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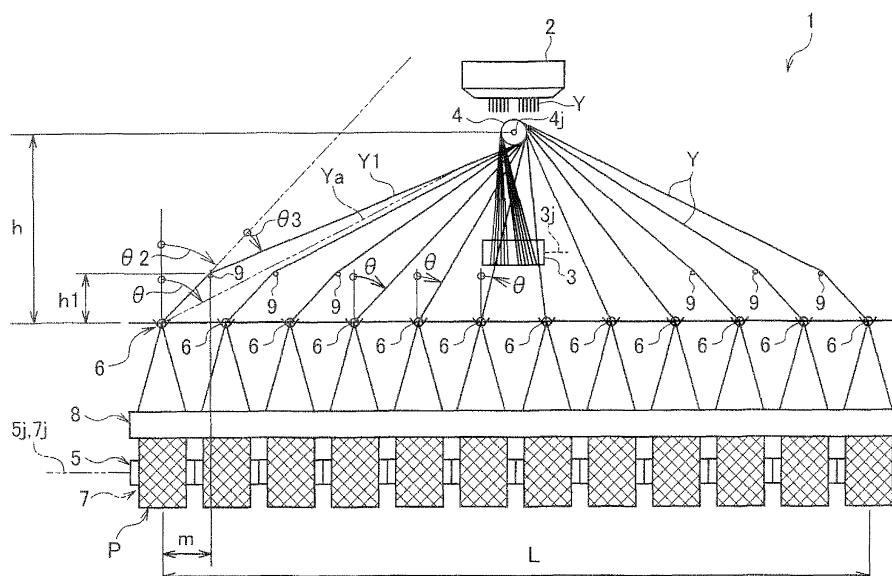
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(54) **Take-up winder**

(57) An object of the present invention is to set a bend angle  $\theta$  equal to or smaller than a management upper-limit bend angle  $\theta_k$  and to reduce the need to install a second godet roller at a higher position without the need to increase the number of guides. A take-up winder 1 includes a spinning section 2, a first godet roller 3 and a second godet roller 4 arranged in order along yarn paths of yarns Y spun by the spinning section 2, a bobbin holder 5 supporting a plurality of take-up bobbins 7 around which the respective yarns Y fed from the second godet roller 4 are wound, and a plurality of traverse support point

guides 6 each configured to set a traverse support point for traversing of the corresponding one of the yarns Y fed from the second godet roller 4. The plurality of winding bobbins 7 are coaxially supported by the bobbin holder 5. The axial direction 4j of the second godet roller 4 is set to be orthogonal to the axial direction 7j of the take-up bobbins 7. Each of the yarns Y bent at the respective traverse support point guides 6 by more than the management upper-limit bend angle  $\theta_k$  is bent by a close guide 9 provided upstream of and close to the corresponding traverse support point guide 6.

**FIGURE 3**



## Description

### Field of the Invention

**[0001]** The present invention relates to a take-up winder.

### Background of the Invention

**[0002]** In connection with techniques of this kind, the Examined Japanese Patent Application Publication (Tokko-Hei) No. 2-41490 refers to a conventional take-up winder. As shown in Figure 1 or the present application, the take-up winder sequentially winds synthetic filament yarns (hereinafter simply referred to as yarns) spun by a spinning section, around a first godet roller and a second godet roller in order. The take-up winder then uses traverse support point guides and reciprocating traverse guides to traverse the yarns fed from the second godet roller, while winding the yarns on winding bobbins. Thus, a plurality of packages are simultaneously formed.

**[0003]** Specifically, the winding bobbins are supported by a bobbin holder. The plurality of winding bobbins are juxtaposed along the axial direction of the winding bobbins. The juxtaposition direction of the winding bobbins is parallel to the axial direction of the second godet roller. To allow the yarns to be fed out from the second godet roller in a direction perpendicular to the axial direction of the second godet roller as seen in a front view in Figure 1A, a yarn path regulating guide is provided downstream side of and immediately close to the second godet roller to regulate the yarn paths of the yarns. The yarns having passed through the yarn path regulating guide spread radially as seen in the front view and eventually reach the respective traverse support point guides. The traverse guide reciprocates to traverse each of the yarns with respect to the winding bobbin, while winding the yarn around the winding bobbin. Eventually, a package is formed.

**[0004]** In the above-described configuration, the bend angle  $\theta$  of the yarn at each of the guides has a value varying with the guide. In particular, the bend angle  $\theta$  of the yarn at the traverse support point guide increases from the center of the bobbin holder toward the end of the bobbin holder in a direction in which the bobbin holder extends. This also applies to the bend angle of the yarn at the yarn path regulating guide.

**[0005]** To increase the number of packages simultaneously formed by one take-up winder to improve productivity, the length of the bobbin holder has recently tended to be further increased as shown in Figure 2. Thus, the bend angle  $\theta$  of the yarn at the traverse support point guide, corresponding to the end of the bobbin holder, has further been increased. On the other hand, an increase in bend angle  $\theta$  causes the quality of the yarn to be degraded. Thus, for operational reasons, the present applicant sets a predetermined upper limit value (for example, 15 degrees) for the bend angle  $\theta$  for man-

agement. That is, the above-described tendency to increase the length of the bobbin holder hinders implementation of a layout allowing the bend angle  $\theta$ , particularly the bend angle  $\theta$  of the yarn at the traverse support point guide, corresponding to the end of the bobbin holder, to be set equal to or smaller than the upper limit value (hereinafter referred to as a management upper-limit bend angle  $\theta_k$ )

**[0006]** Thus, as shown by an alternate long and two short dashes line in Figure 2, the yarn path regulating guide, located downstream side of and immediately close to the second godet roller, may be placed away from the traverse support point guides. That is, the second godet roller may be installed at a higher position. Then, as shown by reference numeral 02 in Figure 2, the bend angle  $\theta$  of the yarn at the traverse support point guide, corresponding to the end of the bobbin holder, can be set to such a small value as shown in Figure 1. However, installing the second godet roller at a higher position as described above increases the construction costs of a building in which the take-up winder is accommodated. This also degrades operability and reduces cooling and heating efficiency.

**[0007]** Thus, it is possible to add guides to the yarn paths of the yarns instead of installing the second godet roller at a higher position. This enables a reduction in the bend angle  $\theta$  of the yarn at each guide. However, in this case, the addition of the guide increases resistance to the travel of the yarn. Thus, the quality of the yarn may be degraded.

**[0008]** On the other hand, the Examined Japanese Patent Application Publication (Tokko-Hei) No. 2-41490 contains no reference to the bend angle of the yarn at the traverse support point guide.

**[0009]** Thus, there is no other way but to install the second godet roller at a higher position in order to increase the length of the bobbin holder under the precondition that the above-described bend angle  $\theta$  is set equal to or smaller than the management upper-limit bend angle  $\theta_k$  and that increasing the number of guides compared to that in the conventional example shown in Figure 1 is avoided, as described above. Consequently, a certain technical breakthrough is required.

**[0010]** The present invention has been developed in view of the above-described points. A main object of the present invention is to provide a technique for reducing the need to install the second godet roller at a higher position under the precondition that the bend angle  $\theta$  of the yarn at the guide is set equal to or smaller than the management upper-limit bend angle  $\theta_k$  and that increasing the number of guides compared to that in the conventional example shown in Figure 1 is avoided.

### Summary of the Invention

**[0011]** The problems to be solved by the present invention have been described. Now, means for solving the problems and the effects of the means will be de-

scribed.

