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(54) Title: A METHOD TO MANUFACTURE A TEXTILE PRODUCT, A USE THEREOF AND A DEVICE FOR APPLYING THE METHOD

(57) Abstract: The present invention pertains to a method to continuously produce a laminated textile product comprising a primary carrier sheet with yarns that form a pile on the front surface thereof, and a secondary carrier sheet attached to the back surface of the primary carrier sheet, the method comprising providing the primary carrier sheet with the yarns as a first continuous web, providing the secondary sheet as a corresponding second continuous web, transporting the first and second web to a laminating station where the two webs are laminated to each other, wherein the first web is guided over a roller adjacent the laminating station, the roller being in contact with the pile, wherein the roller is a first bowed roller and that the transport distance between the bowed roller and the laminating station is less than 4 meters. The invention also pertains to a method to use a textile product obtained with the new method and a device for applying the said method.

A METHOD TO MANUFACTURE A TEXTILE PRODUCT, A USE THEREOF AND A DEVICE FOR APPLYING THE METHOD

GENERAL FIELD OF THE INVENTION

The present invention pertains to a method to continuously produce a laminated textile product comprising a primary carrier sheet with yarns that form a pile on the front surface thereof, and a secondary carrier sheet attached to the back surface of the primary carrier sheet, the method comprising providing the primary carrier sheet with the yarns as a first continuous web, providing the secondary sheet as a corresponding second continuous web, and transporting the first and second web to a laminating station where the two webs are laminated to each other, wherein the first web is guided over a roller adjacent the laminating station, the roller being in contact with the pile. The invention also pertains to a method to use a textile product obtained with the new method and a device for applying the said method.

BACKGROUND ART

A method to continuously produce a laminated textile product (i.e. to produce a laminated textile product out of at least two corresponding continuous materials) as outlined here above is known from GB 2076336. As is known from this disclosure, the primary carrier sheet is transported to the laminating nip with its pile side being guided over at least one roller adjacent the nip, in order to be able and apply adhesive to the back side of the primary carrier sheet. In order to prevent that the pile negatively influences a stable guidance of the primary carrier sheet, a set-up is chosen wherein the primary carrier is sheet is guided by a complex steering nip consisting of two rollers, the axis of which rollers can be adjusted with respect to the transport direction. Next to this, before entry of the laminating nip, the primary carrier sheet is guided over a transport belt to further secure stable guidance. The reason for all this is that the transport of a running web over a guide roller, with a pile directed to this roller, inevitably leads to a very strong tendency of the web to move laterally in one particular direction. Simply adjusting the axis of the rollers is typically not sufficient to keep the web running parallel to the process direction. Lateral guides may be an option for very thick and heavy running webs (such as thick rubber belts provided with a pile for producing weatherstripping or brushes), but not for more flexible textile products, in

particular not for carpet products such as broadloom carpet, carpet tiles, mats, rugs and runners. Hence the setup chosen in GB2076336, with a complex set of adjustable guide rollers combined with a transport belt. For the secondary carrier sheet, not having a pile which may negatively influence the running direction of the web, a simple set up with guide rollers, including a bowed roller, is chosen.

OBJECT OF THE INVENTION

It is an object of the invention to provide an improved method to manufacture a textile product which is less complex of construction.

SUMMARY OF THE INVENTION

In order to meet the object of the invention a method to manufacture a textile product as defined in the GENERAL FIELD OF THE INVENTION section has been devised, wherein the roller adjacent the laminating station is a bowed roller (also called “bow roller”) and the transport distance between the bowed roller and the laminating station is less than 4 meters, in particular less than 3.90, 3.80, 3.70, 3.60, 3.50, 3.40, 3.30, 3.20, 3.10, 3.00, 2.90, 2.80, 2.70, 2.60, 2.50, 2.40, 2.30, 2.20 or 2.10 meters. To applicant’s surprise, a bowed roller may be sufficient to stably guide the continuous primary carrier, with its pile against the roller, parallel to the process direction, not needing additional adjusting rollers, transporting webs, lateral guides or other running web adjusting means as known from the art. Indeed, the arc needed in the roller may depend on the speed of the process, the needed accuracy, the stiffness of the web, the height of the pile, the stitching pattern of the pile etc.. Still, applicant found that even in a worst case scenario, i.e. using a primary carrier sheet with a very high pile (above 1 cm), a bowed roller may suffice to provide for an adequate running of the web. Prerequisite for being able to find a bowed roller set-up that is sufficient for effective guidance in each and every case is that the transport distance between the bowed roller and the laminating station is less than 4 meters. If the distance is longer than these 4 meters, a stable running of the web may not always be able to be provided.

