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- (71) Applicant: FAMECCANICA.DATA S.P.A. [IT/IT]; Via
Alessandro Volta, 10, I-65129 Pescara (IT).
- (72) Inventor: DE LUCA, Armando; Contrada Quercia Notar
Rocco, 11, I-66023 Francavilla al Mare (Chieti) (IT).
- (74) Agent: MARCHITELLI, Mauro; c/o Buzzi, Notaro &
Antonielli d'Oulx S.r.l., Via Maria Vittoria 18, I-10123
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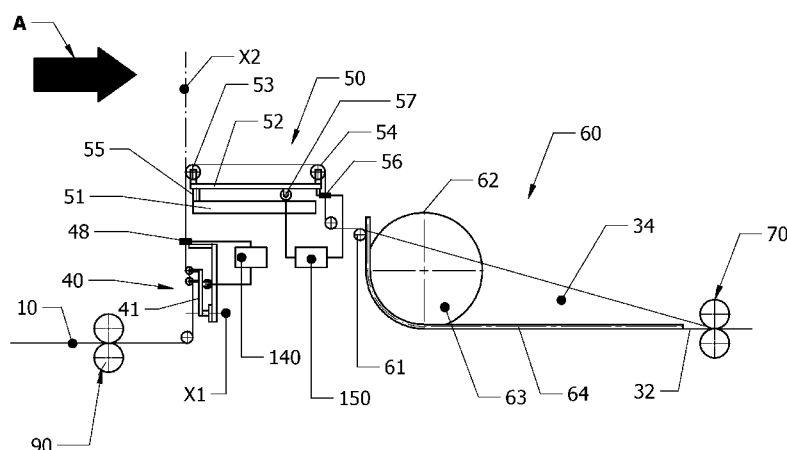


FIG. 2A

(57) Abstract: An apparatus for folding in two a composite continuous web (10) with anisotropic mechanical characteristics advancing in a longitudinal direction of feed (A) along a longitudinal-folding line (B) parallel to said direction (A), said web (10) having opposite longitudinal edges (14, 15) and having an original transverse dimension subject to variation during said advance, so as to bring said longitudinal edges (14, 15) into a predetermined relative position as a result of said folding, said apparatus comprising: - a station for transverse laying-out of the web (40) designed to restore said original transverse dimension of said web (10); - an alignment station (50) designed to align the centre line of said web (10) with respect to said longitudinal-folding line (B) parallel to said direction of feed (A); and - a folding station (60) designed to fold said continuous web along said longitudinal-folding line (B) parallel to said longitudinal direction (A).



"Apparatus and process for folding a web in two"

TEXT OF THE DESCRIPTIONField of the invention

5 The present invention relates to an apparatus and a process for folding in two a web that advances in a continuous way in a longitudinal direction.

 The invention has been developed in particular for the production of absorbent sanitary products that can
10 be worn like pants. A typical example of absorbent sanitary products of this type is represented by the so-called training pants.

Description of the relevant art

 A common technique for the production of sanitary
15 products that can be worn like pants consists in providing a continuous composite web formed by a continuous chain of blanks arranged in a transverse direction with respect to the direction of feed of the web. The continuous composite web is folded in two
20 about a longitudinal axis so as to set the opposite longitudinal edges of the web on top of one another. The opposite longitudinal edges are then connected together in transverse connection areas set at a distance apart in the longitudinal direction by a pitch
25 equal to the width of the products. The continuous chain of blanks is then subjected to an operation of cutting in a transverse direction to form the finished products.

 An example of a process for manufacturing
30 absorbent sanitary products of this type is described in the documents Nos. EP-A-1523968 and EP-A-2025311 filed in the name of the present applicant.

 In processes of this type it is necessary to ensure a mutual alignment between the opposite
35 longitudinal edges of the continuous web during the

folding step. To obtain a precise alignment of the edges, it is necessary to detect the position of the longitudinal edges of the web by means of sensors and correct the relative position of the web and, consequently, of the edges if the edges are not aligned to one another as required.

The document No. EP-A-1607357 describes a device for correcting the position of the opposite longitudinal edges of the continuous web during the folding operation. The document No. EP-A-1607357 describes an apparatus and a method for folding a web, which carries out alignment of the edges causing variation of the path followed by each edge of said web and, consequently, causing variation of the state of tension of the entire composite web. Said process is certainly effective with webs with constant and homogeneous mechanical characteristics throughout its length.

Neither in the aforesaid document nor in others are the effects caused by the marked anisotropy present in a continuous composite web formed by a continuous chain of blanks arranged in a transverse direction taken into due consideration.

In fact, it is known that, since said web is obtained by setting on top of one another a number of layers of different materials with elastic elements set between the various layers, during its advance along the production line its original transverse dimension (corresponding to the effective width of the web in a completely splayed-out configuration) with respect to the longitudinal direction of feed varies easily and in an unforeseeable way, precisely on account of the aforesaid anisotropy and variability.