**[0012]** An aspect of the present invention provides a take-up winder configured as described below. That is, the take-up winder includes a spinning section spinning a plurality of filament yarns, a first godet roller and a second godet roller arranged in order along yarn paths of the yarns spun by the spinning section to take off the yarns, a bobbin holder supporting a plurality of winding bobbins around which the respective yarns fed from the second godet roller are wound, and a plurality of traverse support point guides each configured to set a traverse support point for traversing of a corresponding one of the yarns fed from the second godet roller, with respect to the winding bobbin. The plurality of winding bobbins are coaxially supported by the bobbin holder. An axial direction of the second godet roller is set to be orthogonal to an axial direction of the winding bobbins supported by the bobbin holder. Each of the yarns bent at the respective traverse support point guides by more than a predetermined angle is bent by a guide provided upstream of and close to the corresponding traverse support point guide.

**[0013]** When the plurality of winding bobbins are coaxially supported by the bobbin holder as described above, some of the plurality of yarns traveling from the second godet roller toward the traverse support point guides may be bent at the traverse support point guides by more than the predetermined angle (management upper-limit bend angle) determined in view of the quality of the yarns. Thus, such yarns can be bent by the respective guides provided upstream side of and close to the corresponding traverse support point guides. This allows the bend angle of each of the yarns at the corresponding traverse support point guide to be set equal to or smaller than the management upper-limit bend angle.

**[0014]** Furthermore, because of the presence of the bend angle of the yarn at the guide provided upstream side of and close to the traverse support point guide in addition to the bend angle of the yarn at the traverse support point guide, in broad perspective, the yarn appears to be bent by more than the management upper-limit bend angle, thus enabling a reduction in the height of the installation position of the second godet roller. Furthermore, the actual yarn is bent in two stages by the traverse support point guide and the guide provided upstream side of and close to the traverse support point guide, and each bend angle does not exceed the management upper-limit bend angle. Thus, the yarn quality is prevented from being degraded. For example, it is assumed that both the bend angle of the yarn at the traverse support point guide and the bend angle of the yarn at the above-described guide are set equal to the management upper-limit bend angle. Then, since the above-described guide is located upstream side of and "close" to the traverse support point guide, the yarn appears, in broad perspective, to be bent at the traverse support point guide by an angle that is double the management upper-limit bend angle.

**[0015]** Furthermore, the axial direction of the second godet roller is different, by 90 degrees, from that in the conventional example shown in Figure 1. This eliminates the need for the yarn path regulating guide provided in the conventional example.

**[0016]** Additionally, even though the need for the yarn path regulating guide is eliminated, the number of guides allowing the yarn to be bent need not be increased compared to that in the conventional example shown in Figure 1. Thus, in terms of the resistance of the guide to the yarn, the quality of the yarn is prevented from being degraded.

**[0017]** As described above, the above-described configuration meets the precondition that the bend angle  $\theta$  of the yarn at the guide is set equal to or smaller than the management upper-limit bend angle  $\theta_k$  and that increasing the number of guides compared to that in the conventional example shown in Figure 1 is avoided. The above-described configuration can still reduce the need to install the second godet roller at a higher position.

**[0018]** Furthermore, the reduced need to install the second godet roller at a higher position collaterally alleviate the following problems: increased construction costs of the building in which the take-up winder is accommodated, degraded operability, reduced cooling and heating efficiency, and the like.

**[0019]** The above-described take-up winder is further configured as follows. An interlace nozzle is provided between the second godet roller and each of the traverse support point guides to interlace the yarn. The interlace nozzle includes a nozzle main body interlacing the yarn and paired nozzle guides arranged to sandwich the nozzle main body therebetween. One of the paired nozzle guides is used as the guide. The other of the paired nozzle guides is not used to bend the yarn. This configuration has the advantage of being able to reduce the number of guides in the configuration into which the interlace nozzles are introduced. Furthermore, since the other of the paired nozzle guides is not used to bend the yarn, increasing the number of guides compared to that in the conventional example shown in Figure 1 is avoided. Thus, in terms of the resistance of the guide to the yarn, the quality of the yarn is prevented from being degraded.

**[0020]** The above-described take-up winder is further configured as follows. For each of the yarns bent at the respective traverse support point guides by at most the predetermined angle, a yarn tension applying guide applying tension to the yarn is provided. That is, the yarns bent at the respective traverse support point guides by at most the predetermined angle may be subjected to an insufficient tension. Thus, the above-described configuration allows the tension of the yarn to be compensated for. Furthermore, even though the need for the yarn path regulating guide is eliminated, the number of guides allowing the yarn to be bent need not be increased compared to that in the conventional example shown in Figure 1. Thus, in terms of the resistance of the guide to the yarn, the quality of the yarn is prevented from being de-

graded.

**[0021]** The above-described take-up winder is further configured as follows. For the yarns bent at the traverse support point guides by at most the predetermined angle, the guide is not provided. In this manner, this configuration positively avoids providing the guides for the yarns that do not necessarily require the guides. This configuration enables a reduction in the number of guides compared to that in the conventional example shown in Figure

1. Thus, the manufacture costs of the take-up winder can be reduced.

Other features, elements, processes, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the present invention with reference to the attached drawings.

#### Brief Description of the Drawings

##### **[0022]**

Figure 1A is a front view of a take-up winder in a conventional example, and Figure 1B is a side view of the take-up winder in the conventional example. Figure 2 is a front view of a take-up winder having a tendency to have the size thereof increased.

Figure 3 is a front view of a take-up winder according to a first embodiment of the present invention.

Figure 4 is a front view of a take-up winder according to a second embodiment of the present invention.

Figure 5 is a front view of a take-up winder according to a third embodiment of the present invention.

Figure 6 is a diagram showing the appearance of a guide.

#### Detailed Description of the Preferred Embodiments

##### <First Embodiment>

**[0023]** A first embodiment of the present embodiment will be described below with reference to the drawings. Figure 3 is a front view of a take-up winder according to the first embodiment of the present invention. As shown in Figure 3, the take-up winder 1 according to the present embodiment includes a spinning section 2, a first godet roller 3 and a second godet roller 4, a bobbin holder 5, and traverse support point guides 6 as main components.

**[0024]** The spinning section 2 spins a plurality of filament yarns Y. In the present embodiment, the yarns Y are synthetic filament yarns. In the present embodiment, the spinning section 2 is configured to simultaneously spin 12 yarns.

**[0025]** The first godet roller 3 and the second godet roller 4 are arranged in order along the yarn paths of the yarns Y spun by the spinning section 2. The first godet roller 3 and the second godet roller 4 thus take off the yarns Y.

**[0026]** Specifically, the first godet roller 3 is located below the spinning section 2 in the vertical direction. The first godet roller 3 is installed as follows in order to allow the plurality of yarns Y spun by the spinning section 2 to be wound around the first godet roller 3 while keeping parallel to one another. That is, the first godet roller 3 is installed such that the axial direction 3j thereof is parallel to the planar direction of a spinning plane that can be defined as a plane containing all the yarn paths of the plurality of yarns Y spun by the spinning section 2 and that the axial direction 3j corresponds to the horizontal direction.

