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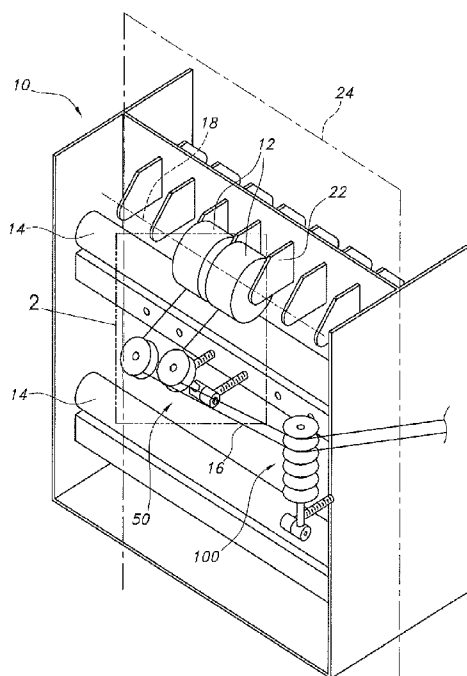


FIG. 1

(57) Abstract: A rolling guide for a fiber strand comprises a first support member extending from a base of the roller guide to a compound joint having first and second portions. The first portion of the compound joint is mounted on the first support member for rotation around a first axis. The second portion of the compound joint being rotatable relative to the first portion around a second axis at a compound angle to the first axis. A second support member is connected with the second portion of the compound joint at a proximal end of the second support member. A channeled roller is carried on the second support member distally from the proximal end, and mounted for rotation around a third axis. The channeled roller has an annular channel formed therein. A fastener is provided to selectively prevent the second portion of the compound joint from rotating around the second axis relative to the first portion of the compound joint. Also provided according to the present disclosure is a method of guiding one or more fiber strands from a fiber package on a creel device to a destination location for further processing.

CREEL GUIDE

BACKGROUND

Field of the Disclosure

[0001] The present disclosure relates to textile manufacture. More specifically, the present disclosure is directed to method and system for guiding multiple thread ends from a creel to a textile manufacture machine while reducing friction, variations in tension, twist and scuffing.

Brief Discussion of Related Art

[0002] It is known in the textile manufacturing art, in which multiple strands of fiber are simultaneously fed to a manufacturing device, to provide an individual package and/or wound bobbin of such fibers as a source for each strand. One such textile product, as mere example and without limitation of the instant disclosure, is called a Machine Direction Stretch Nonwoven (MDXA). This fabric consists of a plurality of elastic fibbers arranged parallel with one another and under tension in an axial direction, that are laminated between layers of a non-woven polypropylene fiber by the application of adhesive and heat. With the laminate layers and bound together with one another and the intervening elastic fibers, the tension is released, and the laminate relaxes.

[0003] For efficiency in manufacturing these packages or bobbins are as large as practical, such as a 2Kg package, so that the process may continue uninterrupted, and that in the aggregate, the time required to string or thread each fiber into the manufacturing device is minimized. The multiple packages of fiber are therefore positioned on a creel,

one example of which is given by U.S. Patent No. 6,676,054 to Heaney, et al., hereby incorporated by reference herein.

[0004] Moreover, for several types of textile products, the several strands are brought from their position and orientation on the creel, including various heights and axial takeoff directions, which is determined at least in part by the geometry of the creel, and these strands are brought together at or near parallel condition to facilitate their incorporation into the manufactured textile. In doing so, attempt must be made to minimize friction in the apparatus guiding each strand of fiber, in order to maintain a consistent fiber tension and also to avoid fiber breakage. This is particularly so in the case of elastomeric fibers, one example of which is sold by the assignee and applicant of the instant application under the LYCRA trademark.

[0005] Other considerations include minimizing scuffing of the exterior of the strand, which can adversely affect the strand-to-strand adhesion properties of certain fibers, including LYCRA® fiber. Scuffing can occur from abrasion of the fiber against static guides, or in the case of a free-rolling channel guide, scuffing can occur when the fiber is caused to bear, and thus rub against the side walls of the channel as it enters and/or exits the rolling guide.

[0006] The same forces that cause scuffing of the fiber strand can also cause twisting of the strand. Among the negative side-effects of twisting the fiber strand are variations in fiber tension, and deterioration of the structure of the fiber, which often is itself composed of filaments turned, braided and/or twisted around one another.

[0007] Friction also causes static buildup in the fiber strands, which in turn can cause strands to cling to or repel one another when this is not desired. This is particularly troublesome and difficult to avoid, for example in the MDXA fabric described above, among others, as the plural strands are converged adjacent to one another in a parallel condition in preparation for lamination.

[0008] The present state of the art is therefore wanting.

SUMMARY

[0009] Therefore, provided according to the present disclosure is a rolling guide for a fiber strand comprising a first support member extending from a base of the roller guide to a compound joint having first and second portions. The first portion of the compound joint is mounted on the first support member for rotation around a first axis. The second portion of the compound joint being rotatable relative to the first portion around a second axis at a compound angle to the first axis. A second support member is connected with the second portion of the compound joint at a proximal end of the second support member.

