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(54) ZONED STRETCHING OF A WEB

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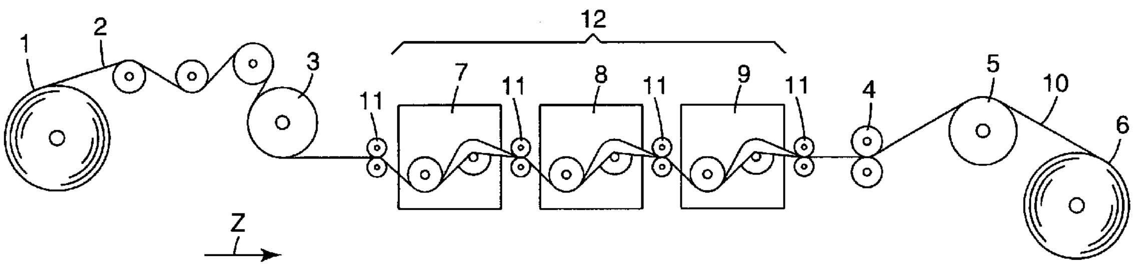
(57) ABSTRACT

An apparatus and methods for stretching one or more zones of an anisotropic web and anisotropic webs including one or more stretched zones is provided. Each of the stretched zones in the web is stretched in the cross-web direction, i.e., the direction transverse to the down-web direction. The stretching can be performed continuously as the web is advancing through the apparatus in the down-web direction. The method for stretching an extensible web in the cross direction generally is practiced on a substantially continuous, extensible anisotropic web. The cross web stretching occurs in an orientation zone established by an orientation unit. The orientation unit moves the web out of the plane of the web where the web is under tension, but without any side restraints. The web moves over the orientation unit where the degree of orientation is proportional to the cross direction displacement of a portion of the web by the orientation unit. The anisotropic web has a tensile strength in the downweb direction greater than the cross direction such that the web is preferentially displaced in the cross web direction by the orientation unit. This can be a downweb direction tensile strength at least 50 percent greater than the cross web direction.