**[0027]** The second godet roller 4 is located above the first godet roller 3 so that the axial direction 4j of the second godet roller 4 is orthogonal to the axial direction 3j of the first godet roller 3 and corresponds to the horizontal direction. In other words, the axial direction 3j of the first godet roller 3 is in an orthogonal relationship with the axial direction 4j of the second godet roller 4 as seen in a plan view of the yarn winder 1. Thus, the inter-godet yarn traveling plane that can be defined by the plurality of yarns between the first godet roller 3 and the second godet roller 4 is twisted by 90 degrees in an S twist (or Z twist) direction as the yarns Y travel from the first godet roller 3 to the second godet roller 4.

**[0028]** The bobbin holder 5 rotatably supports a plurality of (in the present embodiment, 12) take-up bobbins 7 (winding bobbins) around which the yarns Y fed from the second godet roller 4 are wound. Specifically, the bobbin holder 5 rotatably supports the plurality of take-up bobbins 7 so as to coaxially arrange that the plurality of take-up bobbins 7 at predetermined equal intervals in the axial direction 7j of the take-up bobbins 7. Furthermore, in the present embodiment, the axial direction 5j of the bobbin holder 5 is set to be parallel to the axial direction 3j of the first godet roller 3 and to correspond to the horizontal direction. Thus, the axial direction 5j of the bobbin holder 5 according to the present embodiment is set to be orthogonal to the axial direction 4j of the second godet roller 4 and to correspond to the horizontal direction. In other words, the axial direction 4j of the second godet roller 4 is orthogonal to the axial direction 7j of the plurality of take-up bobbins 7 supported by the bobbin holder 5 as seen in a plan view of the take-up winder 1.

**[0029]** The traverse support point guides 6 are arranged between the second godet roller 4 and the take-up bobbins 7 to set traverse support points for traversing of the yarns Y fed from the second godet roller 4 with respect to the take-up bobbins 7. Specifically, a plurality of the traverse support point guides 6 are juxtaposed in the same direction as the axial direction 5j of the bobbin holder 5 on a one-to-one relationship with the take-up bobbins 7. Each of the traverse support point guides 6 is configured to completely enclose the periphery of the traveling yarn Y, for example, as shown in Figure 6B so as to prevent the yarn Y from slipping out from the guide during traversing.

**[0030]** The take-up winder 1 further includes a traverse device (not shown in the drawings) and a friction roller 8 compressed against the take-up bobbins 7 (or packages P; this also applies to the description below) to rotate the take-up bobbins 7. The traverse device traverses the yarns Y guided from the second godet roller 4 to the traverse support point guides 6; the traversing is carried out on the downstream side of the traverse support point guides 6 with respect to the take-up bobbins 7. The traverse device includes a traverse guide (not shown in the drawings) reciprocated along the axial direction 5j of the take-up bobbins 7 to traverse the yarns Y hooked on the traverse guide with respect to the take-up bobbins 7. The friction roller 8 is located parallel to the axial direction 5j of the bobbin holder 5.

**[0031]** In the above-described configuration, the yarns Y in the take-up winder 1 according to the present embodiment follow the path described below. The yarns fed out from the spinning section 2 are wound around the first godet roller 3 and the second godet roller 4 in order. The plurality of yarns Y fed out from the second godet roller 4 are radially guided toward the traverse support point guides 6 scattered around over a wide range in the lateral direction of the drawing. Each of the yarns Y guided to the traverse support point guide 6 is wound on the take-up bobbin 7 while being traversed by the traverse device (not shown in the drawings). As a result, a package P with a predetermined shape and a predetermined size is formed on each of the take-up bobbins 7.

**[0032]** Now, a management upper-limit bend angle  $\theta_k$  will be described. An increase in the bend angle  $\theta$  of the yarn Y at the guide causes the quality of the yarn Y to be more severely degraded by the bending. Consequently, the bend angle  $\theta$  of the yarn Y at the guide cannot be set to a random large value. Thus, in order to ensure the quality of the yarn Y, the present applicant sets a predetermined upper limit value for the bend angle  $\theta$  of the yarn Y at the guide. The upper limit value is hereinafter referred to as the management upper-limit bend angle  $\theta_k$ . The present applicant sets the management upper-limit bend angle  $\theta_k$  to, for example, 15 degrees.

**[0033]** The take-up winder 1 according to the present embodiment further includes close guides 9 (guides). The close guides 9 will be described below in detail.

**[0034]** In the present embodiment, the second godet roller 4 is located at a position corresponding to the center of the bobbin holder 5 in the axial direction 5j of the bobbin holder 5, that is, in the direction in which the bobbin holder 5 extends. Thus, in regards to the bend angle  $\theta$ , at the traverse support point guide 6, of the yarn Y guided from the second godet roller 4 toward the corresponding traverse support point guide 6, the bend angle  $\theta$  corresponding to the end of the bobbin holder 5 in the extending direction thereof is larger than that  $\theta$  corresponding to the center of the bobbin holder 5 in the extending direction thereof. In the present embodiment, the bend angle  $\theta$  of the yarn Y is particularly large at the first, second, third traverse support point guides 6 from the left end of

the sheet of the drawing and at the first, second, third traverse support point guides 6 from the right end of the sheet of the drawing. Only the bend angles  $\theta$  of the yarn Y at the six traverse support point guides 6 exceed the management upper-limit bend angle  $\theta_k$ .

**[0035]** Thus, in the present embodiment, for the yarns Y bent at the respective traverse support point guides 6 by particularly large bend angles  $\theta$  exceeding the management Upper-limit angle  $\theta_k$ , the close guide 9 is provided upstream side of and close to the traverse support point guide 6 and used to bend the yarn Y. In other words, the bend angle  $\theta$  set by the bending at the traverse support point guide 6 is shared by bending at the traverse support point guide 6 and bending at the close guide 9. That is, in Figure 3, the relationship  $\theta = \theta_2 + \theta_3$  holds true. The relationship  $\theta > \theta_k$  holds true, and  $\theta_2$  is the bend angle  $\theta$  of the yarn Y at the traverse support point guide 6 reduced by the presence of the close guide 9. Thus,  $\theta_2 \leq \theta_k$  holds true.  $\theta_3$  is the bend angle  $\theta$  of the yarn Y at the close guide 9, and the relationship  $\theta_3 \leq \theta_k$  holds true. For example, as shown in Figure 6A the traverse support point guide 6 is configured as a U-shaped ceramic guide not completely enclosing the periphery of the traveling yarn Y. In the present embodiment, the close guide 6 is not provided on the upstream side of the other traverse support point guides 6.

**[0036]** More specifically, in the present embodiment, the relationships  $\theta_2 = \theta_k$  and  $\theta_3 = \theta_k$  hold true. Here, the horizontal distance from the first of the plurality of traverse support point guides 6 from the left end of the sheet of the drawing to the first traverse support point guide 6 from the right end of the sheet of the drawing is defined as L. The horizontal distance from the first of the plurality of traverse support point guides 6 from the left end of the sheet of the drawing to the close guide 9 provided for the yarn Y guided to the first traverse support point guide 6 is defined as (m). The vertical distance from the first traverse support point guide 6 from the left end to the corresponding close guide 9 is defined as h1. The vertical distance from the plurality of traverse support point guides 6 to the second godet roller 4 is defined as (h). Then, the relationships  $h_1 = m/\tan\theta_2 = m/\tan\theta_k$  and  $h - h_1 = (L/2 - m)/\tan(\theta_2 + \theta_3) = (L/2 - m)/\tan(2 \times \theta_k)$  hold true. Substituting the right side of the first expression into the second expression results in the relationship  $h = (L/2 - m)/\tan(2 \times \theta_k) + m/\tan\theta_k$ . In the present embodiment, the close guide 9 is provided "close" to the first of the plurality of traverse support point guides 6 from the left end of the sheet of the drawing. Thus, in broad perspective, in the above-described expressions, it is possible to consider that  $m \approx 0$ . Consequently, the above-described expression can be rewritten as  $h = (L/2)/\tan(2 \times \theta_k)$ . Here, when  $\theta_k$  is about 15 degrees, it is possible to consider that  $\tan(2\theta_k) \approx 2 \times \tan\theta_k$ . Thus, the expression shown above can further be rewritten as  $h = (L/2)/\tan\theta_k/2$ . On the other hand, if the close guide 9 is not provided, the relationship  $h = (L/2)/\tan\theta_k$  holds true. These expressions indicate that in the present embodiment, the presence of the close