The invention also pertains to the use of a textile product obtainable in line with the above described method to cover a surface of a building or any other artificial or natural construction.

The invention also pertains to a device for use in continuously producing a laminated textile product comprising a primary carrier sheet with yarns that form a pile on the front surface thereof, and a secondary carrier sheet attached to the back surface of the primary carrier sheet, the device comprising a laminating station for laminating two web materials together, transporting means for transporting the primary carrier sheet with the yarns as a first continuous web to the laminating station, wherein the transport means comprises a roller adjacent to the laminating station, the roller being in contact with the pile, further transporting means for transporting the secondary sheet as a corresponding second continuous web to the laminating station, wherein the roller is a bowed roller and has transport distance of less than 4 meters with respect to the laminating station, in particular less than 3.90, 3.80, 3.70, 3.60, 3.50, 3.40, 3.30, 3.20, 3.10, 3.00, 2.90, 2.80, 2.70, 2.60, 2.50, 2.40, 2.30, 2.20 or 2.10 meters, or even less than that as described here below with respect to embodiments of the method according to the invention.

DEFINITIONS

A *textile product* is a product that comprises textile (i.e. material made mainly of natural or artificial fibres, often referred to as thread or yarn), optionally with other components such as backing layers, carrier layers and/or adhesives. Textile products typically comprise an upper layer of pile attached to a backing (where the raised pile fibres are also denoted as the ''nap'' of the product), but may also be flat weave. Such products can be of various different constructions such as woven, needle felt, knotted, tufted and/or embroidered, though tufted products are the most common type. The pile may be cut (as in a plush carpet) or form loops (as in a Berber carpet).

A *laminate* is a structure comprising multiple stacked layers mechanically connected to each other.

A *continuous* sheet or web is a sheet having a length that is significantly longer than its width and having a minimum length of at least 1 meter, in particular at least 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 100 or even over 200 meters.

A *woven* material is a fabric material woven from yarns, fibres, tape or other thread-like material.

A *bowed roller*, also called a "banana roller", is a type of "spreader roller" having a curved stationary axle upon which a rotating sleeve(s) is mounted, typically over multiple bearing sets. The axle may have either a fixed or variable bow. The sleeve is typically a one-piece flexible tube of a soft synthetic composite, or may consist of numerous narrow metal shells. The amount of bow is typically between 0.1 and 2% (height of the arc vs length of the roller).

A *sheet* is a substantially two dimensional mass or material, *i.e.* a broad and thin, typically, but not necessarily, rectangular in form, and inherently has two opposite surfaces.

Stitching is a method of mechanically making a yarn part of an object by stitches or as if with stitches, such as by tufting, knitting, sewing, weaving etc.

EMBODIMENTS OF THE INVENTION

In a first embodiment the transport distance between the first bowed roller and the laminating station is less than 2 meters. It appears that with a shorter distance, there is more freedom in the type of bowed roller to use, that is, the type of sleeve, the bow of the axle (i.e. the height of the arc) etc.. Apparently, at a shorter distance the type of roller is less critical to arrive at a proper balance between adequate guidance of the web and prevention of distortion of the web due to the strain induced by the bowed roller. In particularly, the transport distance is less than 1.95, 1.90, 1.85, 1.80, 1.75, 1.70, 1.65, 1.60, 1.55, 1.50, 1.45, 1.40, 1.35, 1.30, 1.25, 1.20, 1.15, 1.10, 1.05, 1.0, 0.95, 0.90, 0.85, 0.80, 0.75, 0.70, 0.65, 0.60, 0.55 or less than even 0.5 meters. The distance is preferably above 0.1 meters, or even above 0.15, 0.20, 0.25, 0.30, 0.35, 0.40 or 0.45 meters to provide sufficient space to configure the bowed roller with respect to the laminating station and to have sufficient process length at the station.

In another embodiment the pile has a height larger than 0.5 cm, in particular larger than 1 cm. Even at these high piles, which typically lead to a very strong tendency of a web, that is, when transported over a guide roller with the pile in contact with this roller, to move in lateral direction, the use of a bow roller on itself might suffice to keep the web running parallel to the process direction.