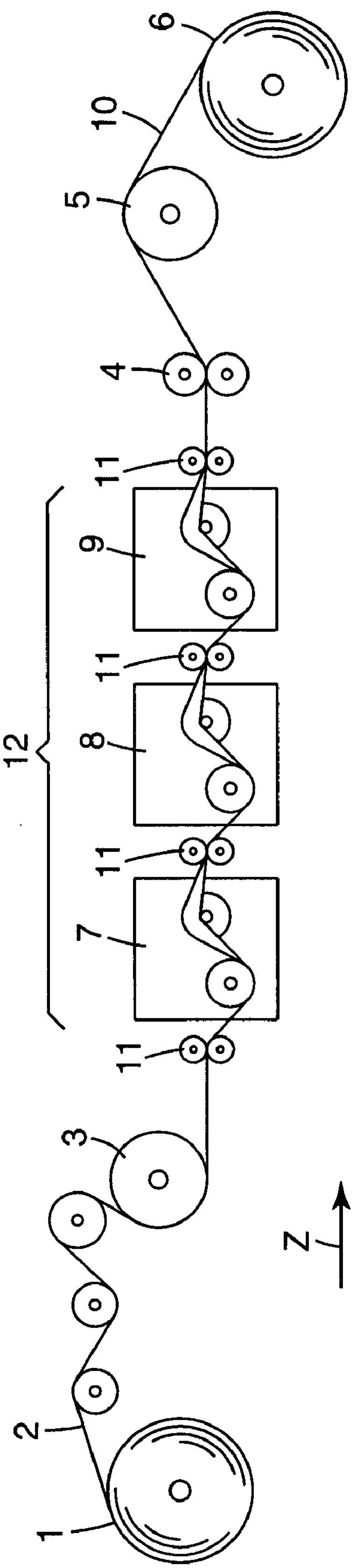


Fig. 1

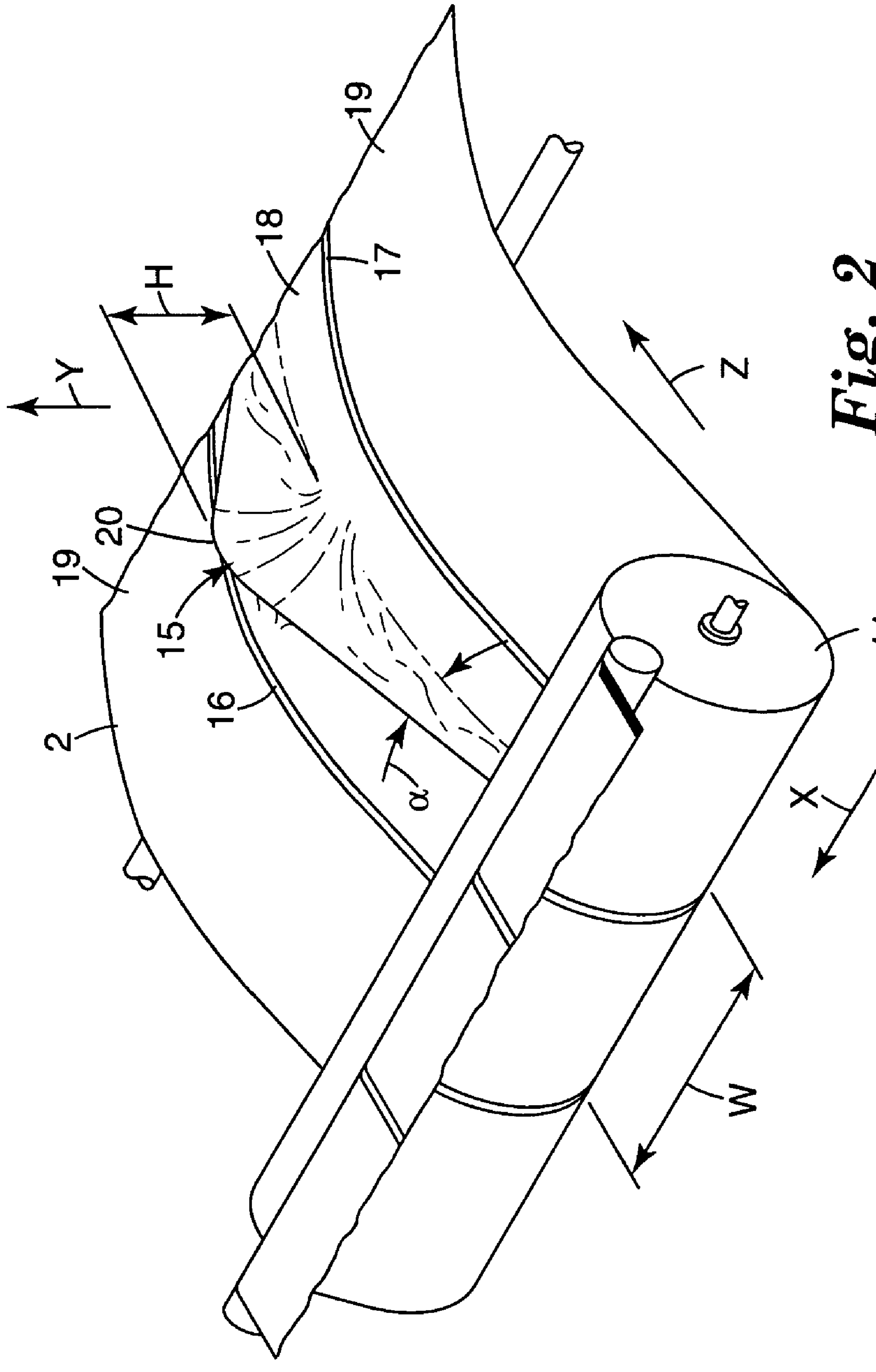


Fig. 2

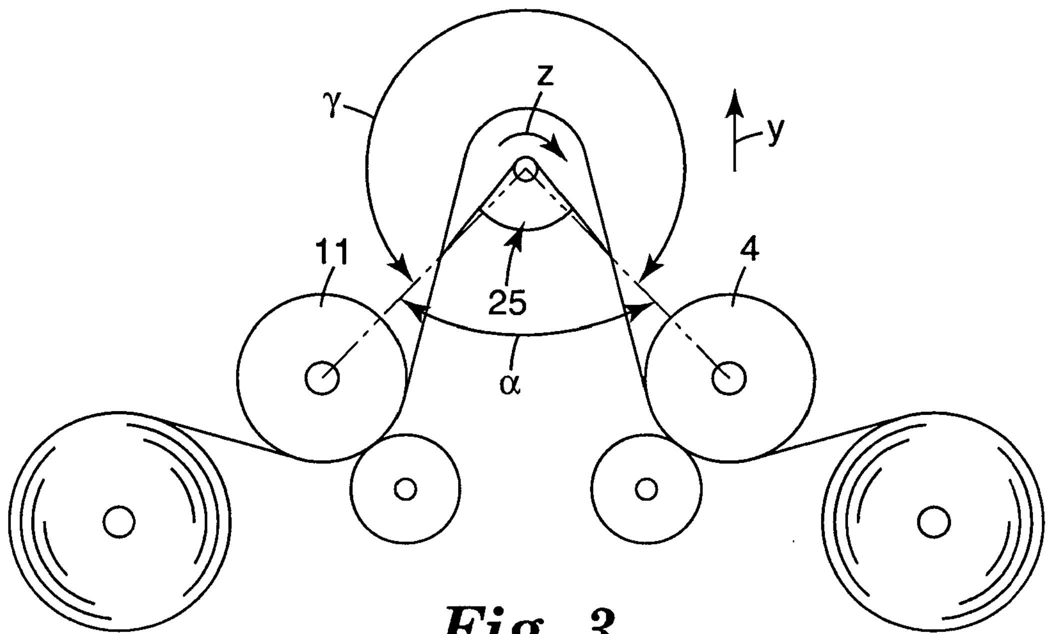


Fig. 3

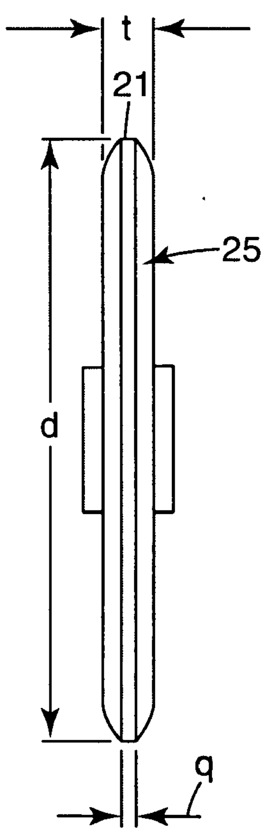


Fig. 4

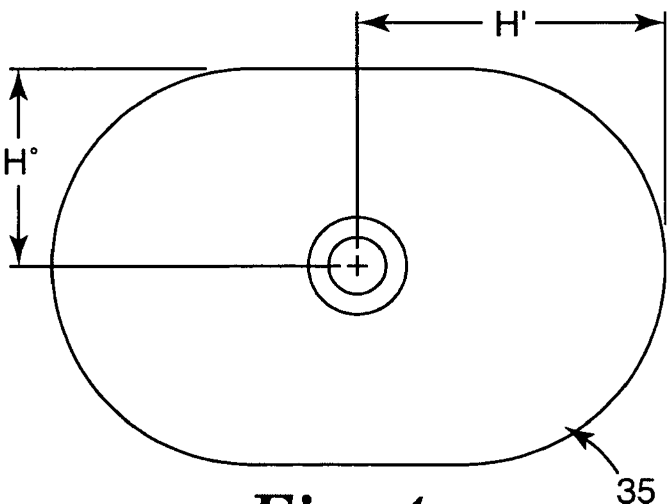


Fig. 4a

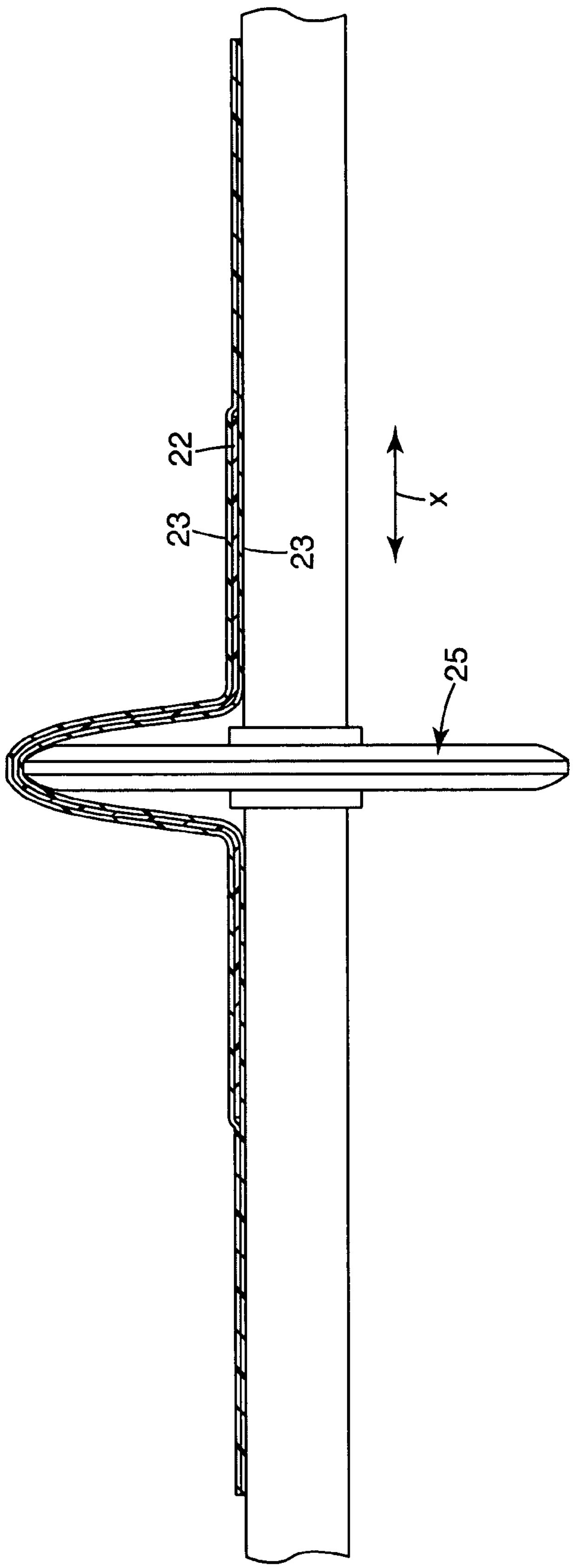


Fig. 5

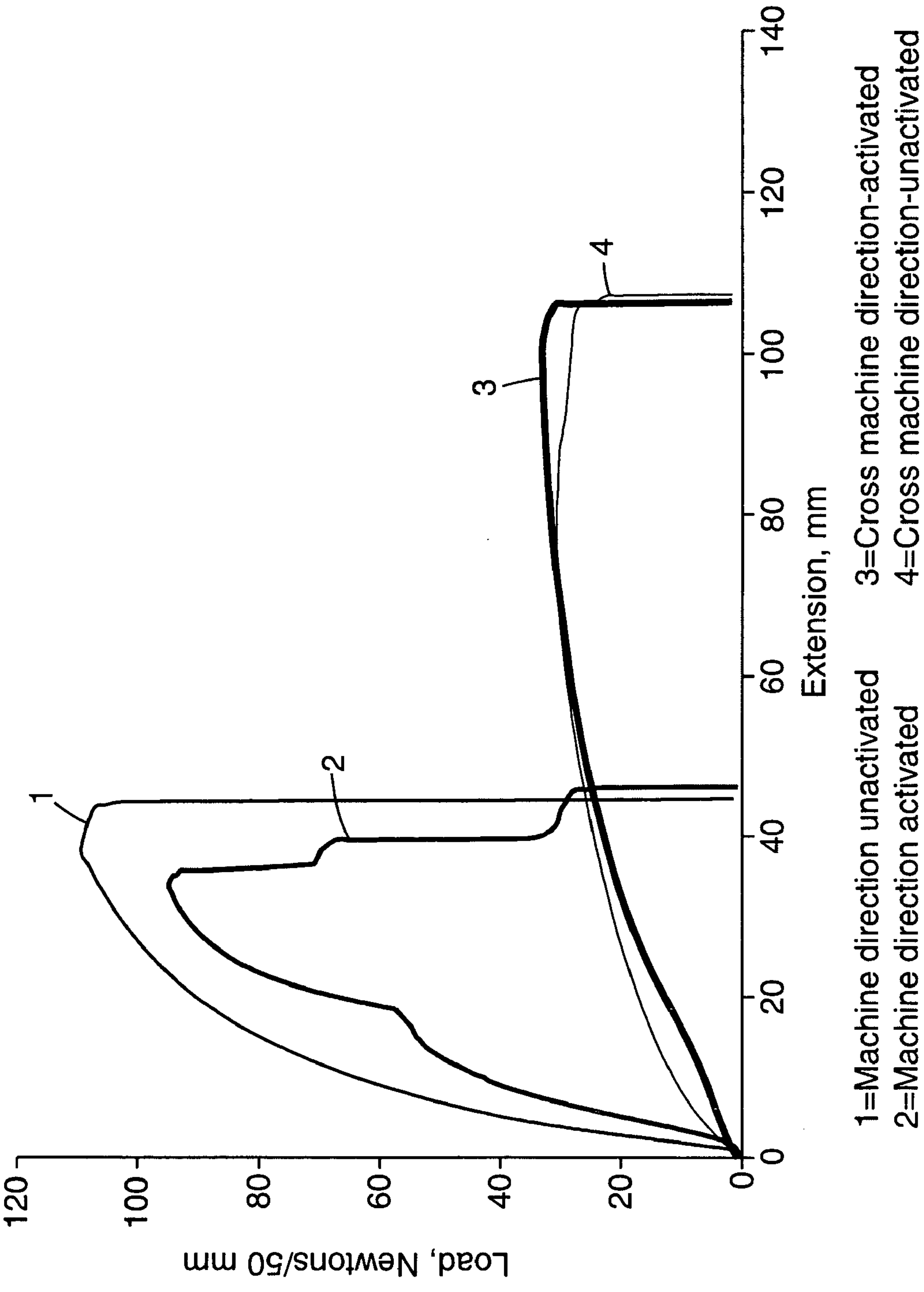
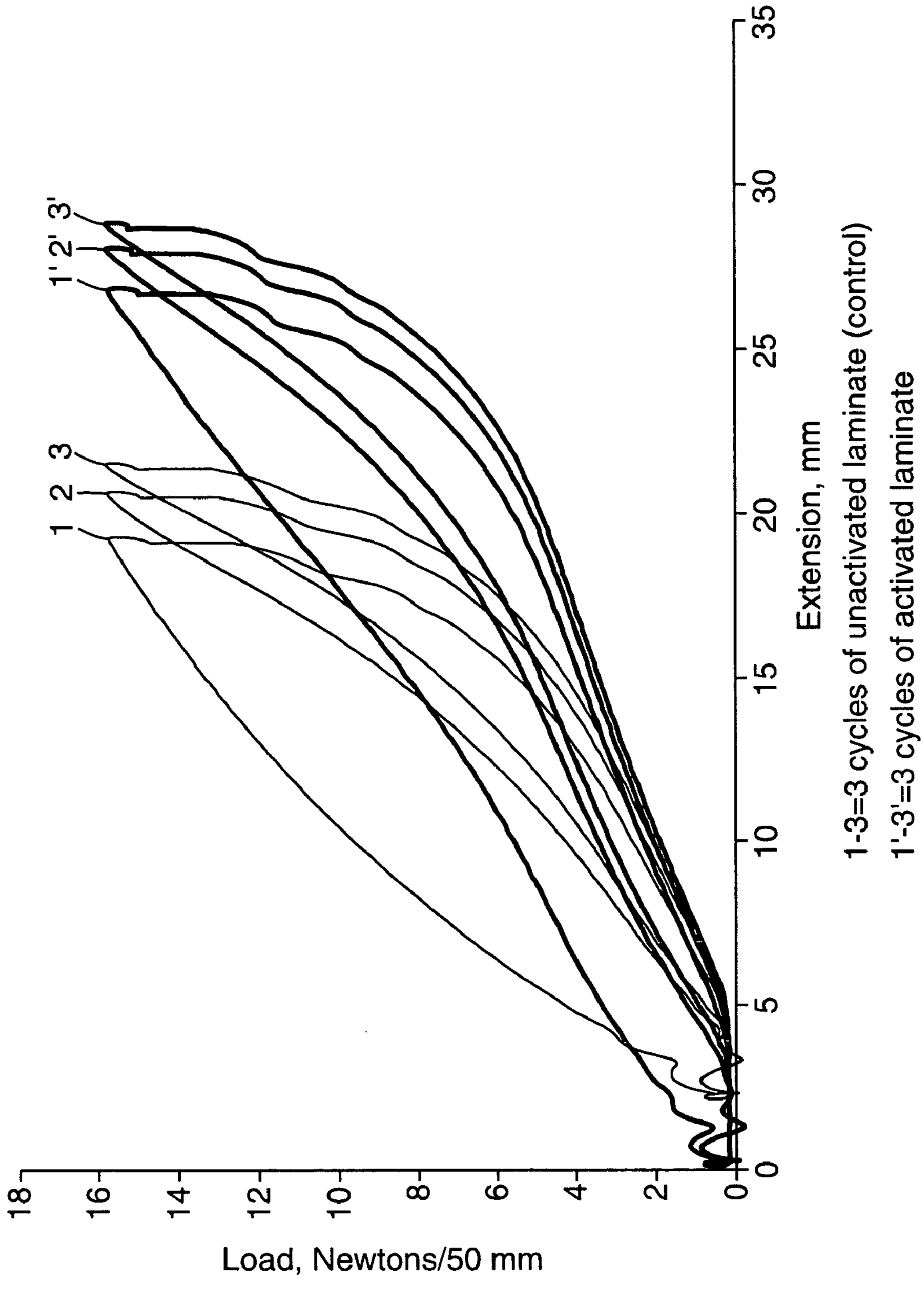

Load, Newtons/50 mm
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
Extension, mm
1
2
3
4
1=Machine direction unactivated
2=Machine direction activated
3=Cross machine direction-activated
4=Cross machine direction-unactivated

Fig. 6a



Load, Newtons/50 mm
0
2
4
6
8
10
12
14
16
18
Extension, mm
0
5
10
15
20
25
30
35
1
2
3
1'
2'
3'
1-3=3 cycles of unactivated laminate (control)
1'-3'=3 cycles of activated laminate

Fig. 6b

ZONED STRETCHING OF A WEB

FIELD OF THE INVENTION