guide 9 enables (h) to be reduced to substantially half compared to the case in which the close guide 9 is not provided. In this discussion, the magnitude of (h) has been considered based on the first of the plurality of traverse support point guides 6 from the left end of the sheet of the drawing. However, the traverse support point guides 6 are most dominant in connection with the need to ensure the height (h). Thus, it should be appreciated that the above discussion is sufficient in considering the need to ensure the appropriate height for the installation position of the second godet roller.

**[0037]** As described above, in the above-described embodiment, the take-up winder 1 is configured as follows. The take-up winder 1 includes the spinning section 2 spinning the plurality of yarns Y, the first godet roller 3 and second godet roller 4 arranged in order along the yarn paths of the yarns Y spun by the spinning section 2 to take off the yarns Y, the bobbin holder 5 supporting the plurality of take-up bobbins 7 around which the respective yarns Y fed from the second godet roller 4 are wound, and the plurality of traverse support point guides 6 each configured to set the traverse support point for traversing of the corresponding one of the yarns Y fed from the second godet roller 4, with respect to the take-up bobbin 7. The plurality of take-up bobbins 7 are co-axially supported by the bobbin holder 5. The axial direction 4j of the second godet roller 4 is set to be orthogonal to the axial direction 7j of the take-up bobbins 7 supported by the bobbin holder 5. Each of the yarns Y bent at the respective traverse support point guides 6 by more than the management upper-limit bend angle  $\theta_k$  is bent by the close guide 9 provided upstream of and close to the corresponding traverse support point guide 6.

**[0038]** When the plurality of take-up bobbins 7 are co-axially supported by the bobbin holder 5 as described above, any of the plurality of yarns Y traveling from the second godet roller 4 toward the traverse support point guides 6 may be bent at the traverse support point guides 6 by more than the management upper-limit bend angle  $\theta_k$  determined in view of the quality of the yarns Y. Thus, such yarns Y are bent by the respective close guide 9 provided upstream side of and close to the corresponding traverse support point guide 6. This allows the bend angle  $\theta$  of each of the yarns Y at the corresponding traverse support point guide 6 to be set equal to or smaller than the management upper-limit bend angle  $\theta_k$ .

**[0039]** Furthermore, because of the presence of the bend angle  $\theta$  of the yarn Y at the close guide 9 provided upstream side of and close to the traverse support point guide 6 in addition to the bend angle  $\theta$  of the yarn Y at the traverse support point guide 6, in broad perspective, the yarn Y appears to be bent by more than the management upper-limit bend angle  $\theta_k$ , thus enabling a reduction in the height of the installation position of the second godet roller 4. In broad perspective, the leftmost yarn Ya shown by an alternate long and two short dashes line in Figure 3 appears to be bent, at the traverse support point guide 6, by bend angle  $\theta$  exceeding the management

upper-limit bend angle  $\theta_k$ . However, the actual yarn (the yarn Y1 shown by a solid line) is bent in two stages (02, 03) by the traverse support point guide 6 and the guide 9 provided upstream side of and close to the traverse support point guide 6, and each bend angle does not exceed the management upper-limit bend angle  $\theta_k$ .

Thus, the yarn quality is prevented from being degraded. For example, it is assumed that both the bend angle 02 of the yarn Y at the traverse support point guide 6 and the bend angle 03 of the yarn Y at the close guide 9 are set equal to the management upper-limit bend angle  $\theta_k$ . Then, since the close guide 9 is located upstream side of and "close" to the traverse support point guide 6, the yarn Y appears, in broad perspective, to be bent at the traverse support point guide 6 by an angle that is double the management upper-limit bend angle  $\theta_k$ .

**[0040]** Furthermore, the axial direction of the second godet roller 4 is different, by 90 degrees, from that in the conventional example shown in Figure 1. This eliminates the need for the yarn path regulating guide provided in the conventional example.

**[0041]** Additionally, even though the need for the yarn path regulating guide is eliminated, the number of guides allowing the yarn Y to be bent need not be increased compared to that in the conventional example shown in Figure 1. Thus, in terms of the resistance of the guide to the yarn Y, the quality of the yarn Y is prevented from being degraded.

**[0042]** As described above, the above-described configuration meets the precondition that the bend angle  $\theta$  of the yarn Y at the guide is set equal to or smaller than the management upper-limit bend angle  $\theta_k$  and that increasing the number of guides compared to that in the conventional example shown in Figure 1 is avoided. The above-described configuration can still reduce the need to install the second godet roller 4 at a higher position.

**[0043]** Furthermore, the reduced need to install the second godet roller 4 at a higher position collaterally alleviates the following problems: increased construction costs of the building in which the take-up winder 1 is accommodated, degraded operability, reduced cooling and heating efficiency, and the like.

**[0044]** Additionally, the above-described configuration reduces the distance between the second godet roller 4 and the traverse support point guide 6 over which the yarn Y travels. This makes the quality of the yarn Y unlikely to be degraded by wind or the like.

**[0045]** In the above-described embodiment, the axial direction 4j of the second godet roller 4 is set to be orthogonal to the axial direction 7j of the take-up bobbins 7 supported by the bobbin holder 5. However, since the second godet roller 4 is located away from the take-up bobbins 7 in the vertical direction as is apparent from Figure 3, the axial direction 4j of the second godet roller 4 does not cross the axial direction 7j of the take-up bobbins 7. On the other hand, in a plan view of the take-up winder 1, the axial direction 4j of the second godet roller 4 is orthogonal to the axial direction 7j of the take-up

bobbins 7. Under these circumstances, the term "orthogonal" in the specification is interpreted as follows. The expression "an axial direction B is orthogonal to an axial direction A" means "in a visual field extending in a direction orthogonal to the axial direction A (in the above-described embodiment, this corresponds to, for example, the case in which the take-up winder 1 is seen in a plan view), the axial direction A appears to be orthogonal to the axial direction B".

**[0046]** Furthermore, the above-described take-up winder 1 is further configured as follows. For the yarns Y bent at the respective traverse support point guides 6 by at most the management upper-limit bend angle  $\theta_k$ , the close guide 9 is not provided. In this manner, this configuration positively avoids providing the close guides 9 for the yarns that do not necessarily require the close guides 9.

This configuration enables a reduction in the number of guides compared to that in the conventional example shown in Figure 1. Thus, the manufacture costs of the take-up winder 1 can be reduced.

**[0047]** The preferred first embodiment has been described above. However, the above-described embodiment may be varied as follows.

**[0048]** (1) For example, the following positional relationships are not limited to those illustrated in the above-described embodiment: the relative positional relationship between the spinning section 2 and the first godet roller 3, the relative positional relationship between the first godet roller 3 and the second godet roller 4, and the relative positional relationship between the spinning section 2 and the second godet roller 4.

