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(54) **WINDING DEVICE AND WINDING METHOD**

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(57) **ABSTRACT**

This winding device includes: a bobbin for winding an optical fiber, the bobbin being a striated body; a cover that covers the outer periphery of the bobbin, the cover having provided thereto a slit that is parallel to the axial direction of the bobbin, and the optical fiber being inserted through the slit; and a roller for directly guiding the optical fiber to the bobbin. In accordance with the bobbin winding barrel diameter of the optical fiber on the bobbin, the bobbin and the roller are caused to move relatively, or the position of the slit in the cover is caused to move in the circumferential direction.

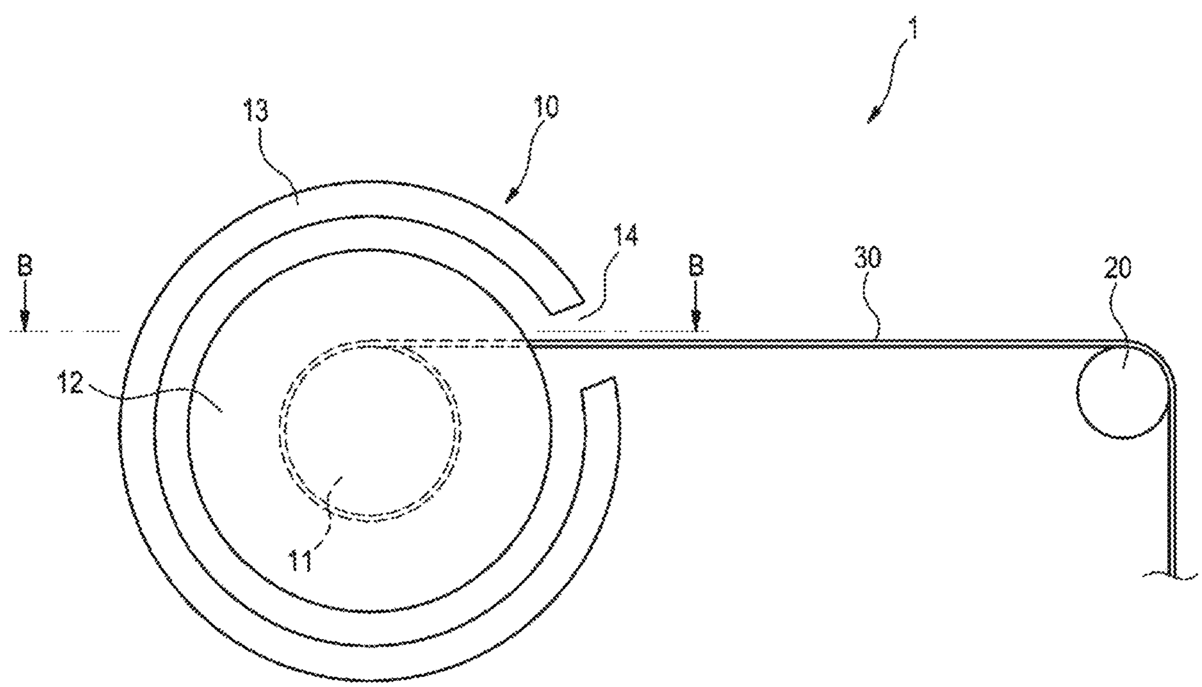


FIG.1A

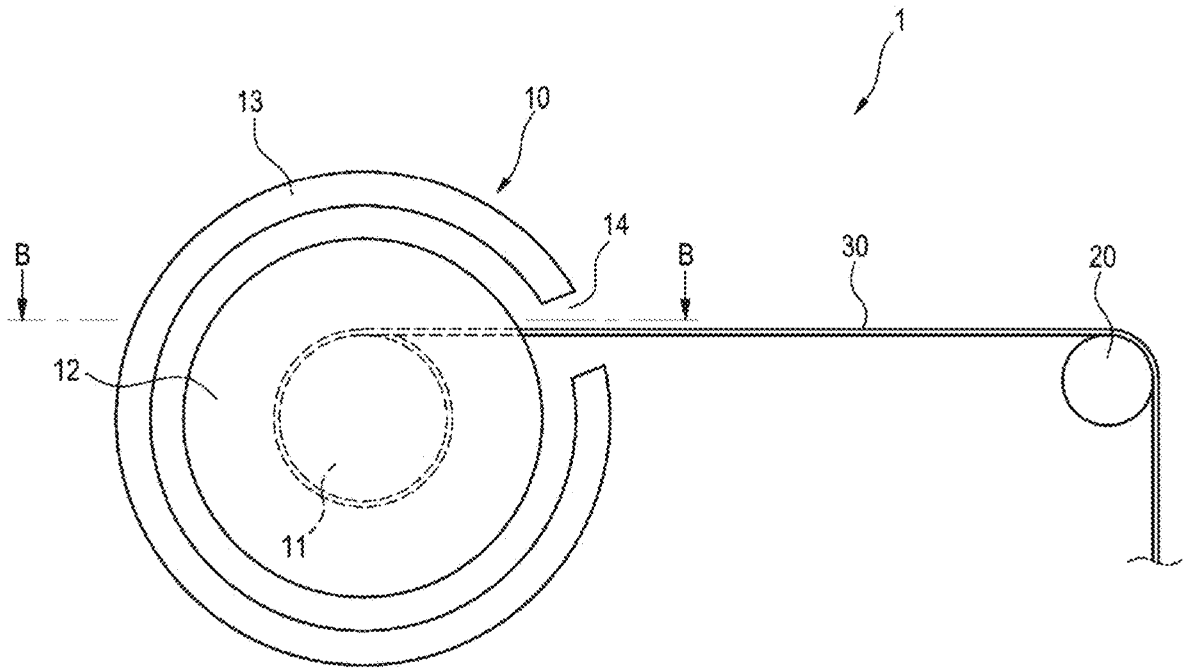


FIG.1B

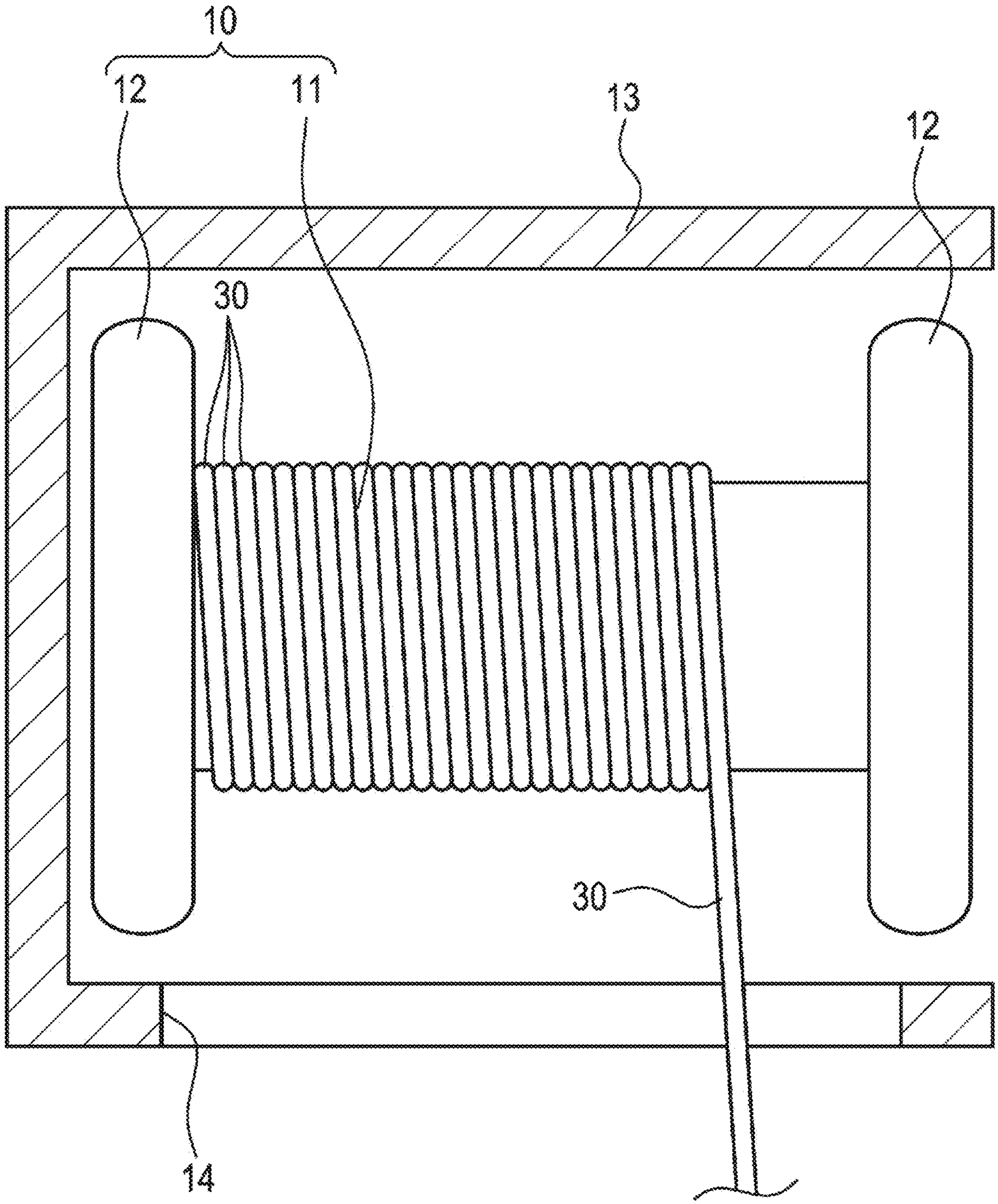


FIG.2A

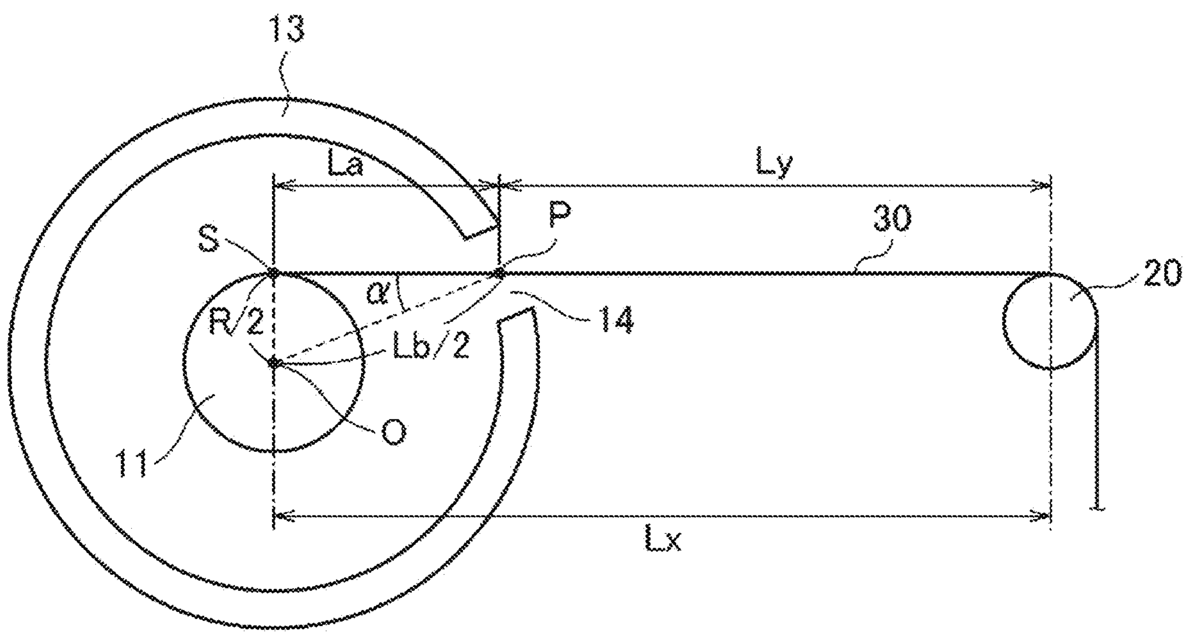