[0001] The present invention relates to the field of webs, web processing methods, and web processing apparatus. More particularly, the present invention provides apparatus and methods for stretching one or more zones of a web in the cross-web direction and webs so stretched.

BACKGROUND

[0002] It is desirable in many instances to stretch a web in the cross-web direction during processing. For example, webs including layers of inelastic materials, e.g., nonwoven webs, laminated or otherwise attached to elastic layers while the elastic is not extended typically require stretching to impart elasticity to the web. The web is stretched so that the inelastic layers, or bonds within the inelastic layer or layers, are broken or otherwise disrupted allowing the elastic to freely stretch which leaves the stretched web laminate elastic. Such stretching to impart elasticity to a web is commonly referred to as "activation" of the web (with the elasticity of the web being "activated" by the stretching). Activation can be done in the machine direction of the web or the cross direction of the web or both. Cross direction stretching or activation can be performed by a variety of known methods including, for example, tentering and ring rolling.

[0003] Tentering typically involves grasping the edges of a web and stretching the web in the cross-web direction while advancing the web in the down-web direction (i.e., along the length of the web). Although tentering does provide the ability to vary the amount of strain induced in the web, it also suffers from a number of disadvantages. For example, the edges of the web must often be discarded after tentering due to damage or inconsistent strain in the web at the edges. Another potential disadvantage is that it may be difficult or impossible to induce strain into selected portions or zones of a web using tentering. Further, tentering equipment can be both costly, complex, and may require significant amounts of floor space to operate as the web expands in the cross direction during the process.