**[0049]** (2) The types of the guides are not limited to those illustrated above.

**[0050]** (3) The number of take-up bobbins 7 simultaneously supported by the bobbin holder 5 may be smaller or larger than 12, which is the illustrated number; the number may be, for example, 8, 10, or 16.

**[0051]** (4) The yarns Y are synthetic filament yarns but may instead be natural fiber yarns.

**[0052]** (5) The close guide 9 may be provided for all the yarns Y.

#### <Second Embodiment>

**[0053]** Now, a second embodiment of the present invention will be described with reference to Figure 4. Figure 4 is a front view of a take-up winder according to the second embodiment of the present invention. Differences between the present embodiment and the first embodiment will mainly be described, and duplicate descriptions are appropriately omitted.

**[0054]** As shown in Figure 4, the bend angle  $\theta$  of each of the yarns Y at the traverse support point guides 6 other than the following do not exceed the management upper-limit bend angle  $\theta_k$ : the first, second, and third traverse support point guides 6 from the left end of the sheet of the drawing and the first, second, and third traverse sup-

port point guides 6 from the right end of the sheet of the drawing. In the above-described first embodiment, the close guide 9 is not provided for the yarns Y guided by and bent at the above-described traverse support point guides 6 by at most the management upper-limit bend angle  $\theta_k$ . In the present embodiment, the close guide 9 is also not provided for the yarns Y guided by and bent at the above-described traverse support point guides 6 by at most the management upper-limit bend angle  $\theta_k$ .

**[0055]** However, in the present embodiment, unlike in the case of the above-described first embodiment, yarn tension applying guides 10 are provided for the respective yarns Y guided by and bent at the above-described traverse support point guides 6 by at most the management upper-limit bend angle  $\theta_k$ , in order to apply tension to the respective yarns Y. Specifically, the yarn tension applying guides 10 are provided for the respective yarns Y guided by the four centrally-arranged traverse support point guides 6 in order to apply tension to the respective yarns Y.

**[0056]** Specifically, for example, as shown in Figure 6A each of the yarn tension applying guides 10 is configured as a U-shaped ceramic guide that does not completely enclose the periphery of the traveling yarn Y. The yarn tension applying guide 10 is provided at any point between the second godet roller 4 and the corresponding traverse support point guide 6. That is, the yarn tension applying guide 10 is provided, for example, upstream side of and close to the traverse support point guide 6 or downstream side of and close to the second godet roller 4 or exactly midway between the second godet roller 4 and the traverse support point guide 6. Moreover, the yarn tension applying guide 10 is provided on a plane defined to contain the yarn paths of the yarns Y for which the close guides 9 are provided, or on a plane different from the above-described plane. The yarn tension applying guide 10 is located so as to slightly bend the yarn path of the yarn Y. Specifically, the yarn tension applying guide 10 is located so as to bend the yarn path of the yarn Y by, for example, 1 to 5 degrees. The bending at the yarn tension applying guide 10 applies an appropriate tension to the yarn Y hooked on the yarn tension applying guide 10.

**[0057]** As described above, in the present embodiment, the above-described take-up winder 1 is further configured as follows. For each of the yarns Y bent at the respective traverse support point guides 6 by at most the management upper-limit bend angle  $\theta_k$ , the yarn tension applying guide 10 applying tension to the yarn Y is provided. That is, the yarns Y for which the bend angle  $\theta$  at the respective traverse support point guides 6 is at most the management upper-limit bend angle  $\theta_k$  may be subjected to an insufficient tension. Thus, the above-described configuration allows the tension of the yarn Y to be compensated for. Furthermore, even though the need for the yarn path regulating guide is eliminated, the number of guides allowing the yarn to be bent need not be increased compared to that in the conventional ex-

ample shown in Figure 1. Thus, in terms of the resistance of the guide to the yarn Y, the quality of the yarn is prevented from being degraded.

<Third Embodiment>

**[0058]** Now, a third embodiment of the present invention will be described. Figure 5 is a front view of a take-up winder according to a third embodiment of the present invention. Differences between the present embodiment and the first embodiment will mainly be described, and duplicate descriptions are appropriately omitted.

**[0059]** Unlike in the case of the above-described first embodiment, in the present embodiment, interlace nozzles 11 are each provided between the second godet roller 4 and the corresponding traverse support point guide 6 to interlace the corresponding yarn Y. The interlace nozzle 11 includes a nozzle main body 12 interlacing the yarn Y, and paired nozzle guides 13a, 13b arranged so as to sandwich the nozzle main body 12 therebetween. The nozzle guides 13a, 13b inhibit the yarn Y traveling through the nozzle main body 12 from flapping. For example, as shown in Figure 6A each of the nozzle guides 13a, 13b is configured as a U-shaped ceramic guide that does not completely enclose the periphery of the traveling yarn Y. The upstream side nozzle guide 13a of the paired nozzle guides 13a, 13b is used as the close guide 9. The other nozzle guide 13b of the paired nozzle guides 13 is not used to bend the yarn Y. That is, the nozzle guide 13b only lies along the yarn path of the yarn Y.

**[0060]** As described above, in the above-described embodiment, the take-up winder 1 is further configured as follows. The interlace nozzle 11 is provided between the second godet roller 4 and each of the traverse support point guides 6 to interlace the yarn Y. The interlace nozzle 11 includes the nozzle main body 12 interlacing the yarn Y and the paired nozzle guides 13a, 13b arranged to sandwich the nozzle main body 12 therebetween. The upstream side nozzle guide 13a of the paired nozzle guides 13a, 13b is used as the close guide 9. The downstream side nozzle guide 13b of the paired nozzle guides 13 is not used to bend the yarn Y. This configuration has the advantage of being able to reduce the number of guides in the configuration into which the interlace nozzles 11 are introduced. Furthermore, since the downstream side nozzle guide 13b of the paired nozzle guides 13a, 13b is not used to bend the yarn Y, increasing the number of guides compared to that in the conventional example shown in Figure 1 is avoided. Thus, in terms of the resistance of the guide to the yarn Y, the quality of the yarn Y is prevented from being degraded.

**[0061]** The preferred third embodiment has been described above. However, the above-described embodiment may be varied as follows.

**[0062]** For example, instead of using the upstream side nozzle guide 13a of the paired nozzle guides 13a, 13b as the close guide 9, it is possible to use the downstream

side nozzle guide 13b of the nozzle guides 13a, 13b as the close guide 9.

While the present invention has been described with respect to preferred embodiments thereof, it will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than those specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the present invention that fall within the scope of the invention.

## Claims

1. A take-up winder **characterized by** comprising:
  - a spinning section spinning a plurality of filament yarns;
  - a first godet roller and a second godet roller arranged in order along yarn paths of the yarns spun by the spinning section to take off the yarns;
  - a bobbin holder supporting a plurality of winding bobbins around which the respective yarns fed from the second godet roller are wound; and
  - a plurality of traverse support point guides each configured to set a traverse support point for traversing of a corresponding one of the yarns fed from the second godet roller, with respect to the winding bobbin, and
- in that the plurality of winding bobbins are coaxially supported by the bobbin holder,
  - an axial direction of the second godet roller is set to be orthogonal to an axial direction of the winding bobbins supported by the bobbin holder, and
  - each of the yarns bent at the respective traverse support points guide by more than a predetermined angle is bent by a guide provided upstream of and close to the corresponding traverse support point guide.
2. The take-up winder according to Claim 1, **characterized in that** an interlace nozzle is provided between the second godet roller and each of the traverse support point guides to interlace the yarn, the interlace nozzle comprises a nozzle main body interlacing the yarn and paired nozzle guides arranged to sandwich the nozzle main body therebetween,
  - one of the paired nozzle guides is used as the guide, and
  - the other of the paired nozzle guides is not used to bend the yarn.
3. The take-up winder according to Claim 1 or Claim 2, **characterized in that** for each of the yarns bent at the respective traverse support point guides by at most the predetermined angle, a yarn tension apply-

ing guide applying tension to the yarn is provided.