[0010] A channeled roller is carried on the second support member distally from the proximal end, and mounted for rotation around a third axis. The channeled roller has an annular channel formed therein. A fastener is provided to selectively prevent the second portion of the compound joint from rotating relative to the first portion of the compound joint.

[0011] In a further embodiment of the present disclosure, the first support member is operative to adjust the distance between the base of the roller guide and the

compound joint. In yet another embodiment of the present disclosure, the position of the channeled roller is adjustable on the second support member relative to the second portion of the compound joint. According to a further embodiment of the present disclosure, the fastener – locking device – using a hex nut-- is further operative to selectively prevent the first portion of the compound joint from rotating around the first axis.

[0012] In a further embodiment of the present disclosure, the first portion of the compound joint comprises a first facing surface, and the second portion of the compound joint has a second facing surface, the first and second facing surfaces opposing one another. At least one of the first or second facing surfaces is provided with at least one of a fiction-enhancing material, a friction-enhancing surface treatment, and a combination thereof. Alternately or additionally, at least one of the first or second facing surfaces is provided with one or more spaced, complementary, and interlocking surface features arranged radially around the second axis.

[0013] In still a further embodiment of the present disclosure, the channeled roller comprises a plurality of channeled rollers, each channeled roller of the plurality mounted for rotation around the second axis independently of any other channeled roller in the plurality of channeled rollers, and each channeled roller of the plurality having an annular channel formed therein.

[0014] Also provided according to the present disclosure, is a method of guiding a fiber strand from a fiber package on a creel device to a destination location for further processing. The disclosed method includes providing a roller guide as described

according to the one or more above embodiments. The fiber strand is placed in the annular channel of the channeled roller to turn the fiber strand from a first direction vector between the fiber package and the roller guide, to a second direction vector between the roller guide and the destination location. The channeled roller of the roller guide is oriented to place the fiber strand in a first plane defined by a bottom of the annular channel therein, the first plane containing both the first and second direction vectors, wherein the fiber strand is tangent and perpendicular (on average) – only the center package yarns will be perpendicular—because the packages are not parallel to the annular channel. The fastener is secured to hold the orientation of the channeled roller.

[0015] In still a further embodiment of the present disclosure, a method of guiding a plurality of fiber strands from respective origin locations on a creel device to respective destination locations for further processing comprises providing a roller guide according to the one or more above embodiments including a plurality of channeled rollers. Each of the plurality of fiber strands is placed in a respective annular channel of the plurality of channeled rollers to turn the fiber strands from a first direction vector between the respective origin location and the roller guide, to a second direction vector between the roller guide and the respective destination locations. No fiber strand crosses any other fiber strand. The roller guide is oriented to minimize a deviation of each fiber strand in the plurality from a respective plane defined by a bottom of its respective annular channel between the origin location and the channeled roller, and between the channeled roller and the destination location, wherein the fiber strand is tangent and perpendicular (on average) to the annular channel. The fastener is secured to hold the orientation of the channeled roller.

[0016] These and other purposes, goals and advantages of the present disclosure will become apparent from the following detailed description of example embodiments read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Some embodiments are illustrated by way of example and not limitation in the figure of the accompanying drawings, with like reference numerals referring to like structures across the several views, and wherein

[0018] FIG. 1 depicts, schematically, a creel having creel guides according to an embodiment of the present disclosure;

[0019] FIG. 2 illustrates a roller guide according to an embodiment of the present disclosure;

[0020] FIG. 2A illustrates in a profile view of the channeled roller according to an embodiment of the present disclosure;

[0021] FIG. 2B illustrates an exploded assembly view of the compound joint of the roller guide according to an embodiment of the present disclosure; and

[0022] FIG. 3 illustrates a roller guide according to another embodiment of the present disclosure.

DETAILED DESCRIPTION

[0023] Referring now to FIG. 1, illustrated is a creel, generally **10**. Several packages **12** of wound fiber may be situated on rollers **14** of the creel **10**. The packages

consist of a quantity of the fiber strand **16** wound around an axis **18** of the package, in some cases including a coaxial core (not shown), typically a tube core, which gives initial structure of the package as it is being previously formed. The package is oriented such that by driving a pair of rollers **14**, the package **12** is turned around its axis **18**, and the fiber strand is thus unwound from the package. FIG. 1 depicts fewer than all packages **12** that can be accommodated by the creel **10**, solely for clarity of illustration. The number of packages **12** can vary depending on the number designed for in the creel. In practice, multiple packages **12** are situated on a pair rollers **14**, with the packages **12** on a given set of rollers resting between one or more dividers **22** separating one package **12** from an adjacent package. Each package **12** provides its own strand **16** via roller guide **50**.

[0024] As the driven set rollers **14** turn, the packages **12** rotate and the fiber strand **16** is drawn off of the package **12**. The rate of takeoff from the package **12** is controlled by the speed of the driven roller **14**, independent of the diameter of the package **12**, which will gradually and systematically reduce as the fiber strand **16** is unwound from the package **12**. In the case of FIG. 1, as example only, fiber strands **16** are taken off the package **12** in an outward direction from a medial plane **24** of the creel **10**. Other creel geometries present different specific orientations. However, the challenge remains to guide each fiber strand **16** from the location of its respective package **12** on the creel **10**, to a position and orientation with respect to adjacent fiber strands **16** for their inclusion in a manufactured textile product, without damaging the fiber strand **16**.