Said phenomenon is aggravated by the fact that the variations in dimension are not symmetrical and

homogeneous along the two longitudinal edges; namely, it is normal for one longitudinal edge of the web to present different variations with respect to the variations present on the other edge, thus causing
5 relative displacement of the longitudinal axis of the composite web itself.

Object and summary of the invention

The object of the present invention is to improve the technique for folding a composite web in such a way
10 that the opposite longitudinal edges of the composite web can be easily controlled to maintain the condition of mutual alignment.

According to the present invention, this object is achieved by an apparatus and a process that form the
15 subject of Claims 1 and 8.

The claims form an integral part of the teaching provided herein in relation to the invention.

Brief description of the drawings

The present invention will now be described in
20 detail with reference to the attached drawings, which are provided purely by way of non-limiting example and in which:

- Figure 1 is a schematic perspective view that represents the step of folding of a composite web in a process for the production of absorbent sanitary
25 products that can be worn like pants;

- Figure 2A is a schematic side view of an apparatus for folding a composite web;

- Figure 2B is a schematic side view that
30 illustrates a second embodiment of the apparatus according to the invention;

- Figure 2C is a schematic cross section according to the line II-II of Figure 2B;

- Figure 3 is a schematic perspective view that
35 illustrates a station for transverse laying-out of the

web according to the invention;

- Figure 4 is a schematic perspective view of an absorbent product obtained with an apparatus and a process according to the present invention;

5 - Figure 5 is a schematic top plan view of the product of Figure 4 prior to formation of the transverse welds; and

- Figure 6 is a schematic perspective view that illustrates a variant of the product of Figure 4.

10 Detailed description of embodiments

In the ensuing description various specific details are illustrated aimed at an in-depth understanding of the embodiments. The embodiments may be provided without one or more of the specific
15 details, or with other methods, components, materials, etc. In other cases, known structures, materials, or operations are not shown or described in detail so that various aspects of the embodiments will not be obscured.

20 Reference to "an embodiment" or "one embodiment" in the framework of this description is meant to indicate that a particular configuration, structure or characteristic described in relation to the embodiment is comprised in at least one embodiment. Hence, phrases
25 such as "in an embodiment" or "in one embodiment" that may be present in various points of this description do not necessarily refer to one and the same embodiment. Moreover, particular conformations, structures, or characteristics may be combined in any adequate way in
30 one or more embodiments.

The references used herein are only provided for convenience and hence do not define the sphere of protection or the scope of the embodiments.

With reference to Figure 4, designated by **100** is a
35 disposable absorbent product of the so-called "pull-on"

or "training pant" type obtained with a method and an apparatus according to the teachings provided by the present invention.

In basic terms, the product **100** is made up of a central body or absorbent insert **12**, which is to come into contact with the body of the user and is able to assume the general U conformation suitable for absorbing and withholding exudates. The absorbent insert **12** is moreover positioned on a chassis **114** that sets itself in contact with the garments of the user and is characterized in that it is able to keep the absorbent insert **12** in the correct working position, even when it becomes heavier on account of the liquids absorbed.

The absorbent insert **12** has a structure in which there may be recognized (in addition to various other accessory elements):

- a top layer or topsheet **13**, permeable to body liquids evacuated, which is to face the body of the user;
- a bottom layer or backsheet **115**, impermeable to body liquids, that is to face the outside, i.e., the chassis **114**; and
- an absorbent core **116**, which is set between the topsheet **13** and the backsheet **115** and has the function of absorbing and withholding exudates.

Present on the absorbent insert **12** are other characteristic elements that contribute to increasing the characteristics of wearability and absorbance of the insert **12** itself, such as for example the elastic elements for the legs **117** that contribute to adherence of the absorbent product **100** to the body of the end user and likewise the so-called cuffs or elasticated sides **119** arranged at the sides of the absorbent core **116** with a function of lateral containment of the body

fluids.

For a more detailed description of the characteristic elements listed above and of others still, that are well known to persons skilled in the sector, reference may be made to the extensive literature existing on the subject, such as for example U.S. 4,704,116 granted on November 3, 1987 granted to Enloe.

The chassis **114** is constituted by at least one sheet of non-woven fabric **118**, or some other adequate material, on which there are made to adhere elastic materials in threads and/or strips **19**, such as, for example, Lycra threads produced by Invista and/or synthetic-rubber strips produced by Fulflex.

Said elastic materials are rendered fixed with respect to the sheet of non-woven fabric **118** of the chassis **114** by means of adhesives or thanks to welds made with heated rollers or ultrasound systems. Normally, set on top of the elastic materials is a further sheet of non-woven fabric **17**, which can come from another sheet or can be the same material **118** appropriately chosen wider than necessary and then folded inwards to cover the elastic elements **19**.

Made on the chassis **114** is a shaped cut **113** that outlines the border of the openings for the user's legs.

As is evident to a person skilled in the branch, the representations of Figures 4 and 5 are schematic and have the purpose of highlighting that the process and apparatus forming the subject of the present invention can be applied to a wide range of possible types of embodiment of the product **100**.