In yet another embodiment, downstream of the laminating station the laminated product is transported over a second bowed roller. This embodiment is advantageous in that the processed product is adequately guided and straightened for further processing, which further processing may be as simple as winding on a roller after sufficient cool down.

In still another embodiment the first and/or second bowed roller have an adjustable arc. In this embodiment the bow of the axle can be adjusted to arrive at an adequate balance between guidance of the web and prevention of distortion of the web, independent of the type of web (whether use is made of a non-woven or woven carrier sheet, and if woven, whether this is woven from fibre, tape, low-melting polymer, high-melting polymer, what the type of weave is etc.). The adjustment can be arrived at by extending the (net) length over which the roller axle extends, thereby lowering the arc. Easier to implement is an embodiment wherein the length and arc of the roller as such are fixed, but wherein the spatial configuration of the bowed roller is adjustable by rotating the bowed-roller set-up over the imaginary axle that extends between the end points of the roller. For example, by rotating the bowed roller from a position wherein the arc is upright, over an angle of 90° to a positon wherein the arc extends in horizontal direction, the actual tension applied to the web is altered from very high to very low.

The invention will now be further explained based on the following figures and examples.

EXAMPLES

Figure 1 schematically shows a cross section of a textile product manufactured according to the invention.
Figure 2 schematically shows details of a textile manufacturing process according to the invention.
Figure 3 schematically shows a laminating station for use in the present invention.

Example 1 example describes two carpet products which can be made using a process according to the invention.

Figure 1

Figure 1 is a schematic representation of respective layers of a laminated textile product 1 manufactured according to the invention, in this case a carpet tile. The tile comprises a primary carrier sheet 2, the so called primary backing, which is a woven polyester backing. The polyester yarns 5 extend from the first surface 3 of this first sheet and are sealed to the second surface 4 of the sheet using the yarn melting method as described with reference to figure 2. The weight of this primary sheet is typically about 400-700 g per m^2 (including tufted yarns). In order to provide sufficient mechanical stability for use as an end product such as a carpet tile, the product 1 comprises a primary backing sheet 6, in this case a polyester needle felt backing. The weight of this second sheet is typically about 500-1000 g/m^2. In between the first and second backing is an optional resilient layer 10 (which could for example be a polyester expansion fleece having a weight of 330 g/m^2, obtainable from TWE, Emsdetten, Germany as Abstandsvliesstof). The three layers (first and second backing and intermediate layer) are laminated together using a glue, which may be a polyester hot melt glue as obtainable from DSM, Geleen, the Netherlands, applied as layers 11 and 12 at a weight of about 300 g/m^2.

Figure 2

Figure 2 schematically shows details of a textile manufacturing process according to the invention. In particular, figure 2 shows the process step wherein the binding layer is created for fastening the yarns to the web (the so called fibre-binding step). In the configuration shown in Figure 2 a rigid curved heating plate 500 is present. In this embodiment the plate is an aluminium plate having a radius of 0.37 meter, a length of 40 cm (in the process direction) and a thickness of 1 cm. The plate is provided with two sided heating by having external canals 501, 501', 502 and 502', which feed a hot oil of 295°C in opposite directions. The oil is heated in heating bath 503, pumped to the plate and returned to the heating bath 503 after circulation through the volume of the plate (conduits external of the plate towards and from the heating bath are not shown in figure 2). The heated outer circumferential (convex) surface 510 of this plate 500 is brought in contact with a textile product to be processed, of which product the first sheet 2 (the so-called primary carrier), which in this case is a woven sheet provided with pile yarns applied via a tufting process, is shown. The first sheet is transported face up such that the pile is directed away from the heating plate 500. In operation, the heating plate is stationary and the product is transported relative to the plate in a

direction from entrance 301 to sensor 300.