[0025] Referring now to FIG 2, illustrated is a roller guide, generally **50**, according to a first embodiment of the present disclosure. Like FIG. 1, FIG. 2 depicts

fewer than all packages **12** that can be accommodated by the creel **10**, for clarity of illustration. The roller guide **50** includes a channeled roller **52**, mounted for rotation around a central axis **54**, which in the exemplary embodiment is coincident with a support rod **56**. The channeled roller **52** may include a bearing device (not shown) to facilitate its free rotation around the axis **54**. The support rod **56** in turn is connected with a compound joint **60**, which is formed of first and second halves **62** and **64**. The support rod **56** is connected with the first half **62**. The first half **62** is able to rotate around an intermediate axis **66** with respect to the second half **64**. The second half **64** is in turn connected with a mounting rod **68** such that the second half is operable to rotate around a third axis **70** coincident with the longitudinal axis of the mounting rod **68**. The mounting rod **68** is in turn secured to the creel **10**, which forms a base **82** for the roller guide **50**.

[0026] Referring now to FIG. 2A, illustrated in a profile view of the channeled roller **52**. The channeled roller **52** includes a generally V-shaped channel **72** therein, in which opposing channel walls **74**, **76** converge at an apex **78** in the bottom the channel **72**, which may optionally be flattened or rounded. The fiber strand **16** is arranged to enter the channel **72** and bear against the apex **78** of the channel, and be wrapped some predetermined angle around the central axis **54**. For the avoidance of scuffing, twisting, friction, etc., being applied to the fiber strand **16** by the roller guide **50** as the fiber strand **16** passes through the channeled roller **52**, it is desirable that the fiber strand **16** both enter and exit the roller guide **50** aligned in the plane defined by the apex **78** of the channel **72**, and both enter and exit the channeled roller **52** tangent to an arc described by the apex **78** and perpendicular to **54**.

[0027] Optionally, in certain embodiments, the mounting rod may be adjustable in length, for example where the mounting rod 68 is threaded and its mounting point on the creel 10 is compatibly threaded, such that the roller guide 50 may be made nearer or farther from the creel 10 without altering the plane of the channeled roller 52. Optionally, though not shown in the present embodiment, the support rod 56 may be made adjustable in length as well, and/or the position of the channeled roller on the support rod 56 may be made to adjust.

[0028] Referring now to FIG. 2B, illustrated is an exploded assembly view of the compound joint 60. In certain embodiments of the present disclosure, the first and second halves 62, 64 may optionally include a friction enhancement on their respective facing surfaces 62a, 64a. For example, an application of material to and/or surface treatment of facing surfaces 62a, 64a can serve to increase roughness and thereby enhance friction between the two halves 62, 64. Thus, the halves 62, 64 are less likely to be inadvertently moved once set in a desired position. .

[0029] The halves 62, 64 can be drawn together to hold their position relative to one another, for example by a fastener 80 aligned with the second axis 66. A threaded fastener, washer, and or threaded nut may be used, as will be understood to those of skill in the art. Tightening the fastener 80, optionally including a washer and/or threaded nut, alternately an internal thread provided on one of the halves 62, 64, secures the halves 62, 64 against one another and thus constrains the position of the channeled roller 52. Optionally, tightening of the fastener 80 may also serve to secure the rotation of the compound joint 60 around mounting rod 68, for example by pressing the second half 64 against the mounting rod 68, thus further constraining the position of the roller guide 50.

Accordingly, the compound joint **60** permits the support rod **56** and its central axis **54** to be rotated both in a compound azimuth and elevation with respect to the third axis **70**, which is in the present example coincident with the mounting rod **68**.

[0030] In the configuration described above and illustrated in FIG. 2, the roller guide **50** is operative to guide a fiber strand **16** taken off from a package **12** around roller **14**. As shown in the FIG. 2, the fiber strand **16** is turned some angle around the roller **14**, so that the fiber strand **16** is known to be in a plane defined by the circumference of the roller **14**. The fiber strand **16** is then turned through the apex **78** of the channel **72**, and exits the channeled roller **52** directed in a direction of one end of the creel **10**, and towards a downstream process including the fiber strand **16**.

[0031] Referring now to FIG 3, illustrated is a second embodiment of a roller guide, generally **100**. Certain features of the roller guide **100** will be readily apparent to those of skill in the art having read the instant disclosure above, and therefore a complete recitation of the features will be dispensed with as redundant. The salient differences between roller guide **100** and roller guide **50** will be discussed. Like FIGs. 1 and 2, FIG. 3 depicts fewer than all packages **12** that can be accommodated by the creel **10**.

[0032] Roller guide **100** combines plural channeled rollers **102** coaxially aligned on a common support rod **104**. Each channeled roller **102** is free to rotate independently of any adjacent channeled rollers **102**, and each may be provided with an independent bearing (not shown) for that purpose. The roller guide **100** includes a compound joint **110** that permits the central axis **106** to be rotated both in a compound azimuth and elevation with respect to a third axis **112** of a mounting rod **114**.

