must enter in the variable cross section defined by the block 31 and by the movable element or member 33.

Downstream to the variable section 31, 33, the device 3 has an exit 51 provided with an opening and closing door 53 (see figures 4A-4F) actuated by an actuator, for example a cylinder-piston actuator 55.

Between the variable cross section, defined by the block 31 and by the movable member 33, and the aperture 51 a suction mouth 57 is provided, in fluid connection with a suction tube 59, through which an aspiration can be generated for the reasons and the purposes described below.

At correspondence of the variable cross section defined by the block 31 and by the movable member 33 a discriminating device 33 is positioned, i.e. an identifying device suitable for identifying which of the two ends, different in shape from each other, passes in the cross section. In some embodiments, this device is an optical reader. Preferably, according to some embodiments, the optical reader comprises an array of photocells, advantageously aligned according to a direction preferably nearly orthogonal to the feeding direction of the articles. In the illustrated example the photocells comprise emitters 61E and re-
receivers 61R arranged according to a linear matrix substantially orthogonal to
the direction of feeding of the articles across the device. In the illustrated em-
5 bodiment, the receivers 61R are in the lower part, carried by the fixed block 31,
whilst the emitters 61E are arranged in the upper part, without however exclud-
ing an inverted arrangement. Preferably, to avoid the need for moving the emi-
10 ters 61E together with the movable member 33, said emitters 61E are mounted
on a portion 60 of the device 3 and in front of each emitter 61E the movable
member 33 has a corresponding hole 61F which allows the passage of the light
beam generated by the corresponding emitter and intercepted by the article or
detected by the corresponding receiver 61R. It is also possible to provide for
the emitters 61E to be integral with the movable element or member 33, al-
though this would require an electric connection by means of cables subjected
to cyclical deflections during the functioning of the device.

The functioning of the device described above is illustrated in detail in
15 figures 4A to 4G. With reference to figure 4A, in the initial step for introducing
an article M inside the device 3 the aspiration is activated (arrow A) by means
of the duct or tube 13B. In this way an article M, for example a sock or the like
coming from a basket below, is aspirated and stops against the grid wall 15.
Here it is engaged by the stems 17A, 17B, whose closure controlled by the ac-
tuators 19A, 19B occurs when the photocell 23 has detected the presence of
the article M.

In this phase, the rollers 37, 39 are in open arrangement, i.e. they are
20 spaced from one another so as to allow easy passage of the article M along the
feeding path 11 and in particular its entry inside the variable cross section de-

defined by the block 31 and by the movable member 33. This latter is temporarily
in a raised position, i.e. in the position, which defines the cross section of maxi-
mum dimension. The exit 51 is closed by the door 53.

For longitudinally flattening the article M (figure 4B) once it has been en-
gaged by the stems 17A, 17B, the air flow is inverted inside the duct 13B, 13,
25 13A. This is obtained with an arrangement of valves, not shown, which can be
easily designed by a person skilled in the art.

The inverted aspiration (arrow A') elongates the textile tubular article M,
30 which remains engaged superiorly through the stems 17A, 17B. The other
members of the device 3 still remain in the same position of figure 4A.
In the subsequent step (figure 4C) aspiration through the suction duct or tube 59 is actuated (arrow A1). As the door 53 is in close position, this aspiration causes a return of air through the duct 13 and therefore carries the article M in the position shown in figure 4C. The end of the article M engaged by the stems 17A, 17B remains in the original position, whilst the opposite end (indicated with E) is returned towards the suction mouth 57. Depending upon the length of the article M, the end E may also enter by a greater or lower entity inside the suction duct or tube 59. The rollers 37 and 39 are still in open position and analogously the element 31, 33 are in open position so as to define a cross section of maximum dimension.

In the subsequent step (figure 4D), the rollers 37, 39 are moved towards each other, so as to engage mechanically the article M that can be released by the pins or stems 17A, 17B without being removed due to aspiration through the duct 59.

At this point, the article is fed by rotating the motorized roller 37 until the end E1, previously engaged by the pins 17A, 17B, is in front of a sensor, a photocell or other, indicated with the number 70 in figure 4D, i.e. in a position directly upwards with respect to the rollers 37, 39. When this position has been achieved, the motorized roller 37 is stopped. The distance between the photocell 70 and the array of photocells 61E, 61R is greater than the minimum possible length of the articles M that can be handled through the device 3. This assures that when the end E1 is identified by the photocell or other detector 70, the opposite end E is surely downstream to the array of photocells 61E, 61R.