FIG.2B

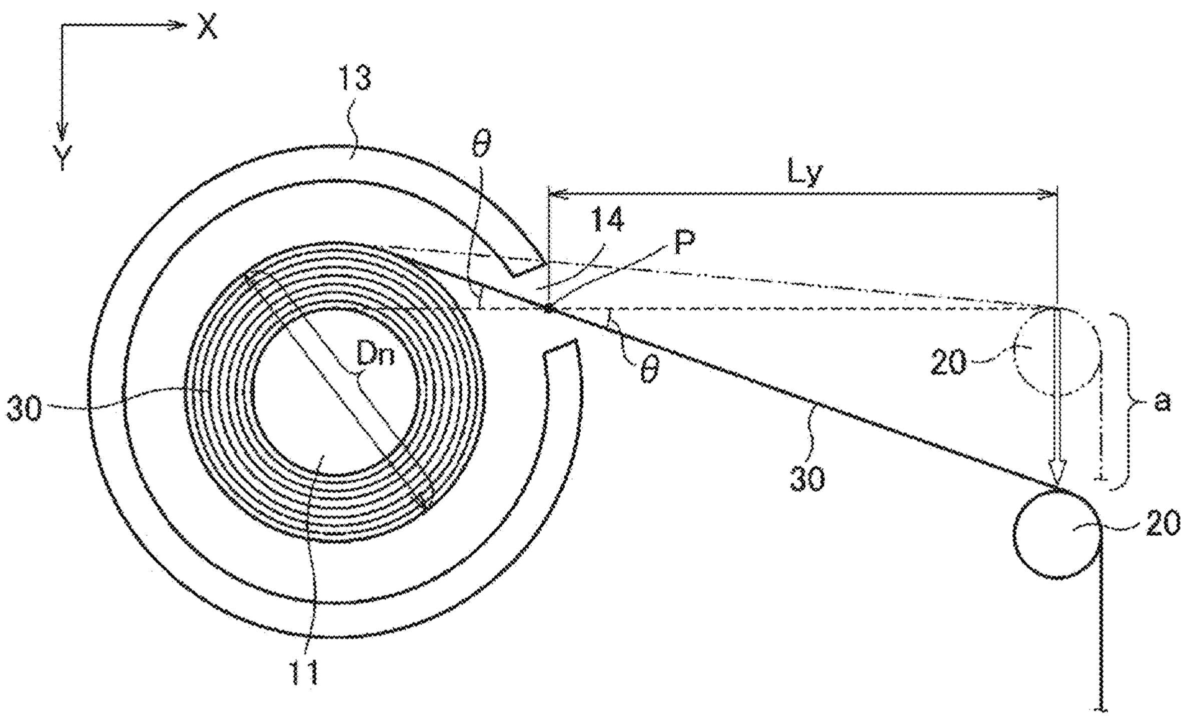


FIG. 3

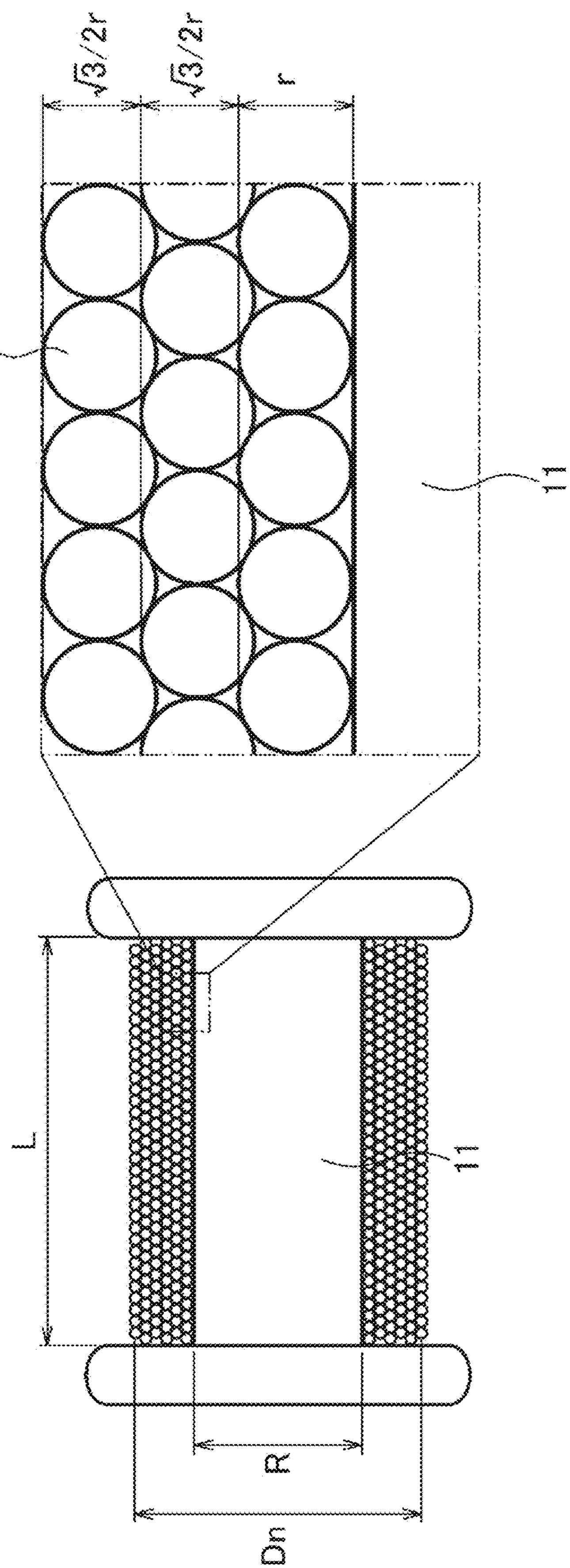


FIG.4

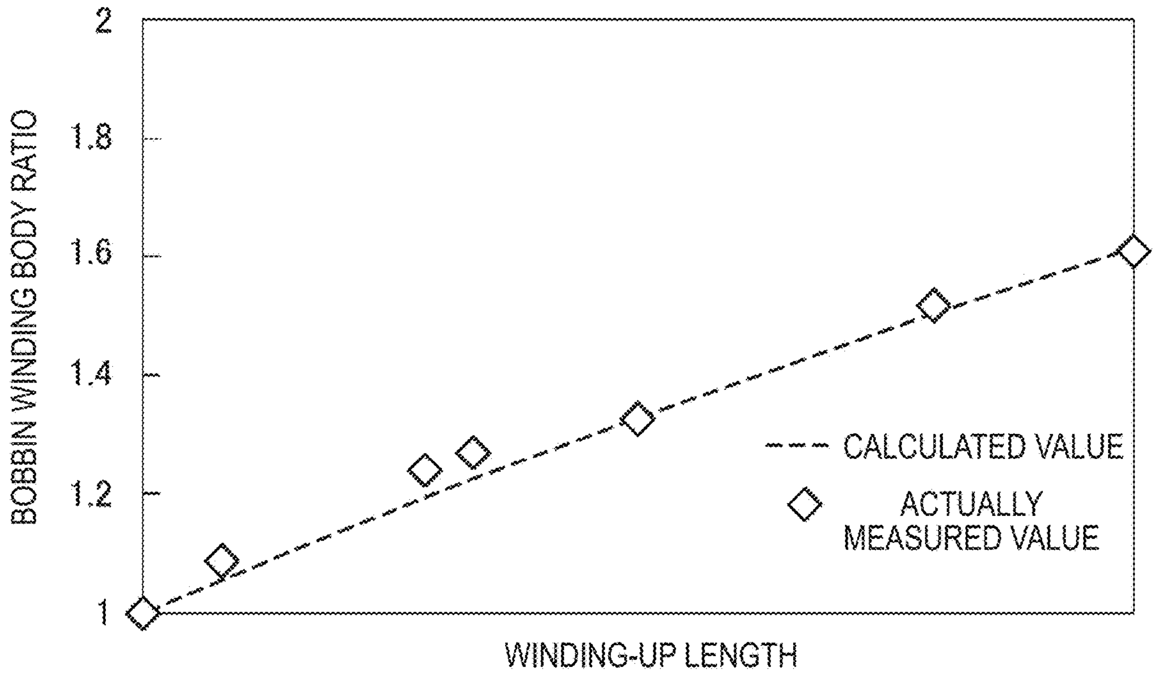

2
1.8
1.6
1.4
1.2
1
BOBBIN WINDING BODY RATIO
WINDING-UP LENGTH