Particular types of pre-closed absorbent product are extensively described in EP 1 523 968 A1 and EP 2 057 975 B1. In particular, in Figure 6 designated by

120 is an absorbent product provided according to the teachings of EP 2 057 975 B1.

Figure 1 is a schematic representation of the process of production of an absorbent sanitary product **120**. In Figure 1 designated by **10** is a composite web, formed by a chain of blanks of absorbent sanitary products **120**, which advances in a continuous way in a longitudinal direction **A**. The composite web **10** has two opposite longitudinal ends **14** and **15**, which on the product provide, respectively, the front waist edge and the rear waist edge. Said edges, during the process of production of the absorbent sanitary product, are set on top of one another following upon folding along a longitudinal-folding line **B** parallel to the direction of longitudinal advance of the web **A**. The arrow **C** indicates schematically the movement of folding that leads to obtaining superposition of the longitudinal edges **14** and **15**. After folding about the longitudinal axis **B**, the longitudinal edges **14** and **15** set on top of one another are connected together at regular intervals. As represented in the embodiment of Figure 4 said connection can be obtained by means of two welds **110** or else, in the embodiment illustrated in Figure 6, by closing elements that can be opened and closed **16** and **18**, as described in greater detail in the document No. EP 2 057 975 B1 filed in the name of the present applicant. After the folding and closing operations, the continuous composite web is subjected to operations of cutting along transverse lines **P** to form individual products **120**. In the embodiments illustrated in Figures 4 and 6, the respective products **100** and **120** are training pants that may be of the type closed in a permanent way on the sides, as illustrated in Figure 4, or else with side panels that can be opened and closed, as represented in Figure 6.

The composition, structure, and process of formation of the continuous composite web **10** are not described in detail in so far as they lie outside the scope of the present invention.

5 From Figure 1, it will be appreciated what may be the complexity of the web that is generated in a process of production in which the blanks **120** extend in a direction transverse to the direction of movement and likewise there will be appreciated the need to ensure
10 that, during the operation of folding about the longitudinal axis **B**, the opposite longitudinal edges **14** and **15** are properly aligned to one another. The present invention regards the way in which the alignment of the longitudinal edges **14** and **15** is carried out within the
15 operation of folding the composite web **10** about the axis **B**.

Figure 2A is a schematic illustration of an apparatus **20** according to the present invention that carries out longitudinal folding of the composite web
20 **10** and mutual alignment of the opposite longitudinal edges **14** and **15**. The apparatus **20** comprises a station for transverse laying-out of the composite web **10**, an alignment station **50** and a folding station **60**, which is set downstream of said station **40** for transverse
25 laying-out and station **50** for alignment of the composite web **10**.

In a preferred embodiment, the folding station **60** comprises a transverse return roller **61** and a folding wheel **62**, which turns about an axis transverse to the
30 longitudinal direction **A**. The folding wheel **62** has a front face **63** contained in a plane orthogonal to the composite web **10** formed by the chain of blanks of absorbent sanitary products **120**, and hence positioned at the middle line of the composite web **10**, i.e., the
35 folding line **B**, in so far as said lines, in addition to

being always parallel to one another, in the majority of cases also coincide. The folding wheel **62** makes a preliminary fold on the continuous web **10** in two sections **32**, **34** set on opposite sides with respect to the longitudinal-folding line **B**. In the embodiment schematically illustrated in Figure 2A, a first section of web **32** is wound on the circumference of the folding wheel **62**, and a second section **34** passes in contact with the front face **63** of the folding wheel **62**. The folding section **60** further comprises a longitudinal-folding bar **64**, which extends along the folding line **B**, i.e., along the middle of the web formed by the blanks of the products **120**. The two sections of web **32** and **34** are folded on top of one another around the folding bar **64**. The folding section **60** terminates with a pair of transverse conveying rollers **70** between which the two sections of web **32**, **34** folded on top of one another are made to pass.

It is evident to a person skilled in the branch that the folding section **60** is not able to ensure that the opposite longitudinal edges **14** and **15** of the continuous web **10** are aligned with one another at the end of the folding operation. For this reason, provided upstream of the folding section **60** are the station for transverse laying-out **40** and the alignment station **50**. The station for transverse laying-out **40** of the composite web **10** is able to bring the composite web **10** back to its original transverse dimension, i.e., to the effective width of the web in the completely splayed-out configuration. In fact, the composite web **10** formed by the blanks **120**, during advance along the production line in the longitudinal direction **A** may typically vary its width, narrowing, both on account of the creases that are generated as a result of the pulling force necessary to cause advance of said web **10** along the

production line and as a result of the internal stresses due to coupling of the various materials, each of which with its own internal state of stress.

5 In one embodiment, the composite web **10**, formed by the blanks **120**, is fed along the entire line thanks to motor means such as, for example, pairs of drawing rollers **90**, as highlighted in Figures **2A** and **2B**.