At this point the movable member 33 is lowered so as to assume the position of figure 4E. The cross section 11 assumes the minimum dimension, with a narrow and long shape. In this way the article M, which will be returned back by inverting its movement in the manner, which will be described below, is flattened in the area of the end E.

Actually, the height H of the cross section 11 is dimensioned (according to the thickness of the fabric which forms the article M) so as to flatten this latter, whilst the transversal dimension, i.e. orthogonal to the plane of figure 4E, is such as to allow the enlargement of the article M for all its transversal dimension.

When the cross section 11 assumes the dimension of figure 4E, the mo-
torized roller 37 is put again in movement in a direction opposite to that through which the article M has been fed inside the section 11. In this way the article M comes back (arrow fM in figure 4E) remaining stretched thanks to the suction (arrow A) through the duct 13.

The backward movement of the article M continues until its end E have been passed in front of the array of photocells 61E, 61R, assuming the position indicated with a dashed line in figure 4E. The photocells 61E, 61R identify the profile of the end E and determine whether it corresponds to the one or the other of the two ends, with different shape from each other, of the article M.

When this latter is a sock, one of the two ends is the elastic edge, which has a substantially rectilinear shape, and the other is the toe, which has a curve shape. A suitable processing application performed by the control unit of the machine 1 determines whether the end E is the toe or the elastic edge, based upon the profile identified by the photocells 61E, 61R, for example by using one of the methods disclosed in WO-A-2007/1 35702, the content of which is integrally incorporated in the present description. A different and more accurate method for identifying and discriminating the ends of the article M will be described in greater detail below.

Once this arrangement has been achieved, the machine on which the device 3 is mounted is suitable to know how the article is oriented, i.e. if the end E is the toe or the edge of the sock or other article. The article M can therefore been extracted from the device and positioned on the conveyor 5. At this end (see figure 4F) the aspiration A' by means of the duct 13A and the aspiration A'' by means of the tube or duct 59 are actuated. The movable member 33 is raised again, whilst the rollers 37 and 39 still grip the article M. The direction of rotation of the roller 37 is reversed again so as to start the feeding of the article M according to the arrow fM towards the exit 51. This latter has been opened through the lifting of the door 53 so as to allow the entry of a pick up member 81, acting as a sort of mechanical hand, which enters inside the path of the article M until advantageously close to the section with variable dimension of the elements 31 and 33.

When the end E of the article M is inside the pick-up member 81, the latter closes and is translated (arrow f81) so as to remove the article M from the device 3. For transversally flattening the end E1 of the article M, opposite to
that flattened in the section defined by the fixed element 31 and by the movable member 33, according to some advantageous embodiments in this phase the reducing element 27 is raised for reducing the cross section for the passage of the textile articles arranged between the duct 13 and the pair of rollers 37, 39. Figure 4G shows the subsequent phase, in which the article M, engaged by means of the extraction member 81, is extracted from the device 3 and is in a substantially flattened arrangement at both the ends E, E1.

The above-described cycle can be performed both by one or the other of the two devices 3 associated to the conveyor 5. Preferably, the articles M are fed alternatively to one or to the other of the devices 3, so as to have a greater productivity of the machine and a balanced wear of the mechanical members.

In some embodiments, the extractor member 81 is common to the two devices 3 and moves along a guide 83 by means of a belt 85 controlled by a motor, not shown in the drawing for greater clarity of representation. In this case the extractor member 81 has a symmetrical conformation so as it can engage articles both in one and in the other of the two mutually opposite devices 3. With this arrangement it is easy to translate the single articles by means of the member 81 in the considered position nearly centrally on the conveyor 5 without risks for collision and arranging the devices 3 mutually opposite along the feeding path of the conveyor 5.