4. The take-up winder according to any one of Claims 1 to 3, **characterized** 5  
**in that** for the yarns bent at the respective traverse support point guides by at most the predetermined angle, the guide is not provided.

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FIGURE 1B

SIDE VIEW

CONVENTIONAL EXAMPLE

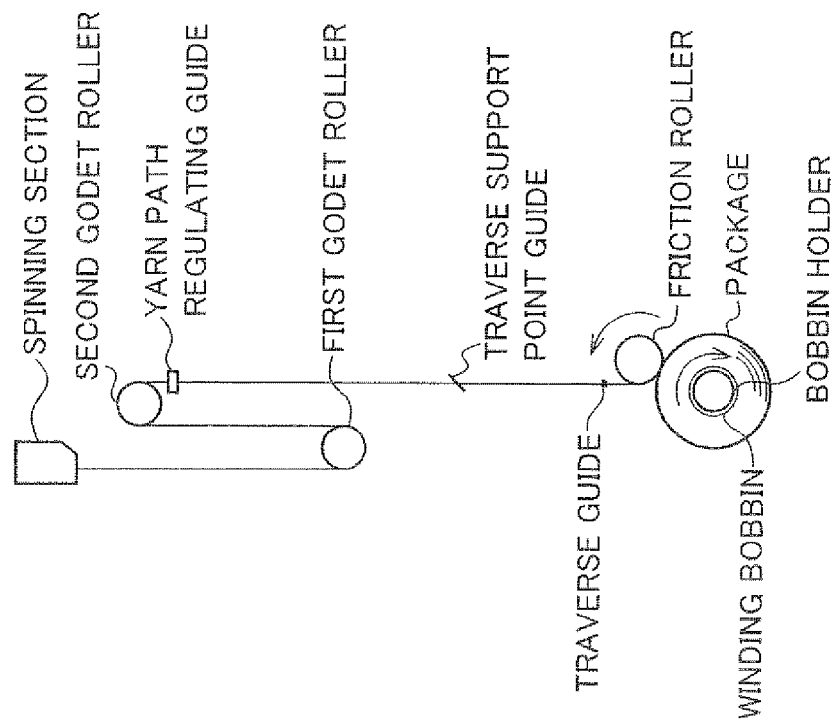


FIGURE 1A

FRONT VIEW

CONVENTIONAL EXAMPLE

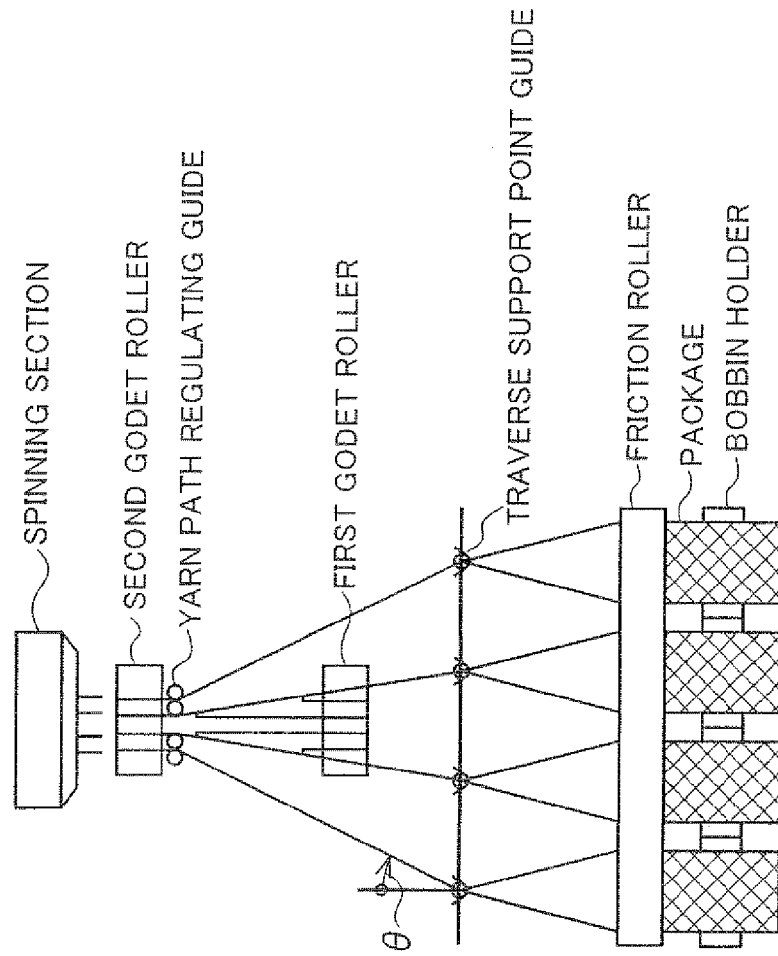


FIGURE 2

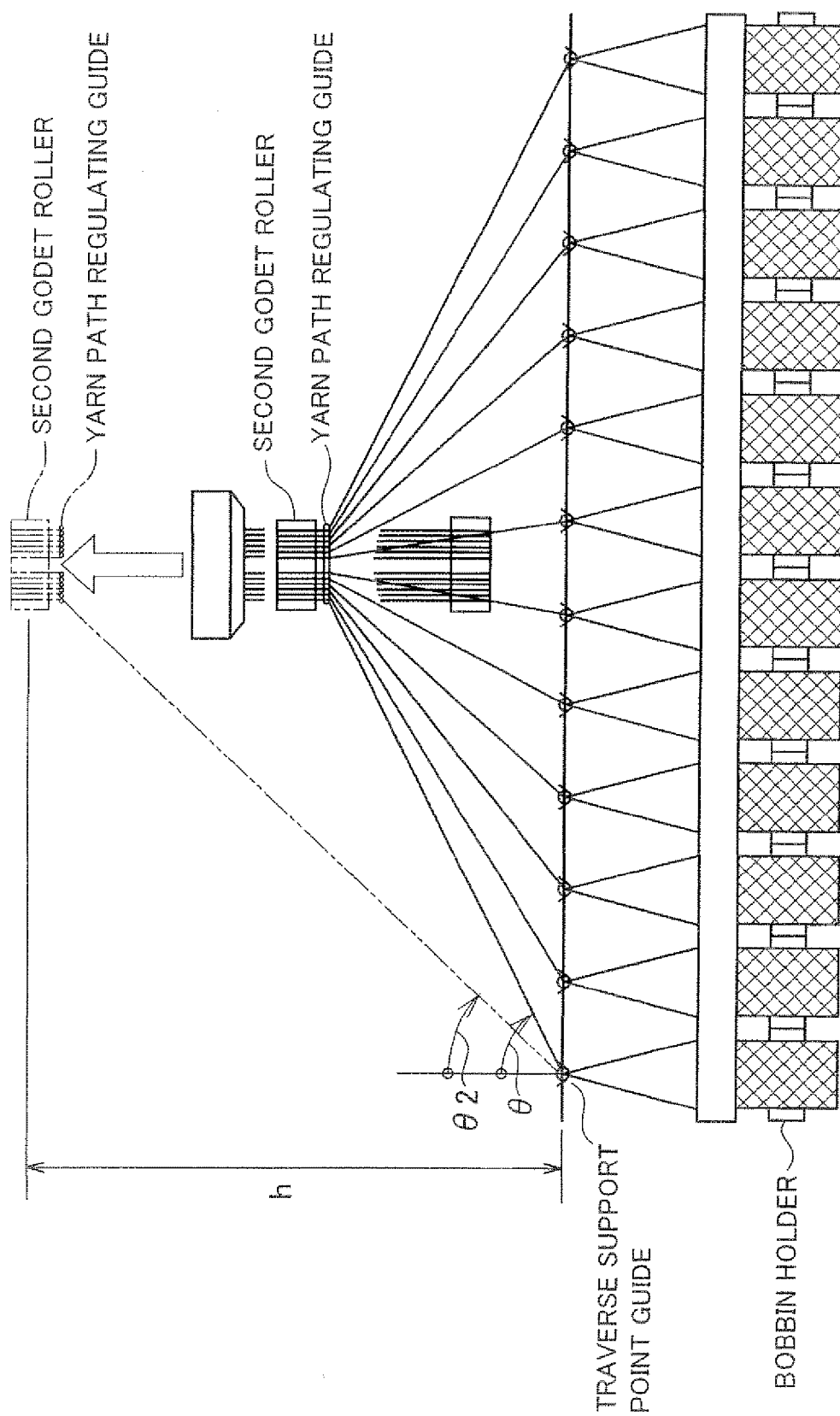
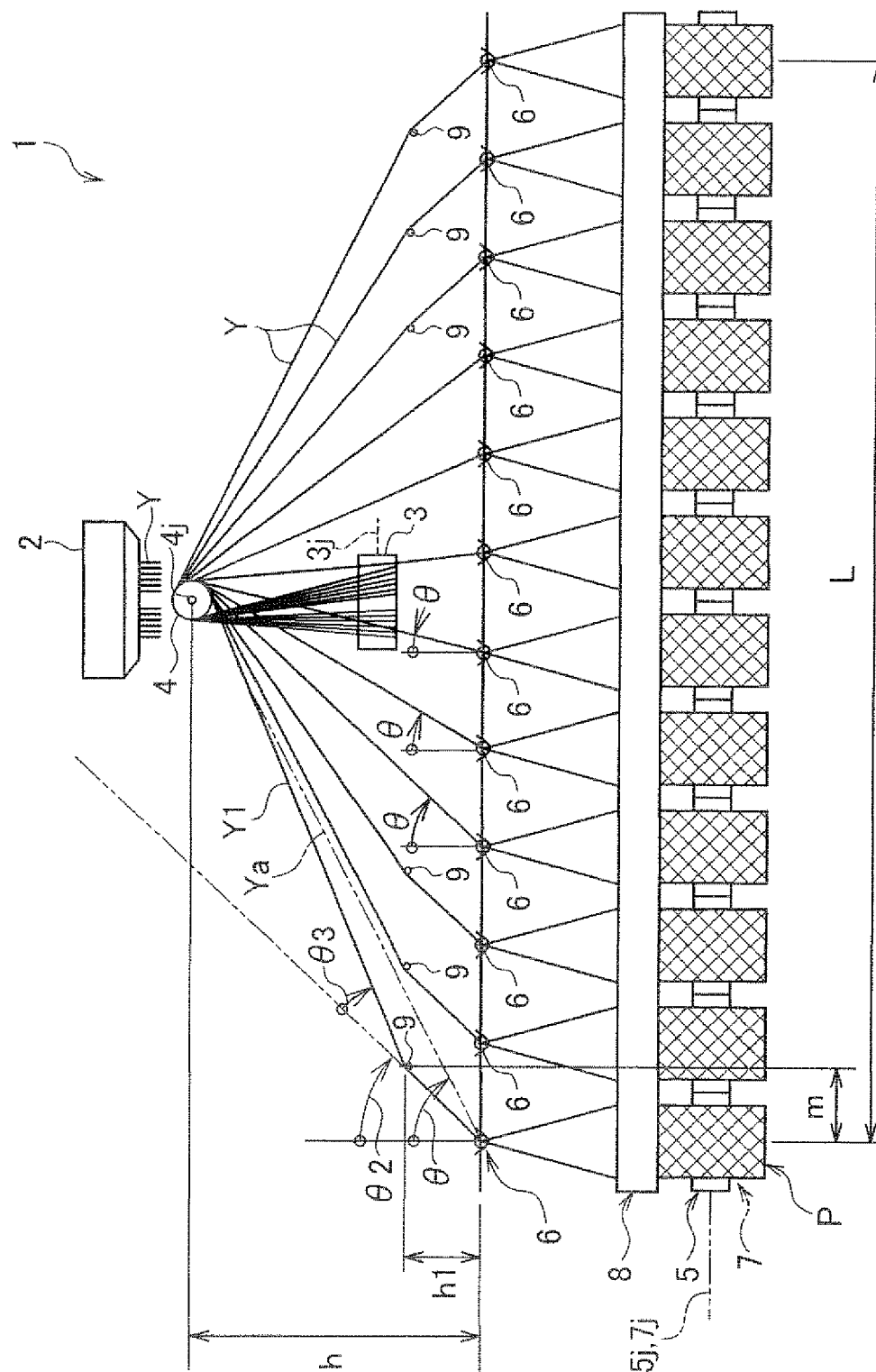