10 Immediately after the station **40** for transverse laying-out of the web and immediately before the longitudinal-folding section **60**, the alignment station **50** is installed, which is able to align the centre line of said composite web **10** with respect to the longitudinal-folding line (**B**) parallel to the direction of feed and, obviously, to the longitudinal axis of the web, which in the specific case, as highlighted by Figure **1**, coincide. The aforesaid configuration constituted by a station for transverse laying-out **40** of the web and by a station for alignment **50** of said web with the centre line, always delivering in a correct way the composite web **10** itself to the longitudinal-folding section **60** causes the edges **14** and **15** to be aligned properly with respect to one another or to present, at the very least, the required precision of alignment.

25 In a preferred embodiment, as may be appreciated in the view of Figure 3, the station for transverse laying-out **40** of the web comprises two gripping devices **41** set alongside the composite web **10**, each of which is able to grip the respective longitudinal edge **14** and **15**.

30 In a preferred embodiment, as illustrated in Figure **3**, each gripping device is provided with two rollers for engagement of the edges **42** and **43**, arranged in such a way that they present the respective axes of rotation parallel to one another and parallel to the

35

plane of advance of the composite web **10**. The two pairs of engagement rollers **42** and **43** are set in front of one another specularly so that the composite web **10**, to pass beyond them, is forced to carry out an S-shaped path. In this way, each of the two longitudinal edges **14** and **15** of the composite web **10** engages the respective pair of engagement rollers in such a way that the first roller **42** comes into contact with the top surface of the web **10**, whilst the second engagement roller **43** engages the bottom surface thereof.

Thanks to the configuration just described the engagement rollers **42** and **43** of each gripping device are able to grip the respective edge **14**, **15** of the composite web **10** in a stable way. To render gripping of the longitudinal edges **14** and **15** on the surfaces of the engagement rollers **42** and **43** still more effective there can be carried out a surface treatment capable of enhancing the coefficient of friction of said surfaces with the material of the composite web **10**. An example of a convenient surface treatment may be Plasma Coating PC 936 manufactured by the company Smaltiriva of Valdaro - Mantova - Italy.

In a preferred embodiment, as may be better appreciated in the view of Figure 3, the engagement rollers **42** and **43** are connected with appropriate mechanical means **44** to the end of the arm **45**, which, in turn, is hinged at the opposite end to the pin **46**, which guarantees rotation of said arm **45** about the axis of rotation **X1** orthogonal to the plane of advance of the web **10**.

Rotation of the arm **45** about the axis **X1** causes movement of the engagement rollers **42** and **43** in a direction substantially transverse to the direction of advance **A** of the composite web **10**.

Each gripping device **41** is provided with an

actuator means **47** designed to govern rotation of said arm **41** about the axis **X1**.

An actuator suitable for this type of use may be the linear motor identified as: Linear Digital Actuator
5 model D-LAB-3A-5-050.1-ISCT manufactured by Fife-Titland GmbH, Fifestrasse 1, (D) 65779 Kelkheim, Germany.

Each gripping device **41** further comprises a device **48** designed to detect the position of the respective
10 longitudinal edge **14, 15** of the composite web **10**.

Detection devices **48** adequate for this type of control may be the linear-matrix sensors model DAC 005 manufactured by Fife-Titland GmbH, Fifestrasse 1, (D) 65779 Kelkheim, Germany.

15 In order to process the signals coming from the sensors **48**, present in the gripping device **41** is a processor or control system **140**, which carries out the measurement of the error of alignment of the respective longitudinal edge **14, 15** by comparing the measurement
20 of position detected by the respective control device **48** with the theoretical position that the corresponding longitudinal edge should occupy, and as a function of said error corrects the position of the respective edge by actuating the actuator **47**.

25 A control system suitable for this type of task may be the Digital Processor model D-MAX-2 designed and manufactured by Fife-Titland GmbH, Fifestrasse 1, (D) 65779 Kelkheim, Germany.

In a preferred embodiment, as may be better
30 appreciated in the view of Figure **2A**, the station for transverse laying-out **40** of the web is followed by a station **50** for alignment of the centre line of the composite web **10**, which is able to centre the longitudinal axis of the composite web **10** with respect
35 to the longitudinal-folding line **B** parallel to the

direction of feed **A**. The alignment station **50** is made up of a guide system generally constituted by a structure comprising a fixed frame **51** and a mobile (or steering) frame **52** mounted on which are the guide
5 rollers **53** and **54**, which, according to how the web **10** traverses the alignment station **50**, are also defined as input roller **53** and output roller **54**. In fact, the web **10** enters the guide system engaging the roller **53** and exits therefrom from the roller **54**. The mobile frame **52**
10 is connected to the fixed frame **51** by means of the device **55** that enables it to turn about the axis **X2** perpendicular to the axis of the guide rollers and tangential to the external edge of the input roller **53** in its middle.

15 The guide system is moreover provided with an actuator means **57** designed to carry out rotation of the mobile or steering frame **52** about the axis **X2**.