Here below a particularly advantageous discriminating method will be described in greater detail with reference to figure 5, i.e. a method for distinguishing between the ends E1, E of the article. Figure 5 shows a Cartesian diagram in which a generic profile P is shown, which represents the profile of any of the two ends E, E1 of a generic article M. On the profile some points are identified (six in the example in the drawing), each defined by a pair of Cartesian coordinates Xi, Yi. The points are at the same distance along the axis X. They correspond to the points of the profile which can be identified by the photocells 61E, 61R which are arranged in a number corresponding to the points Xi, Yi, aligned according to the axis X. The ordinate Yi of each point of the profile is calculated based upon the displacement which the article M performs along the path 11 during detection, displacement which can be determined for example through an encoder associated to the motorized roller 39. The inclination of each segment of the profile P between two adjacent points of coordi-
nates Xj, Yj; X_{i+1}, Y_{i+1} is given by the difference (Y_{j+i} - Y_j).

The two ends E and E1 are different in shape: if the article is a sock, the end, which is constituted by the edge of the sock, has a more rectilinear shape, whilst the end constituted by the toe is more curvilinear. The two ends therefore differ by the value of the average deviation DM, defined in the following manner:

$$DM = \frac{1}{N-1} \sum_{i=1}^{N-1} |Y_{i+1} - \bar{Y}|$$

wherein

$$\bar{Y} = \frac{1}{N-1} \sum_{i=1}^{N-1} |Y_i - \bar{Y}|$$

being N the number of the points on the profile P, i.e. the number of photocells used.

Experimentally, it has been noted that

A. if DM < 10 the analyzed end is sufficiently rectilinear and is constituted by the edge of the sock;

S. if 14 < DM < 60 or DM > 70, the end is a toe;

C. if 11 < DM < 13 or 60 < DM < 69 the end cannot be identified, for example because the article has been not correctly flattened.

When a situation (C) occurs, the device can operate so as to perform an inversion of the article and a reading of the end opposite to that which has not been correctly identified. At this end, the device performs the cycle of the operations indicated in the sequence of figures 6A - 6D, which lead to the inversion of the article M. The inverted article is then manipulated according to the normal cycle of flattening and reading already described above, but on the opposite end.

In some cases the shape of the article M is such that the two ends E and E1 cannot be identified based upon the shape. A situation of this type occurs, for example, in the case of the so called "invisible socks", i.e. socks which cover only the feet and remain invisible inside the shoe. In this case (but the solution can be adopted also for article of other type, which can be detected based upon the shape of the ends) it is possible to use a detecting method based upon the color. In the production phase on the article it can be made a mark on one of the ends, for example always on the toe, or always on the edge. Preferably the
mark is obtained by means of a colored yarn with which a certain number of
knitting courses is obtained. These knitting courses can be for example the
lines of the toe which, after sewing, are cut. In this way the colored yarn is
eliminated from the finished product. The device, which performs this type of
detection, can remain substantially the same of that described above, with the
exception of the presence of photocells or other sensors capable to identify the
color.

It is understood that the drawing only shows an example provided by way
of a practical arrangement of the invention, which can vary in forms and ar-
rangements without however departing from the scope of the concept underly-
ing the invention. Any reference numbers in the appended claims are provided
for the sole purpose of facilitating reading of the claims in the light of the de-
scription and the drawing, and do not in any manner limit the scope of protec-
tion represented by the claims.
Claims

1. A device for flattening a textile article comprising a first end and a
second end and for identifying at least one of said first and second end with re-
spect to each other, comprising a path for the textile article, said path extending
across a variable cross section, defined by a member movable between at least
a first position of maximum cross section and a second position of reduction of
the cross section, in which said cross section assumes a thin and transversally
elongated shape relative to the direction of feed of the articles along said path,
characterized in that to said path is associated a discriminating device for dis-
tinguishing said first end from said second end.

2. A device as claimed in claim 1, characterized in that said discrimi-
nating device is an optical detector.

3. A device as claimed in claim 1 or 2, characterized in that said dis-
criminating device is arranged at said variable section.

4. A device as claimed in one or more of the previous claims, in which
said discriminating device comprises an array of photocells aligned transversely
to the direction of feed of the articles along said feeding path.

5. A device as claimed in one or more of the previous claims, charac-
terized in that to said path is associated a feeding system for said textile arti-
cles, arranged and designed to move the textile articles across said variable
section along opposite directions.

6. A device as claimed in claim 5, characterized in that said feeding
system comprises a pair of rollers, at least one of which is motorized, which are
movable between an active position, in which they act on a textile article, and
an inactive position, in which they are spaced from each other so allowing the
insertion of the textile articles between said rollers.