[0004] Ring rolling is an alternative to tentering for stretching a web in the cross direction. Various ring rolling apparatus are described in, e.g., U.S. Pat. No. 4,223,059 (Schwarz); U.S. Pat. No. 4,968,313 (Sabee); U.S. Pat. No. 5,143,679 (Weber et al.); U.S. Pat. No. 5,156,793 (Buell et al.); and U.S. Pat. No. 5,167,897 (Weber). Ring rolling or incremental stretching refers generally to placing the web between rolls having interengaging teeth. The engaging teeth stretch the web based generally on the size, number and pitch of the teeth. Ring rolling can be used to stretch selected zones in a web and stretch only in the cross direction. However ring rolling teeth grip the web and this contact of the web by the ring rolling apparatus can tear the web and undesirably affect the web's appearance. The amount of strain that can be induced in a web using ring rolling is limited by the specific ring rolls used. Adjustment or change in the degree of stretch requires new ring rolls to be machined. This is of course costly and inflexible.

SUMMARY OF THE INVENTION

[0005] The present invention provides apparatus and methods for stretching one or more zones of an anisotropic web and anisotropic webs including one or more stretched zones. Each of the stretched zones in the web is stretched in the cross-web direction, i.e., the direction transverse to the down-web direction. The stretching can be performed continuously as the web is advancing through the apparatus in the down-web direction.

[0006] The method for stretching an extensible web in the cross direction generally is practiced on a substantially continuous, extensible anisotropic web. The web is traveling in a downweb direction at a first speed under tension in the web plane. The extensible anisotropic web has a width and substantially continuous length in the downweb direction. The cross web stretching occurs in an orientation zone established by an orientation unit. The orientation unit moves the web out of the plane of the web where the web is under tension, but without any side restraints. The web moves over the orientation unit where the degree of orientation is proportional to the cross direction displacement of a portion of the web by the orientation unit. The anisotropic web has a tensile strength in the downweb direction greater than the cross direction such that the web is preferentially displaced in the cross web direction by the orientation unit. This can be a downweb direction tensile strength at least 50 percent greater than the cross web direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] **FIG. 1** is a schematic view of an apparatus for performing the invention method of producing the invention webs.

[0008] **FIG. 2** is a perspective view of an orientation zone of the present invention.

[0009] **FIG. 3** is a side schematic view of an apparatus for performing the invention method of producing the invention webs.

[0010] **FIG. 4** is an end view of an orientation diversion wheel used in the **FIGS. 3 and 5** orientation units.

[0011] **FIG. 4*a*** is a side view of an alternative diversion wheel.

[0012] **FIG. 5** is an end view of an orientation unit diversion device of the invention.

[0013] **FIG. 6*a*** is a graph showing the tensile to break of activated and unactivated webs in machine direction and cross machine direction.

[0014] **FIG. 6*b*** is a graph showing the hysteresis properties of activated and unactivated webs.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] As shown in **FIG. 1**, web **2** is unwound from a supply source **1** which can be a roll of web material. The web **2** tension is maintained between idler roll **3** and driven rollers **4**, which establishes the speed of the web **2** through the orientation apparatus **12**. Orientation apparatus **12** can include one or more orientation units **7**, **8**, and/or **9**. Nip rolls **11** can be used at various locations to ensure that the web maintains a desired flat profile and desired tension into and out of the orientation apparatus **12** or between individual orientation units **7**, **8**, and/or **9**. The zone oriented web **10** is then taken over idler rolls **5**, if needed, and collected in a suitable form, such as on a roll **6**. Generally in the above process, the web is traveling in a downweb direction (z) at a first speed. The stretching occurs in orientation zones established by the orientation units.

[**0016**] As shown in **FIG. 2**, there can be one, or more, orientation zones **18** formed relative to the web in the cross direction (x). Each orientation zone **18** is formed by orientation units **15** in cooperation with the web being oriented. Each of these orientation zones **18** on the web **2** could be the same or different, and there could be different degrees of orientation within the zones **18**. The zones could also have a discrete location where orientation levels rapidly drop or the orientation could gradually taper to zero. This depends on the orientation unit and the properties of the web being oriented. Orientation zones could also be arranged downweb of each other in either an overlapping or nonoverlapping relationship. By overlapping it is meant that the two downweb spaced orientation units activate to some significant extent the same crossweb (x-direction) orientation zone or region of the web sequentially. Overlapping units operating on the same orientation zone **18** would allow additional orientation to be imparted to specific regions, for example at steadily increasing orientation levels to provide for a gentler incremental stretching of a specific zone or region in the web.

[**0017**] As shown in **FIG. 2 a** single orientation unit **15** preferentially orients within orientation zone **18**, where zones **19** are areas where preferably (but not necessarily) little or no orientation occurs. Although the transition between zones **18** and **19** is shown as fairly sharp it should be understood that this could be a gradual transition. The nonpreferentually activated zones **19** are generally where less than 50 percent orientation occurs, preferably less than 10 percent. To help isolate the orientation to a discrete orientation zones **18** (having a width W), in the embodiment shown in **FIG. 2** strengthened zones **16** and **17** are provided. These strengthened zones are characterized in that they have a higher downweb (direction Z) tensile strength than the rest of the web **2** within orientation zone **18**. This higher downweb tensile strength in strengthened zones **16** and **17** could be 100 percent higher or 200 percent higher or 300 percent higher than in the region between two adjacent strengthened zones. The higher strength zones **16** and **17** could be provided by selectively calendaring the web in these zones (under heat and or pressure), laminating additional materials in these zones, folding the web in these zones, coating the webs in these zones, or other like methods. These strengthened zones will tend to isolate the orientation to the orientation zone **18** bounded by these strengthened zones. With higher strength strengthened zones this isolation effect generally increases when coupled with higher tensions being applied to the web **2** in the downweb direction Z.

[**0018**] Generally the orientation provided by the orientation units **15** is created preferentially in the cross web direction by the overall anisotropic strength behavior of the web being oriented and without any longitudinal side restraints holding the web on either side of the orientation zone while the web is in the orientation unit. This anisotropic strength can be due to strengthening zones, as described above, or by providing the web, or one or more layers forming the web with anisotropic strength properties such as a strength in the downweb direction at least 50% greater than the cross web direction or greater than 100% or 200%. The web **2** being treated, generally has a significantly higher overall strength in the downweb direction Z than in the crossweb direction X. This tends to isolate the orientation induced by the orientation units **15** in the cross web or X direction orientation.