Devices that are adequate for this guide system may be the electromechanical web-guides of the series
20 Fife Symat model 70B or 120A, to be chosen according to the width of the composite web **10**, manufactured and marketed by Fife-Titland GmbH, Fifestrasse 1, (D) 65779 Kelkheim, Germany.

The alignment station **50** further comprises one or
25 more sensors **56** designed to detect the position of each of the longitudinal edges **14** and **15**. In the examples illustrated in Figures 2A and 2B, two sensors **56** are provided, each of which detects the position of the respective longitudinal edge **14** or **15** of the composite
30 web **10**, then determining, by comparison of the relative positions of the side edges **14** and **15**, the width of the composite web **10** identifying the position of the middle line (or centre line) of the web **10** itself.

Detection devices adequate for this type of
35 control may be ultrasound sensors with 25.4-mm

proportional band model SE-37 produced by the Fife-Titland GmbH, Fifestrasse 1, (D) 65779 Kelkheim, Germany.

5 In the alignment station **50** a processor or control system **150** is moreover present, which processes the signals coming from the sensors **56** and determines instantaneously the measurement of the error of alignment of the middle line of the composite web **10** with respect to the desired/predetermined position.

10 A control system suitable for this type of task may be the Digital Processor model D-MAX-2 designed and marketed by Fife-Titland GmbH, Fifestrasse 1, (D) 65779 Kelkheim, Germany.

15 As soon as the composite web **10**, on account of the internal stresses generated by its anisotropy deriving from its composite nature, or for external causes, abandons the correct working position, the sensors **56** detect the fact, in so far as they no longer read the predetermined position of the side edges **14** and **15** of
20 the web, corresponding to a displacement of the centre line with respect to the predetermined position. Consequently, each of them sends a signal of a different value to the processor **150**, which actuates instantaneously the actuator **57** of the guide system,
25 which in turn moves appropriately the steering frame **52**, correcting the transverse position of the composite web **10** with respect to the longitudinal direction of feed **A** so as to restore in the sensors **56** two readings that are the same as one another, i.e., two signals of
30 the same value. In this way, the centre line of the web is brought back into the desired position with respect to the axis of longitudinal folding **B**. For example, in the embodiment illustrated, the centre line or longitudinal axis of the web **10** is brought back in to
35 the centre, i.e., to coincide with the axis of

longitudinal folding **B**.

The composite web **10**, thus controlled, is transferred to the longitudinal-folding unit **60** previously described. In this way, even though the
5 folding unit **60** is unable in itself to make a correction of the web and hence of the fold, said folding unit **60**, by receiving the material always in an adequate way, i.e., always with the centre line of the web aligned as desired, for example coinciding, with
10 the longitudinal-folding line **B** and always in a state of complete transverse laying-out, which eliminates any possible misalignment of the side edges thereof, manages to make said longitudinal fold in a correct and reliable way and above all with a constant quality over
15 time.

It will not escape the notice of a person skilled in the sector that systems for longitudinal folding that do not envisage application of a station for transverse laying-out **40** of the web upstream of the
20 stations for alignment **50** and longitudinal folding **60** of the web may not achieve comparable results from the standpoint of precision of the fold and above all of stability of the folding process itself as compared to the system described in the present document. In fact,
25 in the absence of the system for transverse laying-out **40** of the web, non-homogeneous transverse dimensional variations in the two halves of the composite web **10** would lead to intervention of the alignment system **50**, which would cause variation of the position of the
30 longitudinal axis of the composite web **10** with respect to the axis of folding (**B**), in so far as the alignment system **50** would find itself correcting, as position errors, internal deformations of the composite web **10** that have varied the position of the respective
35 longitudinal edges **14** and/or **15** thereof, obtaining as a

result a longitudinal fold of the web **10** that is erroneous.

In a preferred embodiment, the two stations for transverse laying-out **40** and alignment **50** of the web
5 may be integrated in a single station by housing the gripping devices of the station for transverse laying-out on the mobile frame of the guide system of the alignment station.

In a further preferred embodiment, as may be
10 appreciated more clearly in the view of Figure **2B**, the station for transverse laying-out of the web **40** may be housed on the mobile frame **52** of the guide system **50** in the space between the input roller **53** and the output roller **54**.

15 In fact, as is well known to persons skilled in the sector, the guide systems of the Fife Symat type, and their equivalents, to be able to obtain an effective control of the alignment of the web, preferably require respect of appropriate internal
20 dimensional ratios. In particular, the distance between the centres of the input roller **53** and output roller **54** should preferably be at least the same as the width (or transverse dimension) of the web **10** that is to be aligned. In any case, precisely to prevent stresses on
25 the material constituting the web **10** itself, the greater said distance between centres, the smaller the deformation that is induced on the material of the web that is to undergo alignment, and the better the alignment system **50** works. Consequently, thanks to said
30 geometrical needs of the alignment system **50** and in order to optimize the spaces on the production line and finally to optimize the process also eliminating any possible deformations and/or imperfections on the web that might be generated by the action of alignment
35 carried out by oscillation about the axis **X2** of the

mobile frame **52** of the alignment station **50**, the station for transverse laying-out **40** of the web may be conveniently installed on the alignment station **50**, preferably between the input roller **53** and the output roller **54**, with the control devices **48** of each gripping device **41** preferably set in the proximity of the output roller **54**.