7. A device as claimed in one or more of the previous claims, charac-
terized in that it comprises an entry and an exit for said textile articles, said path
developing between said entry and said exit.

8. A device as claimed in claim 7, characterized in that said exit is pro-
vided with an opening and closing member.

9. A device as claimed in claim 7 or 8, characterized in that to said exit
is associated a suction mouth to suck the textile articles towards said exit, said
suction mouth being in fluid connection with the path of the articles.
10. A device as claimed in claim 9, characterized in that said suction mouth is arranged between the variable cross section and the exit of the device.

11. A device as claimed in one or more of claims 7 to 10, characterized in that said suction mouth is in fluid connection with a suction tube, within which the textile articles can be partially sucked.

12. A device as claimed in one or more of the previous claims, characterized by an extracting member to pick up and extract the textile articles from said path.

13. A device as claimed in claims 7 and 12, characterized in that said extracting member is arranged to entry in the path of the articles through said exit.

14. A device as claimed in one or more of the previous claims, characterized in that it comprises a suction system in order to insert the textile articles inside the device.

15. A device as claimed in claim 14, characterized in that said suction system is in connection with said path of the textile articles.

16. A device as claimed in claim 14 or 15, characterized in that said suction system comprises an entry suction duct, inside which is arranged one stop element for stopping and engaging the textile articles.

17. A device as claimed in claim 16, characterized in that said suction duct is connected to a suction circuit so as it can generate in said suction duct an air flow according to both directions.

18. A device as claimed in claim 16 or 17, characterized in that between the suction duct and said variable cross section a reducing element is arranged for reducing the passage section for the passage of the textile articles, said section reducing element defining a second variable cross section along said path.

19. A machine for handling elongated textile articles with a first end and a second end, comprising a conveyor and at least one device as claimed in one or more of the previous claims, for flattening and to identifying the orientation of the textile articles, which are positioned on said conveyor.

20. A machine as claimed in claim 19, comprising two devices as claimed in one or more of claims 1 to 17, arranged on opposite sides of the conveyor.
21. A machine as claimed in claim 19 or 20, comprising an extractor to extract the articles from said device or devices and to put them on the conveyor.

22. A method for flattening and identifying the orientation of a textile article comprising a first end and a second end, comprising the steps of:
   - inserting a textile article in a feeding path;
   - narrowing a cross section of said feeding path so forming a narrow transverse cross section elongated in transverse direction with respect to the feeding direction of the articles in said feeding path, when said article is at least partially in said transverse section;
   - moving at least one end of said article through said narrow and elongated cross section, flattening transversally said end;
   - during the movement, identifying whether at least one end is the first end or the second end of said textile article.

23. A method as claimed in claim 22, wherein said textile article is fed along said path in a first direction across said cross section before narrowing it; and wherein, after the cross section has been narrowed, said article is moved in opposite direction by making said at least one end pass through said narrowed cross section.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. D05B23/00 D06H3/16

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)

D05B D06H

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 practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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<tr>
<td>X</td>
<td>US 6 386 801 B1 (MIGLORINI PIER LORENZO [IT]) 14 May 2002 (2002-05-14) column 3, line 5 - column 5, line 11; figures 1-4</td>
<td>1,3,5,7, 12,19-23</td>
</tr>
<tr>
<td>A</td>
<td>WO 2007/020667 A (GOLDEN LADY COMPANY S P [IT]; MAGNI ANTONIO [IT]; GRASSI NERINO [IT]) 22 February 2007 (2007-02-22) cited in the application page 9, line 9 - page 22, line 16; figures 1-20</td>
<td>1,3,5,7, 6,8-11, 12,19-23</td>
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<td>X</td>
<td>EP 1 063 335 A (CONTI COMPLETT SPA [IT]) 27 December 2000 (2000-12-27) paragraph [0010] - paragraph [0046]; figures 1-5</td>
<td>1,3,5,7, 6,8-11, 12,19-23</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

**Date of the actual completion of the international search**

30 July 2009

**Date of mailing of the international search report**

06/08/2009

Name and mailing address of the ISA/Authorized officer

Herry-Martin, D
### DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>X</td>
<td>EP 1 178 143 A (MATEC SPA [IT]) 6 February 2002 (2002-02-06) paragraph [0009] - paragraph [0022]; figures 1-9</td>
<td>1-5,7, 19-23</td>
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