At about 0.5 meters before the entrance 301 of the heating process a bowed roller 303 is present to guide the sheet (in the form of a continuous web with a width of about 4 meters and a length of about 200 meters) towards the curved heating plate 500. In this particular embodiment the bowed roller is a steel roller provided with a rubber sleeve. The diameter of the roller is 190 mm, and its length is 4400 mm. The height of the arc of the roller is 60 mm. The roller can be spatially configured between two positions. The first one wherein that the arc extends in vertical direction (at 90° with respect to the web) and the second one wherein the arc extends in horizontal direction (at 0° with respect to the web). During the fibre-binding process the spatial configuration is such that the arc extends at an angle between 0 and 90°, typically between 20 and 90°, with respect to the running web. The sheet 2 enters the heating process at position 301. The height of the entrance depends on the vertical position of bowed roller 303. The roller is displaceable in vertical direction, indicated by double arrow A. This way, the contact length between the plate and the sheet can be varied. At the lowermost position of the roller 303, the contact length is at maximum (i.e. the complete length of the curved plate 500), at the highest position of the roller 303, the contact length is at minimum (in this case about one third of the length of the plate 500). At the end of the plate, the sheet 2 is guided by roller 302 towards a calendering nip that consists of cold stationary bar 305 and roller 306. The temperature of the cold bar and roller (which are controlled via CPU 320) is such that the product, in the nip, will have a temperature between the Tg (glass transition temperature) and Tm (melting temperature) of the polymer material in the binding layer. This nip can be used to effect an additional calendering action on the textile product, or actually, the back of the textile product.

The position of the bowed roller 303, the heat of the heating bath 503 and the pressure and temperature of the calendering nip (305, 306) are controlled with CPU (central processing unit) 320. This unit controls these various parts using *i.a.* surface roughness data of the back of the textile product as measured by sensor 300. For this, the sensor is connected to the CPU via line 315. The bath 503, the vertical positioning means of the bowed roller 303 and the calendering nip (305, 306) are connected to the CPU via lines 316, 317 and 318 respectively.

The (intermediate) textile product to be processed with the above described

configuration may consist of a woven primary sheet provided with a cut pile of polyester yarns, tufted into the sheet. The yarns typically have a melting temperature of about 260-280°C. This product is processed using a temperature of the heating element 500 of 285-300°C in order to heat the product. The product, having a width of about 4 meters, corresponding to a width of 4.20 meters of the curved heating element 500, is supplied at a speed of 2 metres per minute or higher. Due to the curved constitution, the pressure with which the product is pulled onto the heating element is about is 1.25 Newton per square centimeter. This way, the loops of the yarns at the second surface of the primary carrier sheet are partly molten to provide a binding material and mechanically spread over the second surface to form a semi-continuous layer of molten material that locks the yarns into the first sheet. Depending i.a. on the temperature of the heating elements, the vertical position of the bowed roller 303 and the use of the calendering nip, this will result in a second surface having a more or less smoothed surface with some noticeable surface texture.

Downstream (distal) of the curved heating plate 500, at a section where the molten material of the binding layer will be sufficiently solidified, directed to the second surface of the product 2, is an optical surface roughness measurement sensor 300. With this sensor the 2D surface roughness of the second surface can be measured and data corresponding to this surface roughness are send to CPU 320 via line 315. In this CPU, the actual surface roughness data are compared to predetermined values. If the data match these values, no adaptation of the manufacturing process will follow. If however the data indicate that the roughness is either too small (surface too smooth) or too large (surface too rough), the contact length between the product and the plate may be adapted. Also the heating temperatures of the oil may be adjusted by adapting the flow rate of the oil through the plate, or the action of the calendering nip may be adapted in order for a next section of product to meet the predetermined surface roughness data. Further downstream is a second bowed roller 303' to further guide the processed web, in this case to a laminating station. This is shown in detail with reference to figure 3.

Figure 3

Figure 3 schematically shows a laminating station 400 for use in the present invention. The basic parts of the station consist of laminating rollers 401 and 402. These rollers form a nip wherein two separate layers, both typically conveyed to the nip in the form of a web, are laminated together, in this case using a hot melt adhesive 12 (see figure 1).

The primary carrier sheet 2 enters the laminating station 400 while being guided with its upper (pile) surface 3 over a bowed roller 303' (see figure 2). The transport distance from this roller to the laminating nip, i.e. the length from the bowed roller to the laminating nip measured along the web 2, in this case is about 1.8 meters. Between the bowed roller 303'and the roller laminating 401 is an additional guide roller 405 positioned against the back of sheet 2. Right before entry of the laminating nip, the back side of the sheet 2 passes station 600, at which station polymer glue 12 is metered via rollers 601 and 602 to the back of sheet 2 as a thin layer at about 300g/m^2. The tension in web 2 is typically between 600 and 3000 N, in this embodiment about 1000 N. Also entering the laminating nip is secondary backing sheet 6 (see figure 1) which enters the nip by guidance over roller 406 (which roller is optionally a bowed roller). The tension in web 6 is typically between 200 and 600 N, in this embodiment about 400 N. Both sheets pass the nip while being laminated to each other to form carpet product 1. This product is guided to a further process station (not shown) over bowed roller 303".