[0033] In the embodiment depicted in FIG. 3, five (5) channeled rollers 102 are depicted mounted together on a single roller guide 100. Those of skill in the art will recognize that the number of channeled rollers included in the roller guide may vary depending on the number of fiber ends, number of packages of yarn and desired denier of the yarn strands. This may include 4 to 20 channeled rollers per roller guide, 5 to 10 channeled rollers, or 5 to 6 channeled rollers. Each roller has independent bearings and rolls independently of the other channeled rollers 102. More or fewer channeled rollers 102 may be provided without departing from the scope of the instant disclosure. In one embodiment, the creel 10 was equipped with rollers 14 providing space for twelve (12) packages 12 of fiber thread 16. Grouping six channeled rollers 102 together allows for two roller guides 100 per roller 14. One of skill in the art acquainted with the instant disclosure may find it convenient to provide three roller guides 100 having four (4) channeled rollers 102 on each roller guide 100, or virtually any other combination of equal or unequal numbers as will seem convenient to the artisan.

[0034] It remains the case that to avoid scuffing, twisting, and/or friction or other deleterious effects on the fiber strand 16 by the channeled roller 102, it is desirable to have the fiber strand 16 both enter and exit the channeled roller 102 aligned in the plane defined by the apex of the channel, and both enter and exit the channeled roller 102 tangent to that apex and perpendicular to 54. In the case of plural channeled rollers 102 in a single roller guide 100, the plural fiber strands 16 will likely approach the roller guide 100 from divergent positions such that the fiber strands 16 are not in respective parallel planes defined by each of the channeled rollers 102. The same may be true for

the destination of the fiber strands **16** upon leaving the channeled rollers **102**, that they are divergent and thus not aligned in respective parallel planes.

[0035] To address this problem of convergence and divergence of the fiber strands **16** at the roller guide **100**, according to the instant disclosure, at the outset it will be advantageous to select those fiber strands **16** having origin and destination with respect to the roller guide **100** as nearly aligned in respective parallel planes, as defined by the bodies of the respective channeled rollers **102**, as is feasible. Moreover, the ability to adjust the alignment of the central axis **106** with respect to both the azimuth and elevation with respect to the third axis **112** of a mounting rod **114**, permits the orientation of the roller guide **100** that is the best compromise for all fiber strands **16** passing through the given roller guide **100**. Often it is the case that fiber strands converge leading to the roller guide **100**, and then diverge proceeding away from it, in a way that none of the fiber strands **16** crosses one another. In that case, setting the roller guide to be in a plane defined by the approach and exit of the centermost fiber strand **16**, or in the case of an even number of channeled rollers **102**, a mean of the two centermost fiber strands **16**, approximates the minimum divergence from the preferred parallel plane orientation described, and thus the minimum stress upon the fiber strands **16**. In further cases where the fiber strands **16** do not converge and/or diverge in an equally distributed manner, it is possible to select an orientation of the roller guide **100** that deviates from the parallel plane condition of all fiber strands **16** to the least extent possible when considering the aggregate cumulative deviation of all affected fiber strands **16** passing over the roller guide **100**. The deviation from a perfect parallel strands convergence and divergence can be addressed or decreased by reducing the number of strands to a quantity less than 6.

[0036] The foregoing description indicates roller guides **50, 100**, that are each attached to the creel **10** itself. It is noted, however, that the alternately or additionally, guide rollers of either type may be advantageously positioned in a position displaced from the body of the creel **10**, to further refine the position and/or angle of approach of the fiber strands **16** to the textile manufacturing process.

[0037] It is noted that in certain applications, multiple fiber threads **16** are strung together through a single roller to channeled roller **102** of the roller guide **100**, in order to advantageously alter the characteristics of the manufactured textile product. Adding more than one ends increases the denier of the yarn. In this case, the plural fiber strands **16** necessarily converge upon a single channeled roller **52, 102**, but would move away from the roller guide **50, 100** as a unit strand. In this embodiment, similarly as described above, it will not be possible that two fiber strands **16** approach the same channeled roller **52, 102** in the plane defined by the channeled roller **52, 102**. Therefore, to minimize scuffing, twisting, or the like, initially the originating position of the two fiber strands **16** which converge upon the same channeled roller **52, 102**, will be selected as near as possible to being within the same plane. Additionally, the position and orientation of the of the roller guide **50, 100** will be set to an orientation that deviates from the parallel plane condition of the plural fiber strands **16** with respect to the channeled rollers **52, 102**, to the least extent possible, considering the aggregate and/or cumulative deviation of all affected fiber strands **16** passing over the roller guide **50, 100**.

[0038] Variants of the above-disclosed and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Various presently unforeseen or unanticipated alternatives, modifications,

variations, or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

I/We Claim:

1. A rolling guide for a fiber strand comprising:
 - a first support member extending from a base of the roller guide to a compound joint having first and second portions, the first portion of the compound joint being mounted on the first support member for rotation around a first axis;
 - the second portion of the compound joint being rotatable relative to the first portion around a second axis at a compound angle to the first axis;
 - a second support member connected with the second portion of the compound joint at a proximal end of the second support member;
 - a channeled roller carried on the second support member distally from the proximal end, and mounted for rotation around a third axis, the channeled roller having an annular channel formed therein;
 - a fastener positioned to selectively prevent the second portion of the compound joint from rotating around the second axis relative to the first portion of the compound joint.
2. A rolling guide for a fiber strand according to Claim 1, wherein the first support member is operative to adjust the distance between the base of the roller guide and the compound joint.
3. A rolling guide for a fiber strand according to Claim 1, wherein the position of the channeled roller is adjustable on the second support member relative to the second portion of the compound joint.