Clearly, it is evident that a configuration such as the one just described and highlighted in Figure **2B** can render still more stable and reliable the folding process in so far as it delivers the web to the folding station **60** in ideal conditions without there possibly intervening further phenomena that might generate new errors on the composite web **10** itself.

In a further embodiment, as is highlighted more clearly in Figure **2B**, in the folding station, in the proximity of its output section, i.e., immediately before the two sections **32**, **34** of the composite web **10** are set on top of one another, there may be installed a further control device **80** designed to detect the position of each of the longitudinal edges **14** and **15**.

In the embodiment illustrated in Figure **2B**, two edge-detection devices **81** are provided, each of which detects the position of a respective longitudinal edge **14**, **15**.

Detection devices **81** adequate for this type of control may be the linear-matrix sensors model DAC 005 manufactured by Fife-Titland GmbH.

In the control device **80**, a processor or control system **180** is moreover present, which processes the signals coming from the sensors **81** and determines instantaneously the measurement of the error of alignment of the middle line of the composite web **10** with respect to a desired position.

Also for this application a control system

suitable for this type of task may be the Digital Processor model D-MAX-2 manufactured by Fife-Titland GmbH.

5 A measurement of the error of alignment between the longitudinal edges **14** and **15** is obtained by comparing the measurements of position of the respective longitudinal edges **14** and **15** thanks to the signals that each sensor **81** sends to the processor or control system **180**.

10 In the case where an error in the position of the longitudinal edges is detected, and hence the system is making the longitudinal fold not along the theoretical folding axis **B**, but along another axis parallel thereto, the control device **180**, through the processor
15 **150**, can carry out a new adjustment on the sensors **56** displacing the reference position thereof; namely, in other words, in the case where on the equipment two detection systems or sensors are provided, one for each longitudinal edge, the processor or control system
20 varies for each sensor the theoretical position of where the edge should be located, virtually displacing said theoretical position of each sensor by one and the same length, but in an opposite direction, hence obtaining displacement of the centre line of the
25 composite web **10** to obtain once again the desired alignment with the longitudinal-folding axis **B**, for example, as in the embodiments illustrated, bringing said centre line to coincide with said axis.

Of course, without prejudice to the principle of
30 the invention, the details of construction and the embodiments may vary widely with respect to is what described and illustrated herein, without thereby departing from the scope of the invention as defined in the ensuing claims.

CLAIMS

1. An apparatus for folding in two a continuous composite web (10) with anisotropic mechanical characteristics advancing in a longitudinal direction of feed (A) along a longitudinal-folding line (B) parallel to said direction (A), said web (10) having opposite longitudinal edges (14, 15) and having an original transverse dimension subject to variation during said advance, so as to bring said longitudinal edges (14, 15) into a predetermined relative position as a result of said folding, said apparatus comprising:

- a station for transverse laying-out (40) of the web designed to restore said original transverse dimension of said web (10);
- an alignment station (50) designed to align the centre line of said web (10) with respect to said longitudinal-folding line (B) parallel to said direction of feed (A); and
- a folding station (60) designed to fold said continuous web along said longitudinal-folding line (B) parallel to said longitudinal direction (A).

2. The apparatus according to Claim 1, wherein said station for transverse laying-out (40) comprises at least one gripping device (41) for each longitudinal edge (14, 15) of said web (10), said at least one gripping device (41) comprising at least two engagement rollers (42, 43), which have axes of rotation parallel to one another and to the plane of advance of the web (10), are able to engage both of the surfaces of the web at said respective longitudinal edges (14, 15), and are mobile in a transverse direction (D) with respect to the longitudinal direction (A) of advance of said web (10).

3. The apparatus according to Claim 2, wherein the at least one gripping device (41) of said station for

transverse laying-out (40) comprises an arm (45) carrying said at least two rollers (42, 43) at one of its ends and hinged at the other end about an axis (X1) perpendicular to the axis of said two rollers (42, 43),
5 said arm (45) being driven in rotation about the axis of rotation (X1) by a respective actuator (47) controlled by a respective sensor (48) designed to detect the position of the respective longitudinal edge (14, 15).

10 4. The apparatus according to any one of the preceding claims, wherein said alignment station (50) comprises a mobile structure (52) carrying an input roller (53) set at entry of the web (10) and an output roller (54) set at exit of said web (10), said mobile
15 structure (52) being rotatable about an axis (X2) perpendicular to the mobile structure (52) and tangential to the external edge of the input roller (53) at its middle, said mobile structure (52) being driven by an actuator (57) governed through a processor
20 (150) by first sensor means (56) designed to detect the position of the centre line of said web (10).