Example 1

This example describes two carpet products (product A and product B) which can be made using a process according to the invention, in particular using the machine set-up as described in conjunction with figure 2 and the laminating configuration as described in conjunction with figure 3.

In this embodiment both products are based on a primary backing made from woven polymer tape. In this backing the warp yarns, which are made of a 1.0 mm wide polyester tape of 42 Tex, are woven at 112 yarns per 10 cm. The weft yarns, made of a 2.0 mm wide polyester tape of 86 Tex, are woven at 59 yarns per 10 cm. This results in a woven sheet having a very low weight of about 100 g/m^2, relatively inexpensive to produce, and which is stable enough for mechanical handling and guidance over rollers. Both carpet products having polyamide yarns tufted therein. These yarns from loops at the back of the primary backing and a pile on the front of the backing in line with what is shown in figure 1. The second one of the carpet products (product B) has an additional layer of meltable polymer fibres at the back of the primary backing. For this, before the polyamide yarns are stitched into the backing, the back surface of this backing is covered with a thin felted fibrous layer. This layer is made by covering the back surface of the primary backing with 5 dTex fibres having a length of about 50 mm, 70% of the fibres being of polyamide (T_m about 220°C) and 30% of the fibres being of a

low melting polyester (T_m about 230°C). The fibres are provided in an amount of about 45 g/m^2. This layer is needle-felted to the primary backing, thereby forming in fact a dual layer primary backing.

Both intermediate products are subjected to the fibre-binding process as described with reference to figure 2. The heat of the plate, together with the fact that the back of the primary backing is pressed against the plate while being fed there along, leads to the (at least partial) melting of the loops of the yarns at the back, and thus to the provision of a binding layer of molten polymer material. For product B, the at least partial melting of the additional felted layer porous layer, leads to additional material available for this binding layer. The molten material is spread and smoothed out over the back of the primary backing due to the fact that the heated plate is stationary with respect to the web that is being transported over the plate. This ultimately results in a binding layer that is able to firmly secure the yarns at the back of the primary backing. Thereafter the products are laminated with a secondary backing in a laminating station such as the one described in conjunction with figure 3, in order to provide additional mechanical stability. In this embodiment the secondary backing is a polyester needle felt backing fleece obtained as Qualitex Nadelvlies from TWE, Emsdetten, Germany, having a weight of about 500 g/m^2. The sheets are laminated to each other using a polyester hot melt glue from DSM, Geleen, the Netherlands, at a weight of about 300 g/m^2.

The textile products were firstly subjected to a tuft bind test according to ASTM D1335-12 (“Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings”). The resulting tuft bind was 24,9 N for the textile product incorporating the felted layer and 17,9 N for the textile product without the additional felted layer. After that, the products were subjected to a delamination test according to ASTM D3969-05 (“Standard Test Method for Resistance to Delamination of the Secondary backing of Pile Yarn Floor Covering”). It appeared that the delamination strength for the textile product incorporating the felted layer was 80-100 N, with peaks between 124-138 N. For the textile product without the felted layer these figures were 20 N and 32-52 N respectively, which is lower but still sufficient to meet practical requirements for laminated carpet products.

CLAIMS

1. A method to continuously produce a laminated textile product comprising a primary carrier sheet with yarns that form a pile on the front surface thereof, and a secondary carrier sheet attached to the back surface of the primary carrier sheet, the method comprising:
   - providing the primary carrier sheet with the yarns as a first continuous web,
   - providing the secondary sheet as a corresponding second continuous web,
   - transporting the first and second web to a laminating station where the two webs are laminated to each other, wherein the first web is guided over a roller adjacent the laminating station, the roller being in contact with the pile,

   characterised in that the roller is a first bowed roller and that the transport distance between the bowed roller and the laminating station is less than 4 meters.

2. A method according to claim 1, characterised in that the transport distance between the first bowed roller and the laminating station is less than 2 meters.