4. A rolling guide for a fiber strand according to Claim 1, wherein the fastener is further operative to selectively prevent the first portion of the compound joint from rotating around the first axis.
5. A rolling guide for a fiber strand according to Claim 1, wherein the first portion of the compound joint comprises a first facing surface, and the second portion of the compound joint has a second facing surface, the first and second facing surfaces opposing one another, at least one of the first or second facing surfaces is provided with one or more spaced, complementary, and interlocking surface features arranged radially around the second axis.
6. A rolling guide for a fiber strand according to Claim 1, wherein the channeled roller comprises a plurality of channeled rollers, each channeled roller of the plurality mounted for rotation around the third axis independently of any other channeled roller in the plurality of channeled rollers, and each channeled roller of the plurality having an annular channel formed therein.
7. A method of guiding a fiber strand from a fiber package on a creel device to a destination location for further processing, the method comprising:
 - providing a roller guide according to claim 1;
 - placing the fiber strand in the annular channel of the channeled roller to turn the fiber strand from a first direction vector between the fiber package and the roller guide, to a second direction vector between the roller guide and the destination location;

orienting the channeled roller of the roller guide to place the fiber strand in a first plane defined by a bottom of the annular channel therein, the first plane containing both the first and second direction vectors, wherein the fiber strand is tangent to the annular channel; and

securing the fastener to hold the orientation of the channeled roller.

8. A method of guiding a fiber strand according to Claim 7, further comprising holding the fiber strand under tension.

9. A method of guiding a plurality of fiber strands from respective origin locations on a creel device to respective destination locations for further processing, the method comprising:

providing a roller guide according to claim 6;

placing each of the plurality of fiber strands in a respective annular channel of the plurality of channeled rollers to turn the fiber strands from a first direction vector between the respective origin location and the roller guide, to a second direction vector between the roller guide and the respective destination locations, wherein no fiber strand crosses any other fiber strand;

orienting the roller guide to minimize a deviation of each fiber strand in the plurality from a respective plane defined by a bottom of its respective annular channel between the origin location and the channeled roller, and between the channeled roller and the destination location, wherein the fiber strand is tangent to the annular channel; and

securing the fastener to hold the orientation of the channeled roller.

10. A method of guiding a plurality of fiber strands according to Claim 9, wherein more than one fiber strand share a channeled roller.
11. A method of guiding a plurality of fiber strands according to Claim 9, further comprising holding the fiber strand under tension.

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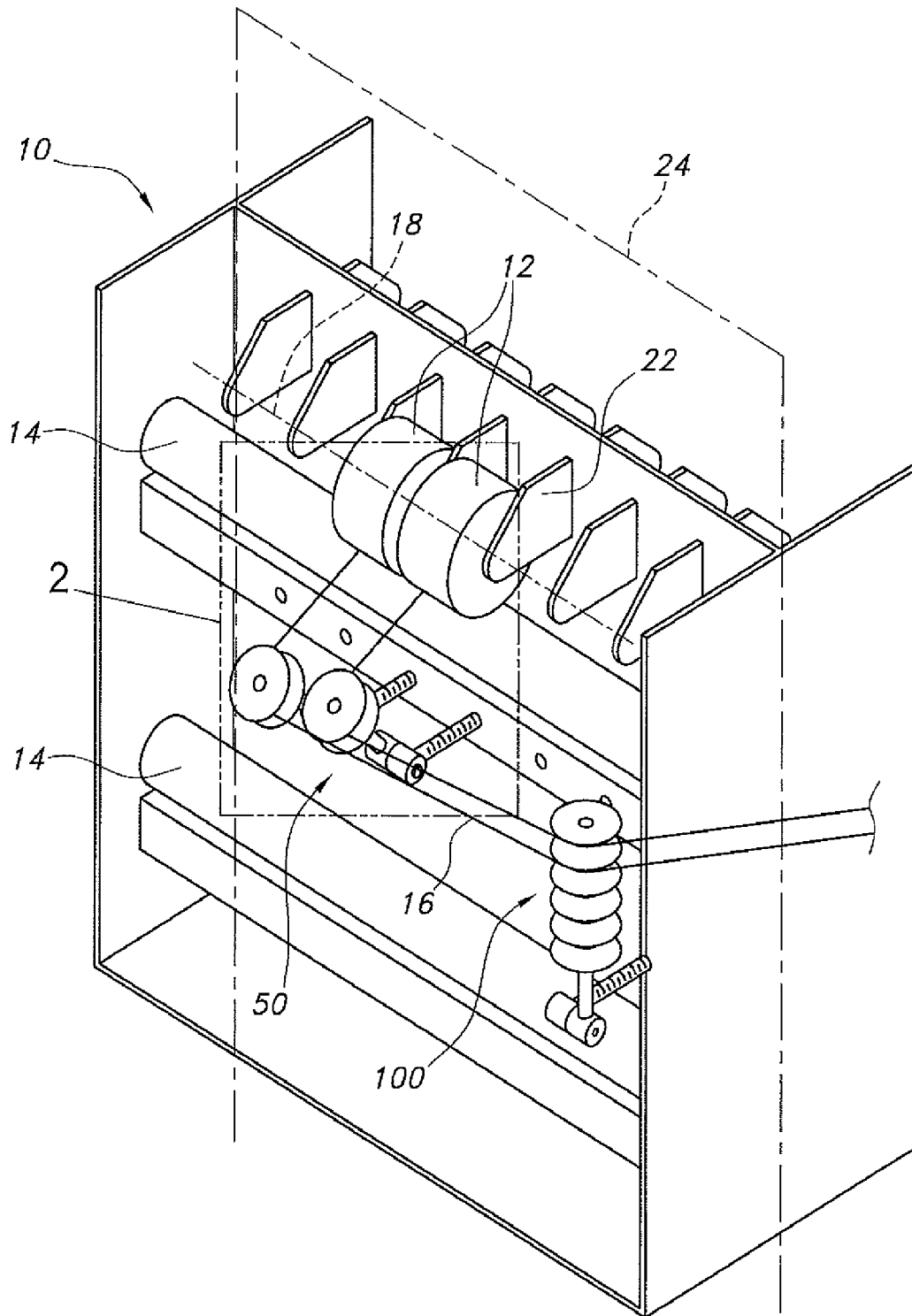