CALCULATED VALUE
ACTUALLY MEASURED VALUE

FIG.5

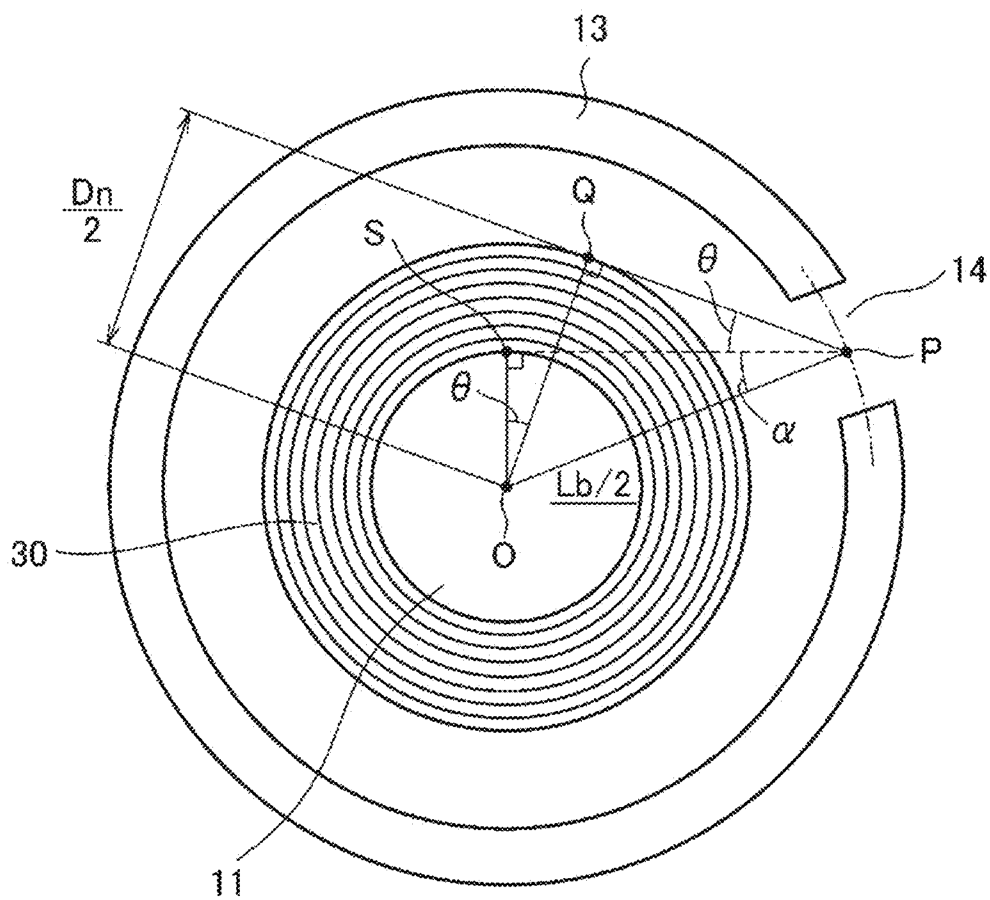
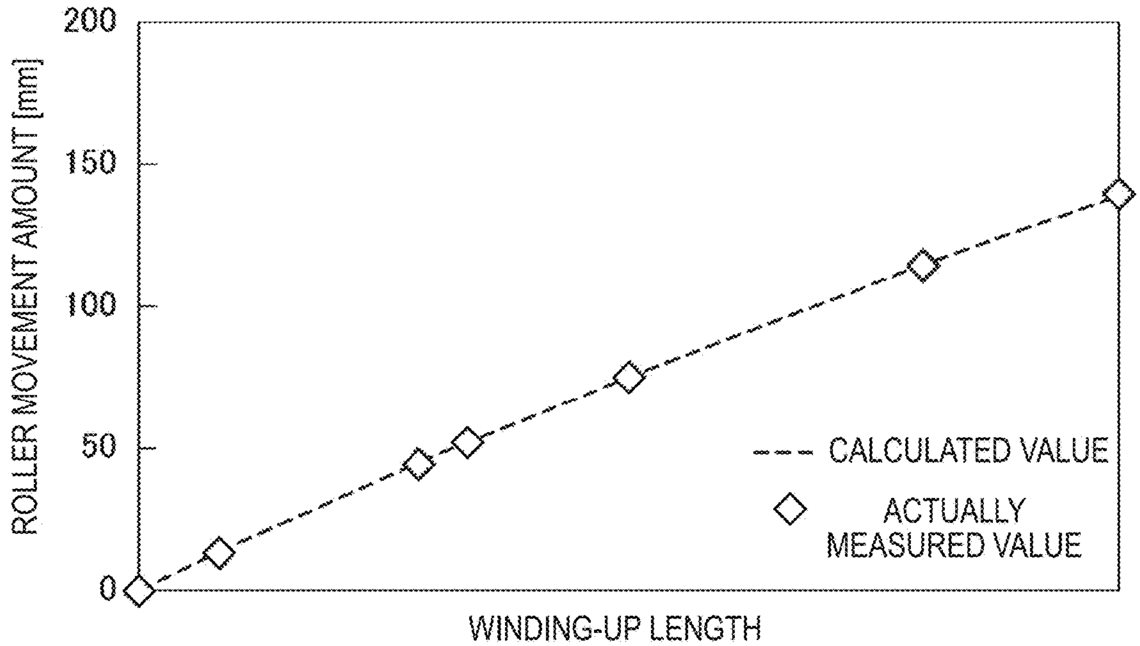
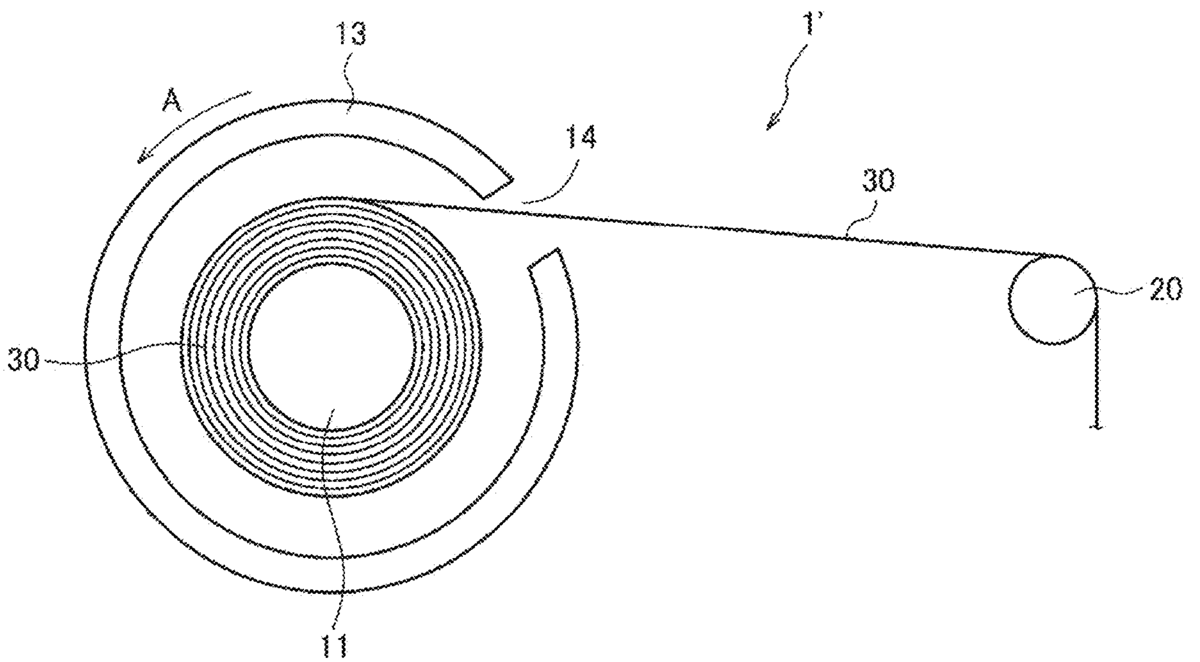

13
Dn/2
Q
S
θ
14
P
θ
α
Lb/2
30
O
11

FIG.6



200
150
100
50
0
ROLLER MOVEMENT AMOUNT [mm]
WINDING-UP LENGTH
CALCULATED VALUE
ACTUALLY MEASURED VALUE

FIG.7



13
1'
A
14
30
20
30
11

WINDING DEVICE AND WINDING METHOD

TECHNICAL FIELD

[0001] The present disclosure relates to a winding device and a winding method.