3. A method according to claim 2, characterised in that the transport distance between the first bowed roller and the laminating station is between 0.1 and 2 meters.

4. A method according to any of the preceding claims, characterised in that the pile has a height larger than 0.5 cm, in particular larger than 1 cm.

5. A method according to any of the preceding claims, characterised in that downstream of the laminating station the laminated product is transported over a second bowed roller.

6. A method according to any of the preceding claims, characterised in that the first and/or second bowed roller have an adjustable arc.

7. Use of a textile product obtainable according to any of the claims 1 to 6 to cover a surface of a building or any other artificial or natural construction.

8. A device for use in continuously producing a laminated textile product comprising a primary carrier sheet with yarns that form a pile on the front surface thereof, and a secondary carrier sheet attached to the back surface of the primary carrier sheet, the device comprising:
   - a laminating station for laminating two web materials together,
   - transporting means for transporting the primary carrier sheet with the yarns as a first continuous web to the laminating station, wherein the transport means comprises a roller adjacent to the laminating station, the roller being in contact with the pile,
   - further transporting means for transporting the secondary sheet as a corresponding second continuous web to the laminating station,

   characterised in that the roller is a bowed roller and has transport distance of less than 4 meters with respect to the laminating station.

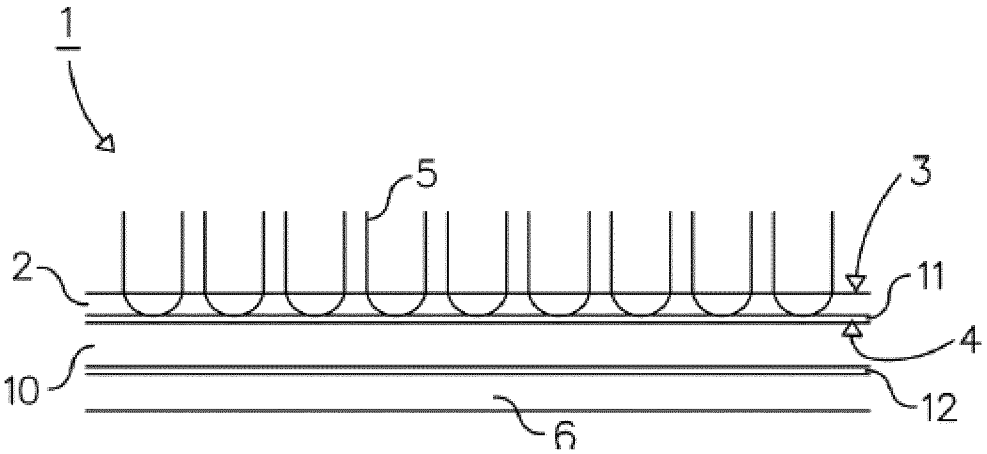

FIG. 1

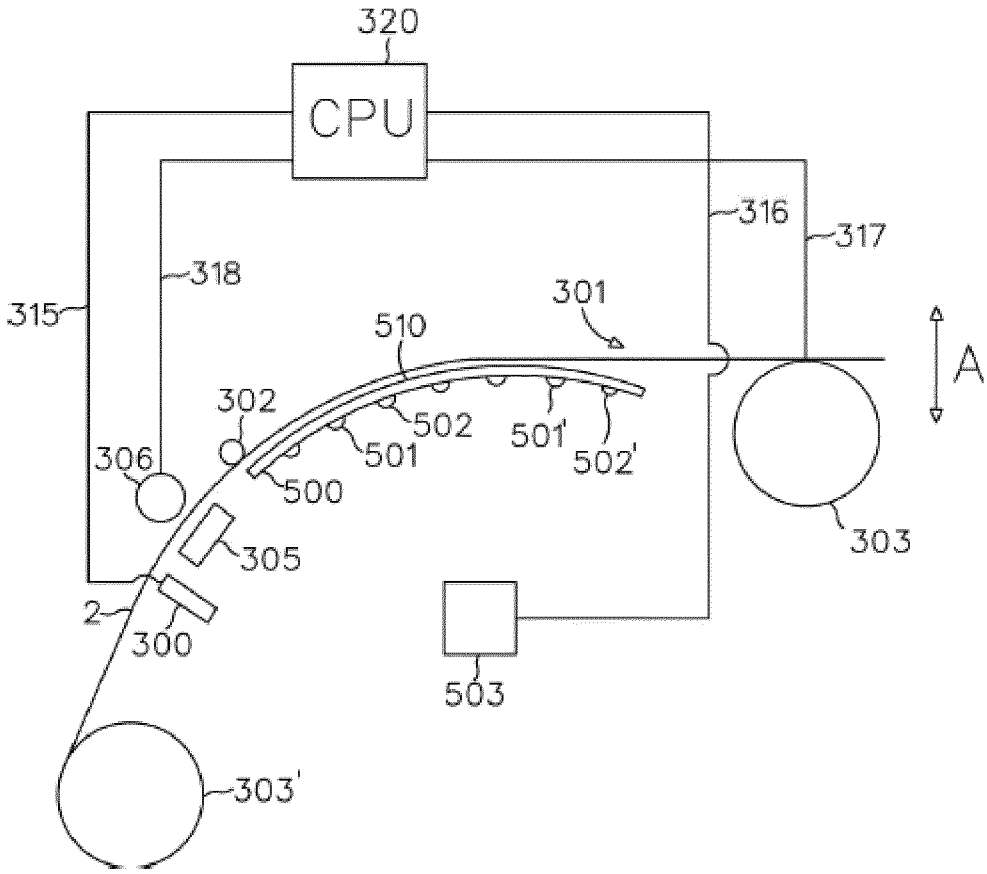
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FIG. 2