FIG. 1

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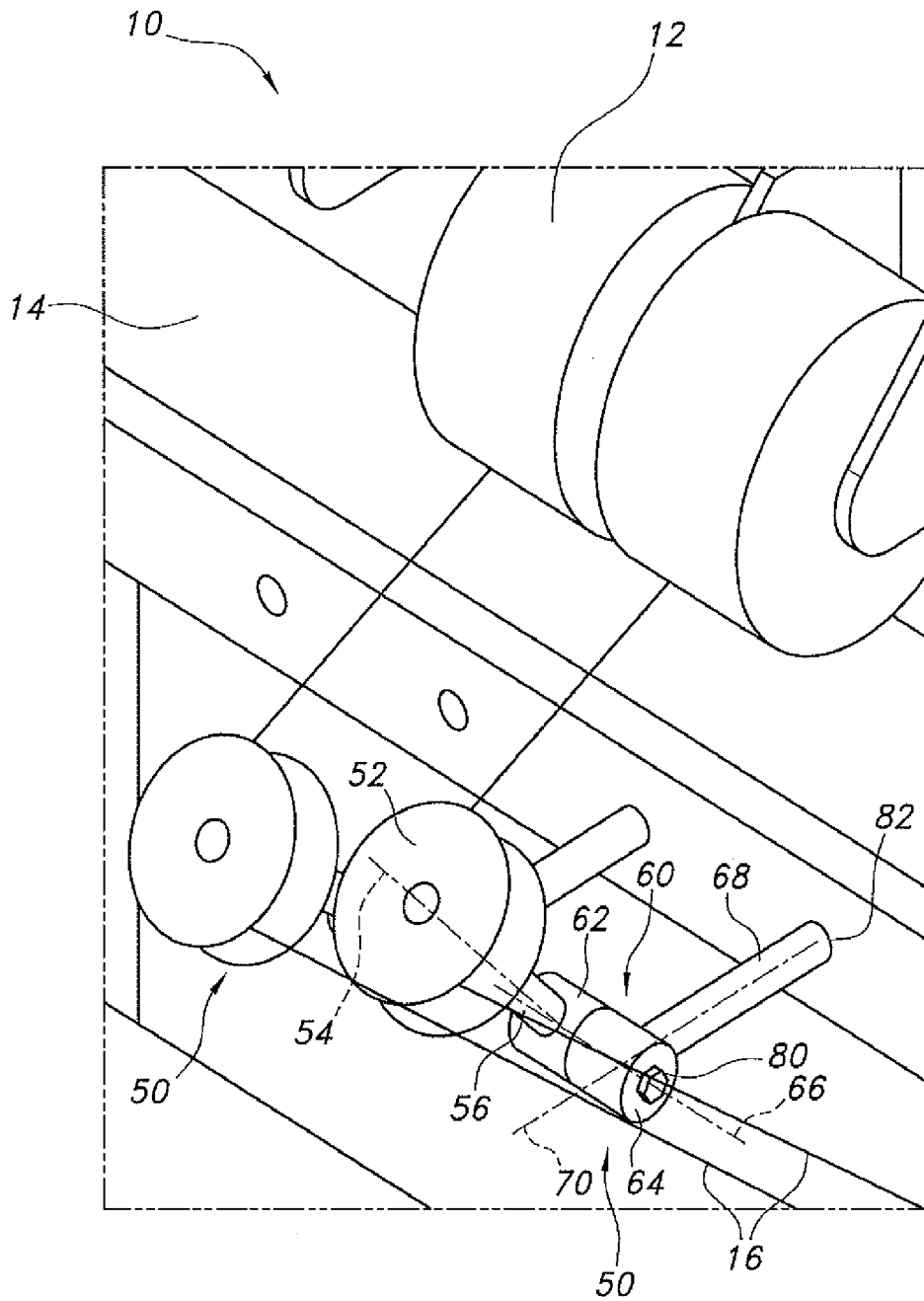