5. The apparatus according to Claim 4, wherein said station for transverse laying-out (40) of the web (10) is positioned on said mobile structure (52).

25 6. The apparatus according to Claim 5, wherein said station for transverse laying-out (40) of the web (10) is positioned on said mobile structure (52) between the input roller (53) and the output roller (54).

30 7. The apparatus according to any one of the preceding claims, comprising second sensor means (81) designed for detection of the relative position of the longitudinal edges (14, 15) of the web (10), positioned immediately before complete superposition of the
35 sections (32, 34) of said web (10) formed upon said

folding, and designed for correcting the information detected by the first sensor means (56) for detection of the longitudinal edges (14, 15) and of the centre line of the web (10) of the alignment station (50).

5 8. A process for folding in two a continuous composite web (10) with anisotropic mechanical characteristics, which advances in a longitudinal direction (A) and has an original transverse dimension subject to variation during said advance, said process
10 comprising the steps of:

- feeding said continuous web in said longitudinal direction (A) by conveyor means (90);
- laying out (40) said web (10) in a direction transverse to the direction of feed (A), so as to
15 restore said original transverse dimension;
- aligning (50) the centre line of the web (10) with respect to a longitudinal-folding line (B) parallel to said direction of feed (A), according to the relative position of the longitudinal edges (14,
20 15) of said web (10), detected following upon said laying-out step; and
- folding (60) the web (10) in a direction transverse to the direction of feed (A) to form respective sections (32, 34) of said web (10), along
25 the longitudinal-folding line (B).

9. The process according to Claim 8, wherein the step (60) of folding the web (10) comprises the steps of:

- controlling (80) the position of the
30 longitudinal edges (14, 15) of said web (10) immediately before said complete superposition;
- generating information on the relative position of the longitudinal edges (14, 15); and
- correcting (180, 150) the position of the centre
35 line of the web (10) with respect to the line (B) of

folding of said web **(10)** according to the information on the relative position of the longitudinal edges **(14, 15)** of said web **(10)**.