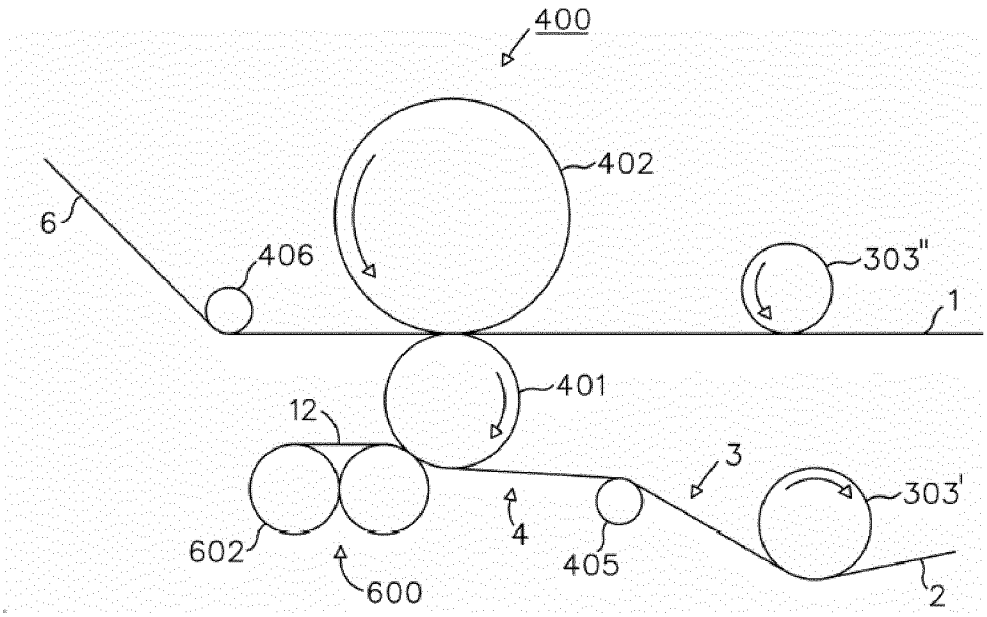

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/052692

A. CLASSIFICATION OF SUBJECT MATTER
INV. B32B38/18 B32B41/00
ADD. D06N7/00

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)
B32B D06N

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 150 024 A (PENMAN HURL W) 22 September 1964 (1964-09-22)	7
Y	column 1, line 11 - line 13 figures 1,4,5,12 column 2, line 72 - column 3, line 1	1-6,8

Y	R Duane Smith: "Guidelines for Rolls Used in Web Handling", AIMCAL Europe, 31 December 2012 (2012-12-31), XP055286853, Retrieved from the Internet: URL:http://www.aimcal.org/uploads/4/6/6/9/46695933/smith_-_guidelines_for_rolls_used_in_web_handling_-_presentation.pdf [retrieved on 2016-07-11] pages 39,62	1-6,8
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"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

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Date of the actual completion of the international search	Date of mailing of the international search report
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