FIG. 2

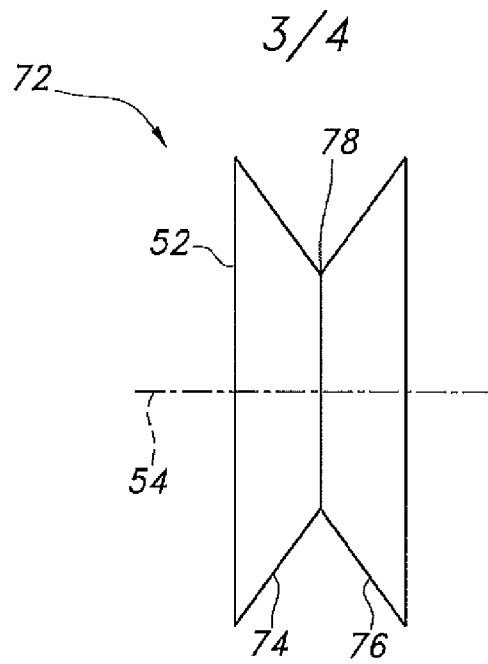


FIG. 2A

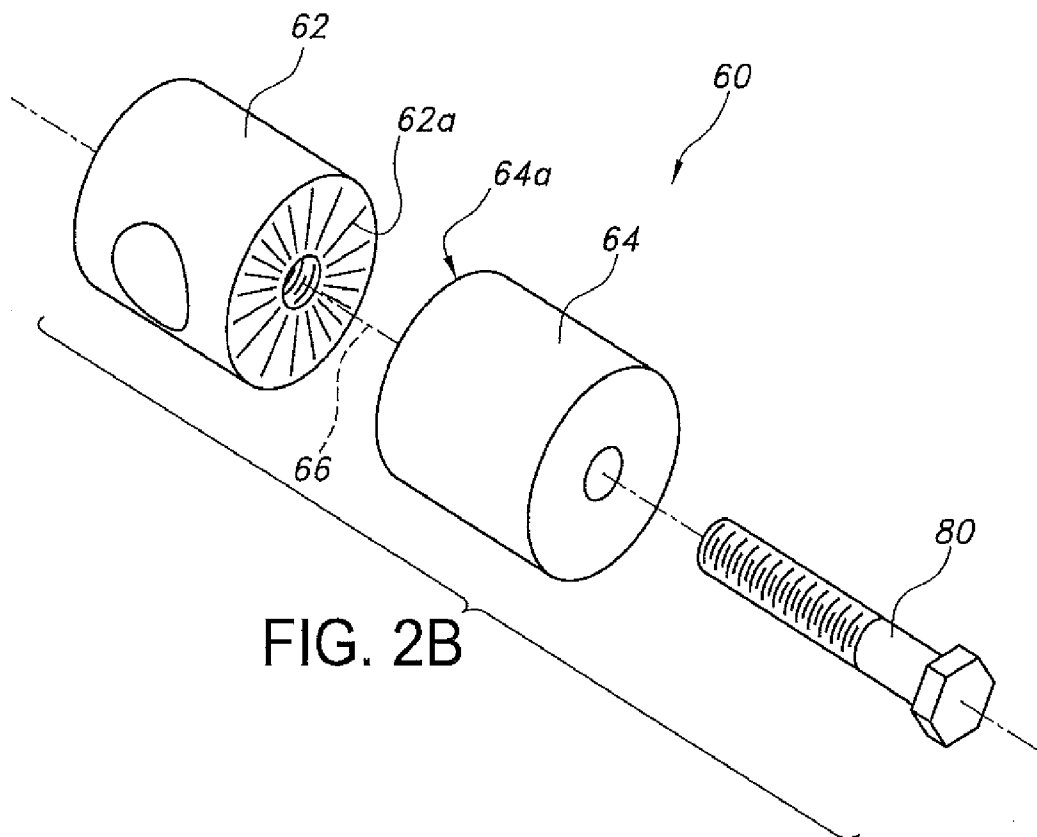


FIG. 2B

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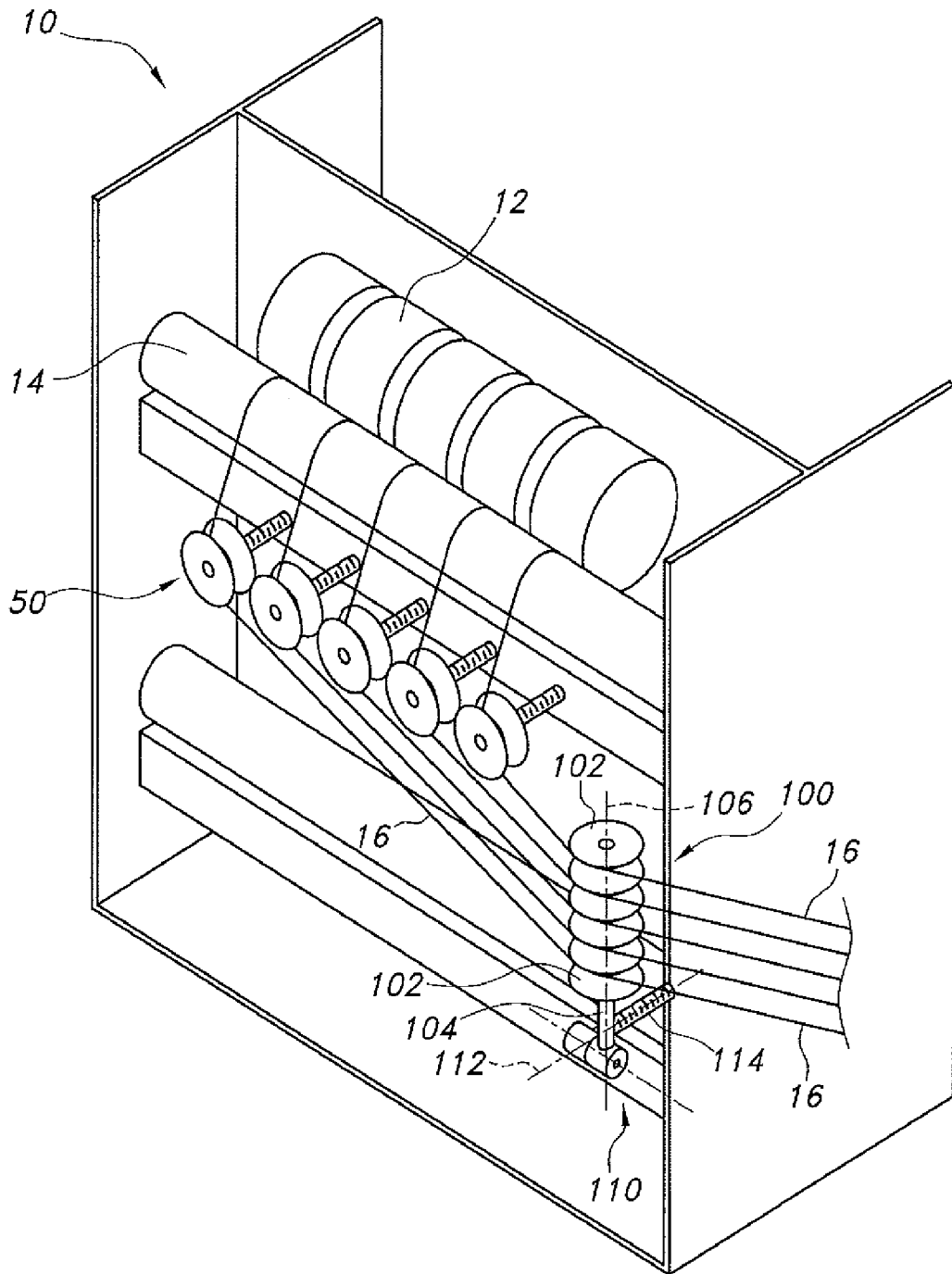


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/036956**A. CLASSIFICATION OF SUBJECT MATTER****B65H 57/14(2006.01)I, B65H 57/26(2006.01)I**

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)

B65H 57/14; B65H 57/28; B65H 51/32; F16C 19/54; B65H 57/00; B65H 54/00; B65H 57/04; F16C 32/06; B65H 57/26

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords:rolling guide, fiber strand, compound joint, channeled roller, fastener

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2015-0014473 A1 (MEADA, YOSHIYASU) 15 January 2015 See abstract, paragraphs [0035]-[0037], [0040], and figures 1, 2.	1-11
A	JP 09-263357 A (SANYO SEIKI K.K.) 07 October 1997 See abstract, paragraphs [0012]-[0015], and figures 1, 2.	1-11
A	JP 2000-072330 A (KYOCERA CORP.) 07 March 2000 See abstract, paragraphs [0017]-[0030], and figures 1, 2.	1-11
A	JP 09-014259 A (YUASA ITOMICHI KOGYO K.K.) 14 January 1997 See abstract, paragraphs [0015]-[0023], and figures 1, 2.	1-11
A	US 5564637 A (BERTHOLD et al.) 15 October 1996 See abstract, column 2, lines 11-36, and figure 1.	1-11



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/036956

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015-0014473 A1	15/01/2015	CN 104204319 A CN 104204319 B EP 2845934 A1 EP 2845934 A4 JP 05137151 B1 JP 2013-234391 A JP 5137151 B1 WO 2013-164920 A1	10/12/2014 10/02/2016 11/03/2015 02/12/2015 22/11/2012 21/11/2013 06/02/2013 07/11/2013
JP 09-263357 A	07/10/1997	None	
JP 2000-072330 A	07/03/2000	JP 3667108 B2	06/07/2005
JP 09-014259 A	14/01/1997	None	
US 5564637 A	15/10/1996	EP 0603841 A1 EP 0603841 B1 JP 06-278993 A JP 3423384 B2	29/06/1994 08/05/1996 04/10/1994 07/07/2003