[**0019**] The overall anisotropic strength behavior of the web can be created for example by an anisotropic nonwoven web or layer where the fibers are preferentially oriented in the downweb direction. This could also be created by a film or film layer that has induced orientation in the downweb direction, which could be melt induced orientation or subsequent elongational orientation created by stretching the film. Elongational orientation can be used with other types of web or web layers as well. Anisotropic fibrous webs are described, for example, in U.S. Pat. No. 5,393,599, the substance of which is incorporated by reference in its entirety, where fibers are laid down in a carding machine to create a high ratio of fibers extending in the machine direction verses the cross direction. The webs described have a tensile strength ratio of at least 4/1 and up to at least 6/1 or higher. This web can then be joined to an elastic web, which could be a nonwoven elastic, a elastic net or a elastic film by hydroentangling, adhesives, heat bonding, ultrasonic bonding, extrusion bonding or the like. This laminate could then be joined to other layers such as a nonanisotropic nonwovens, films or the like and still have preferential strength properties in the machine direction. Spunbond webs can also be made anisotropic, for example by drawing the web in the machine direction during or after web formation or by directing the fibers downweb during web formation by use of the directionality of the spinning device, directional air streams or the orientation and speed of the forming wire, for example. Anisotropic melt blown webs can be formed, for example, as described in U.S. Pat. No. 5,366,793 by preferentially directing the stream of meltblown fibers at an angle to the forming surface or deflecting the stream of fibers relative to the forming surface. These anisotropic nonwoven webs could be directly formed onto other webs or films to directly form a multilayer anisotropic laminate. Anisotropic films can be formed directly in, for example, the melt as described in U.S. Pat. No. 6,270,910, the substance of which is incorporated by reference in its entirety. In this patent anisotropic behavior is created by use of a discontinuous phase of a higher strength material in a continuous phase. The discontinuous phase is aligned in the machine direction by melt shear forces in the extrusion device and/or by post formation stretching. This technique can also be used with co-extruded films or films having included continuous higher strength phases or layers such as described, for example, in U.S. Pat. Nos. 5,501,675; 5,462,708; 5,354,597 or 5,344,691, the disclosures of which are incorporated by reference in their entirety. In this case if an elastic layer or phase is included in the film, higher strength in the machine direction could be enhanced by stretching the film in the machine direction. If the film has a continuous elastic layer, heat treating the stretched film can be used to relax the elastic material, but retaining the orientation within the elongationally oriented inelastic material phase or layer. This would result in a film with elastic properties in the cross direction but high strength properties in the machine direction.

[**0020**] The orientation unit **15** has a web diversion device **25** shown in **FIG. 3**, which has a profile that directs the web **2** out of a webpath, in which the web is under tension, in the

Y direction. The webpath need not be straight but could be any form and could wrap around the diversion device. The degree of diversion from the overall webpath generally determines the amount of cross directional stretch that can occur. However the duration of the diversion and its rate of change from no diversion to the end diversion (H) also can affect the orientation effect. If the overall degree of diversion (H) is too high however there will be greater risk of downweb orientation (Z direction) of the web and increased risk that the web might break or suffer damage. The diversion unit can have a profile or create a diversion path that generally gradually increases to an apex **20** to help decrease the strain rate and providing for gentler orientation. This diversion device profile or diversion path increase could have an incline angle α of from 1 to 90 degrees, but space limitations would generally keep this incline angle at from 5 to 80 degrees, or 20 to 50 degrees.

[0021] The diversion device could be any shape or form and could be, for example, a ramp having a gradual increase to an apex. This ramp could be a solid stationary tool or be formed by one or more discrete elements, wheels, rollers or the like. The diversion device could also be provided as one or more adjacent units, which could be integral or mechanically isolated units.

[0022] The wheel type diversion device **25**, shown in **FIGS. 2-5**, can rotate in a preferred embodiment, but could also be stationary. The wheel **25** could have a land as shown in **FIGS. 4 and 5**, or could have a profile in the X direction. The edge **21** of the wheel in contact with the web preferably is rounded to avoid sharp edges tearing the web. With a wheel type diversion device, the web material will wrap around the wheel over some area. This wrap (γ) is determined by the direction of the web being fed onto the wheel, which is determined by the position of the nip rolls **11** or feed rolls from which the web is fed into the diversion device as well as the take-up rolls onto which the oriented web is fed. This wrap could be from 5 to 300 degrees or 10 to 90 degrees. As shown in **FIG. 3**, the web path z is determined by the diversion device position, which could be out of plane with the nip rolls **11** and/or the roll **4**. The nip rolls **11** (or a driven roll), the diversion device **25** and the roll **4** could be generally aligned as shown in **FIG. 3** to form an angle (α) of from 1 to 180 degrees or 30 to 180 degrees. With a smaller angle (α) there will be a higher degree of wrap of the web **2** around the wheel type diversion device **25**. The height (H) of the apex **20** of the diversion device over the web path could be any value as long as it allows for diversion of the web but generally would be from 1 to 100 cm, or from 5 to 20 cm, which determines the degree of diversion.

[0023] **FIG. 4***a* shows an alternative embodiment of a diversion device wheel **35**, where the wheel is noncircular to create regions that have high degrees of diversion H' and low degrees of diversion H° to allow for variable degrees of cross web orientation of the web in the downweb direction in a single orientation zone. This effect could also be created by eccentrically mounted wheels.

[0024] The extensible web is in a preferred embodiment a laminate of an elastically extensible web **22** and one or more relatively inelastic web **23** as shown in **FIG. 5**. In this case the orientation apparatus and methods of the present invention can be used to "activate" zones in a web such that the activated zones exhibit preferential cross direction elasticity after activation. Activation is stretching a web such that inelastic layers, or bonds within the inelastic layer or layers, are broken or otherwise disrupted, thereby leaving the stretched portion of the web elastic due to, e.g., the elastic materials or layers located within the laminate, which recover after the activation stretching. The inelastic layer or layers which are now broken or otherwise disrupted do not provide significant resistance to subsequent elastic extensions of the web. As used herein, an inelastic zone in a web is "activated" if it has been stretched such that, after stretching, the stretched zone of the web exhibits at least some elastic behavior. By elastic behavior, it is meant that, after stretching of an activated zone, the activated zone returns at least in part to its relaxed dimension in the absence of any constraining forces.