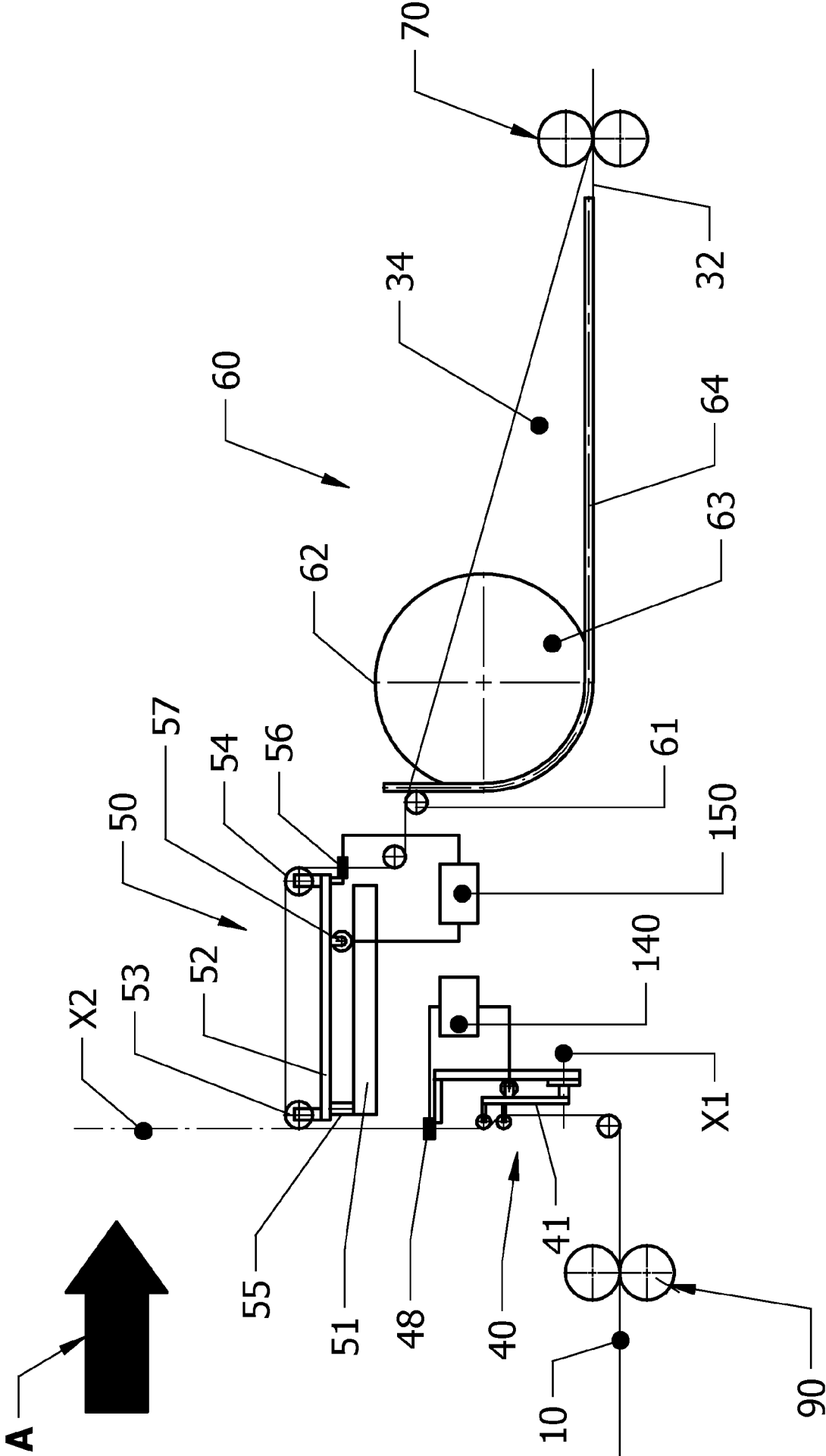


FIG. 2A

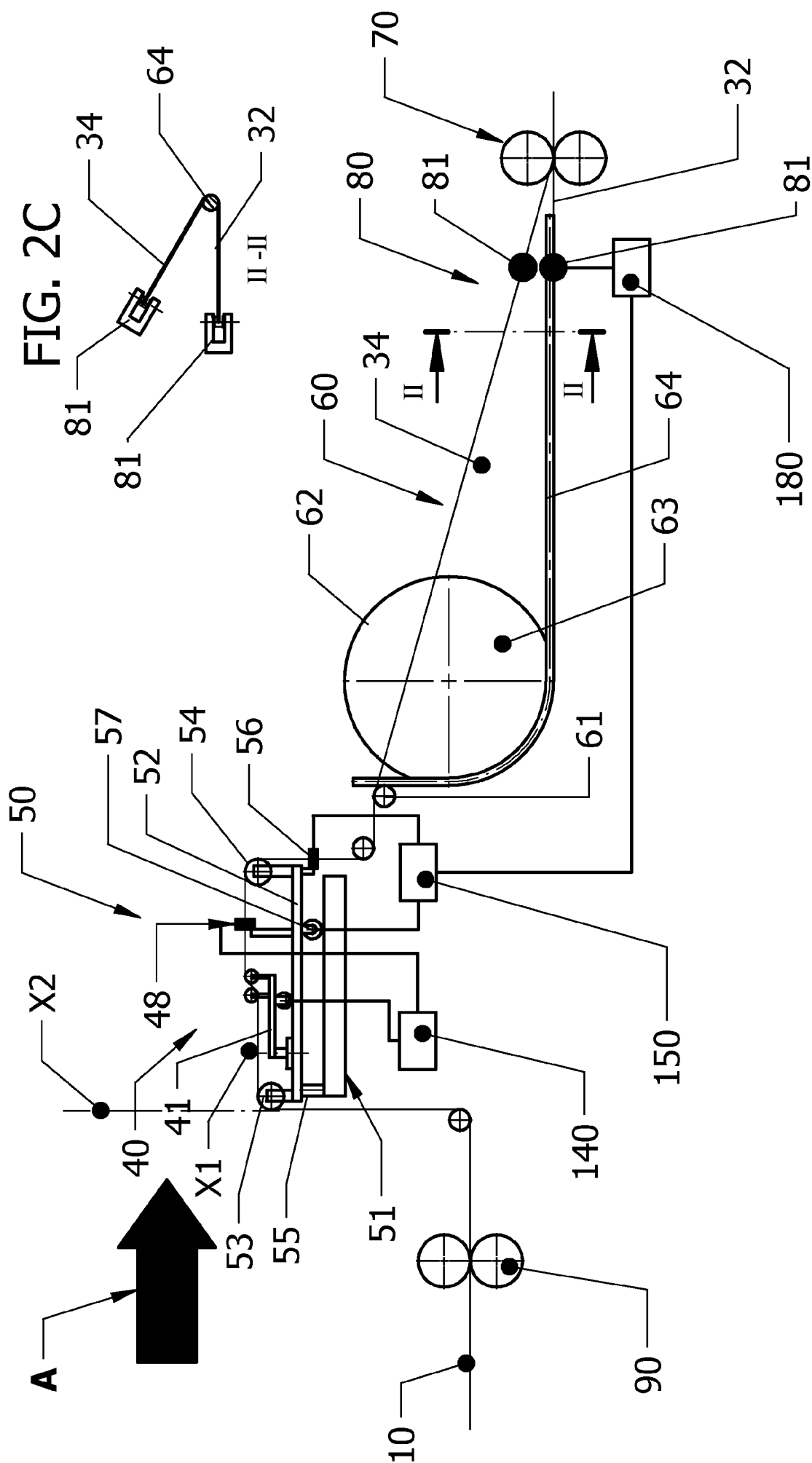


FIG. 2B