FIGURE 3



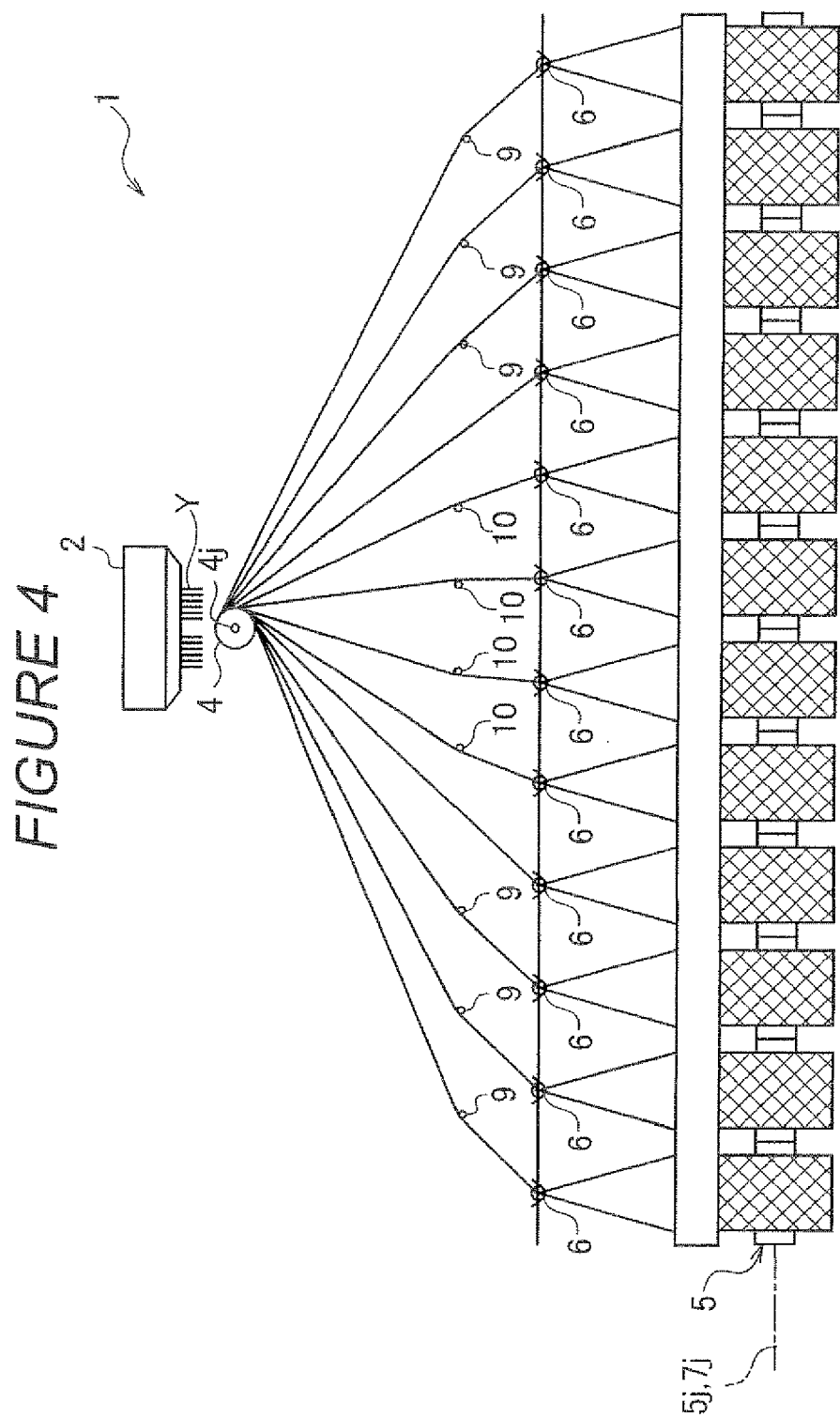
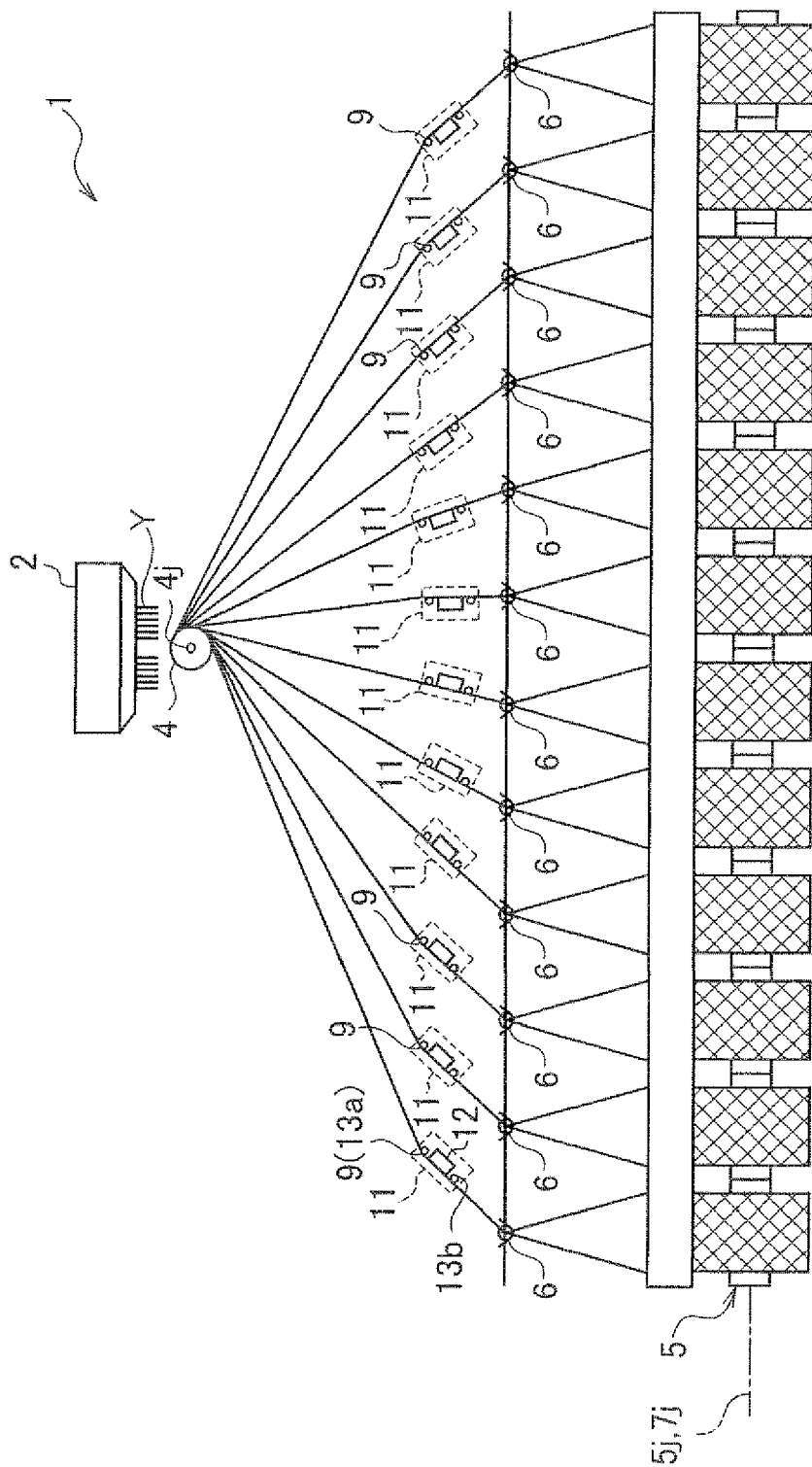
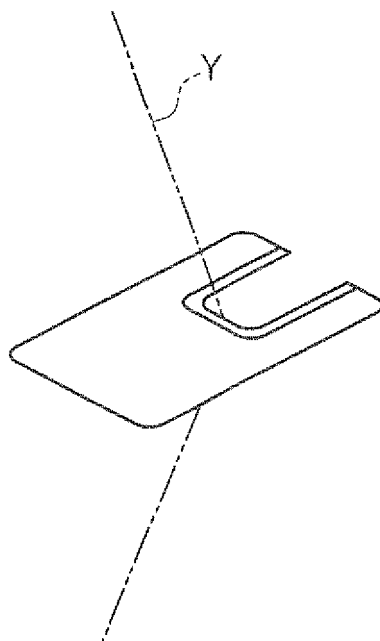


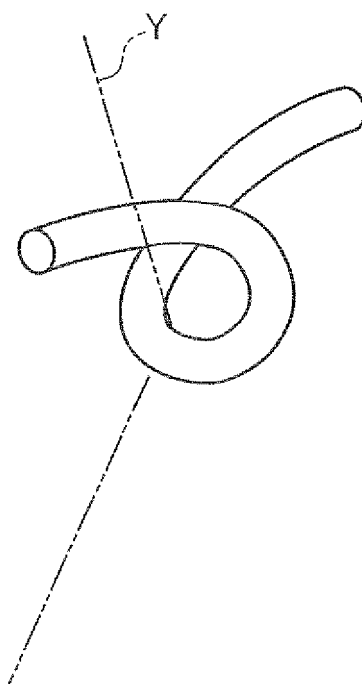
FIGURE 5



*FIGURE 6A*



*FIGURE 6B*



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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