[0025] An orientation unit used to stretch portions of a web in accordance with the invention can be used in-line with other web processing equipment or easily be placed in an existing multifunctional line such as a diaper line. For example, the orientation unit may be located downstream of an apparatus that may, for example, process a pre-existing web by, e.g., heating, cooling, calendaring, applying materials to an existing web (e.g., laminating a material by heat, ultrasonics, hot melt or pressure sensitive adhesives), etc. In some instances the apparatus may manufacture a web (by, e.g., extrusion, spun-bonding, carding, melt blowing, weaving, laminating a nonwoven or other inelastic web to an elastic web, etc.) that is then directed as is, or in a laminated form, into an orientation unit according to the present invention.

[0026] The orientation unit according to the present invention may also be located upstream of another processing apparatus that acts on the web after portions of the web have been stretched according to the principles of the present invention. For example, apparatus for slitting, perforating, and/or aperturing the web at one or more locations or apparatus for laminating materials to the web (e.g., such as attaching fastener materials such as hooks) die cutting, etc. An orientation unit, in accordance with the invention could easily be placed in an assembly line, such as a diaper assembly line; to specifically orient or activate certain predetermined cross direction zones.

EXAMPLES

[0027] The following examples are provided to enhance understanding of the present invention. The examples are not intended to limit the scope of the invention.

Test Methods

Tensile Strength/Hysteresis:

[0028] The tensile strength and hysteresis properties of the elastic/nonwoven laminates were measured. For tensile strength at break testing, a 50 mm wide by 100 mm long piece of laminate was mounted in a tensile testing machines (INSTRON Model 55R1122, available from Instron Corp.) with the upper and lower jaws 40 mm apart. Line contact jaws were used to minimize slip and breakage in the jaws. The jaws were then separated at a rate of 51 cm/minute until sample breakage occurred. The results are shown in **FIG. 6***a* where each curve represents an average of 2 replicates. **FIG. 6***a* graphically shows the anisotropic character of the laminate. When tested in the machine direction, the sample breaks at high tensile force and low elongation relative to the cross machine direction. For hysteresis properties a 50 mm wide by 100 mm long piece of laminate was mounted in a tensile testing machine (INSTRON Model 55R1122, available from the Instron Corp.) with the upper and lower jaws 40 mm apart. Line contact jaws were used to minimize slip and breakage in the jaws. The jaws were then separated at a rate of 51 cm/minute until a load of 15 Newtons was recorded. The jaws were then held stationary for 1 second after which they returned to the zero elongation position. The jaws were again held stationary for 1 second and then separated at the same rate until a load of 16 Newtons was recorded. The cycle was repeated twice more for a total of 3 cycles. Two (2) replicates were tested with the results shown in **FIG. 6*b***. The unstretched laminate was tested as a control and also the stretched laminate (Example 1) as described below. **FIG. 6*b*** shows that the stretching process resulted in a laminate having significantly higher extension at a given load as evidenced by comparing the curves labeled **1'**, **2'** and **3'** with the curves labeled **1**, **2** and **3**. The stretched material also had a significantly flatter (lower slope) stress-strain (hysteresis) curve than the unstretched material which is a desirable feature for an elastic material in many applications.

Example 1

[0029] An elastic/nonwoven laminate web was prepared using the method disclosed in PCT publication WO 2004/082918.

[0030] A 40 mm diameter twin screw extruder fitted with a gear pump was used to deliver 75 grams/meter^2 of a molten elastomeric polymer blend consisting of a styrene-ethylenebutylene-styrene block copolymer (70%, KRATON G-1657, Kraton Polymers Inc., Houston, Tex.) and ultra low density polyethylene (30%, Engage 8452, Exxon Polymers Inc., Houston, Tex.) at a melt temperature of approximately 246° C. to a die. The die was positioned such that a film of molten polymer was extruded vertically downward into the interface region of a heated doctor blade and a cooled forming roll. The doctor blade was maintained at a temperature of 246° C. and the forming roll was maintained at a temperature of 30° C. by circulating chilled water through the interior of the roll. The doctor blade was held against the forming roll with a pressure of 450 pounds per lineal inch (788 Newtons/lineal cm).

[0031] Approximately 10 cm in width of the exterior surface of the forming roll was chemically etched so as to have a series of elliptically shaped posts arranged around the periphery of the roll. The posts were 1.6 mm wide and spaced 3.2 mm apart circumferentially (downweb) around the roll and 5 mm apart axially (crossweb) along the roll. The height of the posts was 63 microns. The tops (or lands) of the posts were the same height as the non-machined outermost areas of the roll such that when the doctor blade wiped extrudate from the roll, no extrudate was left on the lands of the posts resulting in an apertured polymeric film 10 cm in width. The extrudate was transferred from the forming roll to a lightly bonded high extension carded (HEC) nonwoven polypropylene substrate (Product FPN 332D) with a basis weight of 27 grams/meter^2 and a width of 22 cm from BBA Nonwovens (Simpsonville, S.C.) at a nip formed with a conformable backup roll (a steel core with a rubber cover having a durometer of 75 Shore A). The core of the backup roll was chilled by circulating water at a temperature of 5° C. The pressure exerted on the nip between the forming roll and the backup roll was 14 pounds per lineal inch (25 Newtons/lineal cm). To enhance the bond between the extrudate and the nonwoven, the nonwoven was sprayed in a swirl pattern with a hot melt adhesive (4.5 grams/meter^2, H9388, Bostik, Wauwatosa, Wis.) across the full width (22 cm) of the nonwoven. The 10 cm of extrudate was centered onto the 22 cm wide nonwoven, resulting in approximately 6 cm of outermost edge zones without elastomer. A second layer (22 cm width) of the same type of nonwoven, also sprayed with adhesive, was then laminated to the elastomer side of the previously created laminate using a rubber roll/steel roll nip, resulting in a 3 layer laminate in the middle 10 cm of the web and a 2 layer laminate in the outermost 6 cm of the web.

[0032] The laminate was then stretched in the cross-direction using an apparatus similar to that shown in **FIG. 3**. Rolls **4** and **11** were polyurethane rubber coated steel rolls (30 durometer) 6.3 cm in diameter and 25.4 cm long. The web diversion device was a steel stretching wheel **25**, having a diameter d of 7.6 cm and a thickness t of 6.4 mm mounted on a 1.6 cm shaft as shown in **FIG. 4**. The outermost edge of the wheel was machined as shown in **FIG. 4** with a land 'q' of approximately 3.2 mm. The web was positioned such that the stretching wheel **25** was centered on the elastic containing region of the laminate. Rolls **4** and **11** were driven rolls and wheel **25** rotated based on web tension only. The web **2** was stretched by pulling the web over the wheel **25** using a roll **4** speed of 3.7 meter/min and a roll **11** speed of 3.0 meter/min. The 23% overspeed created a machine direction tension on the web which then translated into a cross-direction force as the web was pulled down over the wheel **25**. The innermost 2.5 cm of web centered on the stretching wheel was stretched approximately 250%. The regions of elastic-containing laminate (approximately 3.8 cm on each side) immediately adjacent to the region that was draped over the stretching wheel did not incur as much tension/force and therefore did not stretch as much.

[0033] As briefly addressed above, the present invention can be used to process any suitable extensible web, including homogenous webs, monolayer webs, multilayer webs and composite webs. This would include assembled articles, which had specific zones or regions that were extensible.

[0034] The preceding specific embodiments are illustrative of the practice of the invention. This invention may be suitably practiced in the absence of any element or item not specifically described in this document. The complete disclosures of all patents, patent applications, and publications are incorporated into this document by reference as if individually incorporated in total.

What is claimed:

1. A method of orienting a web in a cross machine direction comprising, providing an anisotropic web having a width dimension and a substantially continuous length dimension, the web having a strength in the length dimension greater than in the width dimension

placing the web along a downweb web path under tension less than that needed to elongate the web in the downweb direction, moving a section of the web in the width dimension out of the web path with an orientation unit having a diversion device, while maintaining the web under tension along the downweb web path, so that at least a section of the web is elongated in the width dimension.

2. The method of orienting a web in a cross machine direction of claim 1 wherein the web is unrestrained on either side of an orientation zone when in the orientation unit.

3. The method of orienting a web in a cross machine direction of claim 2 wherein the web has a strength in the downweb direction at least 50 percent greater than in the cross direction.

4. The method of orienting a web in a cross machine direction of claim 2 wherein the web has a strength in the downweb direction at least 100 percent greater than in the cross direction.

5. The method of orienting a web in a cross machine direction of claim 2 wherein the web comprises a nonwoven web or web layer.

6. The method of orienting a web in a cross machine direction of claim 5 wherein the web is a laminate of an elastic layer and at least one nonwoven layer.

7. The method of orienting a web in a cross machine direction of claim 6 wherein the web the elastic layer is a film layer.

8. The method of orienting a web in a cross machine direction of claim 2, wherein the web has high strength longitudinal zones defining an orientation zone of relatively lower strength web wherein the web is preferentially orientated.

9. The method of orienting a web in a cross machine direction of claim 2 wherein the orientation unit has a degree of diversion of from 1 to 100 cm.

10. The method of orienting a web in a cross machine direction of claim 2 wherein the orientation unit has a degree of diversion of from 5 to 20 cm.

11. The method of orienting a web in a cross machine direction of claim 2 wherein the orientation unit has a diversion path with an incline angle, from the start of diversion of the web from the web path to an apex of the diversions device, of from 5 to 80 degrees.

12. The method of orienting a web in a cross machine direction of claim 11 wherein the orientation unit has an incline angle of from 20 to 50 degrees.

13. The method of orienting a web in a cross machine direction of claim 2 wherein the diversion device is a wheel.

14. The method of orienting a web in a cross machine direction of claim 2 wherein there are multiple orientation units located in the downweb direction of the web.

15. The method of orienting a web in a cross machine direction of claim 14 wherein the downweb orientation units are aligned to orient at least in part the same cross sectional zone of the web.

16. The method of orienting a web in a cross machine direction of claim 14 wherein the downweb orientation units are displaced to orient at least in part different cross sectional zones of the web.

17. The method of orienting a web in a cross machine direction of claim 2 wherein there are multiple orientation units located in the cross web direction of the web.

18. The method of orienting a web in a cross machine direction of claim 14 wherein the orientation unit diversion device is a wheel having a variable apex's to provide variable degrees of cross web orientation in the downweb direction in a single orientation zone.

19. An apparatus for orienting a web in a cross machine direction the apparatus comprising,

a web path having width dimension and a tensioning device in the downweb direction,

and an orientation unit on a portion of the web path having a diversion device for diverting a web out of the web path wherein there are no restraining devices for holding down opposing sections of the web on either side of the orientation unit.

20. The apparatus for orienting a web in a cross machine direction of claim 19 wherein the orientation unit has a degree of diversion of from 1 to 100 cm.

21. The apparatus for orienting a web in a cross machine direction of claim 19 wherein the orientation unit has a degree of diversion of from 5 to 20 cm.

22. The apparatus for orienting a web in a cross machine direction of claim 19 wherein the orientation unit has a diversion path with an incline angle, from the start of diversion of a web from the web path to an apex of the diversions device, of from 5 to 80 degrees.

23. The apparatus for orienting a web in a cross machine direction of claim 22 wherein the orientation unit has an incline angle of from 20 to 50 degrees.

24. The apparatus for orienting a web in a cross machine direction of claim 19 wherein the diversion device is a wheel.

25. The apparatus for orienting a web in a cross machine direction of claim 19 wherein there are multiple orientation units located in the downweb direction of the web path.

26. The apparatus for orienting a web in a cross machine direction of claim 25 wherein the downweb orientation units are aligned along the web path.

27. The apparatus for orienting a web in a cross machine direction of claim 25 wherein the downweb orientation units are displaced along the web path.

28. The apparatus for orienting a web in a cross machine direction of claim 19 wherein there are multiple orientation units located in the cross direction of the web path.

29. The apparatus for orienting a web in a cross machine direction of claim 24 wherein the orientation unit diversion device is a wheel having a variable apex's to provide variable degrees of cross web orientation in the downweb direction.

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