[0002] This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2019-004634, filed on Jan. 15, 2019, the entire contents of which are incorporated herein by reference.

BACKGROUND ART

[0003] Patent Literature 1 disclosures an optical fiber winding device in which a cover is attached to an outer circumference of a bobbin so that a free-state cleaved terminal wire does not bounce back to a wound-up winding body.

CITATION LIST

Patent Literature

[0004] Patent Literature 1: JP-A-2005-200114

SUMMARY OF INVENTION

[0005] A winding device according to one aspect of the present disclosure includes:

[0006] a bobbin that winds up a striatum;

[0007] a cover that covers the bobbin and includes a slit parallel to an axial direction of the bobbin such that the striatum is inserted and;

[0008] a roller that guides the striatum directly to the bobbin; and

[0009] a mechanism for moving the roller relative to the bobbin or moving a location of the slit of the cover in a circumferential direction, depending on a bobbin winding body diameter of the striatum of the bobbin.

[0010] A winding method according to one aspect of the present disclosure is a winding method for a winding device including a bobbin that winds up a striatum, a cover that covers the bobbin and includes a slit parallel to an axial direction of the bobbin such that the striatum is inserted, and a roller that guides the striatum directly to the bobbin, in which the roller is moved relative to the bobbin or a location of the slit of the cover is moved in a circumferential direction, depending on a bobbin winding body diameter of the striatum of the bobbin.

BRIEF DESCRIPTION OF DRAWINGS

[0011] FIG. **1**A is a diagram illustrating a configuration example of a winding device according to a first embodiment of the present disclosure.

[0012] FIG. **1**B is a cross-sectional view taken along an arrow line B-B of FIG. **1**A.

[0013] FIG. **2**A is a diagram illustrating locations of a bobbin and a roller at the time of the start of winding an optical fiber in the winding device according to the first embodiment of the present disclosure.

[0014] FIG. **2**B is a diagram illustrating locations of the bobbin and the roller when a bobbin winding body diameter becomes large by winding up the optical fiber in the winding device of FIG. **2**A.

[0015] FIG. **3** is a diagram illustrating a relationship between a length of the optical fiber wound up around the bobbin and the bobbin winding body diameter.

[0016] FIG. **4** is a diagram illustrating a relationship between a calculated value and an actually measured value with respect to the relationship between the winding-up length of the optical fiber wound up around the bobbin and the bobbin winding body diameter.

[0017] FIG. **5** is a diagram illustrating the bobbin winding body diameter and a winding-up angle of the optical fiber.

[0018] FIG. **6** is a diagram illustrating a relationship between a calculated value of a roller movement amount with respect to the winding-up length of the optical fiber wound up around the bobbin and an actually measured value of the actual roller movement.

[0019] FIG. **7** is a diagram illustrating a configuration example of a winding device according to a fifth embodiment of the present disclosure.

DESCRIPTION OF EMBODIMENTS

Technical Problem to be Solved by the Present Disclosure

[0020] In a winding device, when winding up a striatum such as an electric wire, an optical fiber, or the like that are continuously fed around a bobbin at a high speed, the winding device cannot immediately stop when the striatum is broken in the middle, such that a cleaved terminal wire becomes a free state and swings around the bobbin with rotation of the bobbin. Therefore, the cleaved terminal wire hits surrounding obstacles and protrusions and bounces back to a wound-up winding body, thereby causing a state called wire hitting that hits a surface of the winding body. This wire hitting has a significant effect on high-speed winding-up and damages the striatum wound up around the bobbin. Particularly, when the striatum is the optical fiber, the optical fiber wound up around the bobbin has low intensity or is broken. When such wire hitting occurs, the optical fiber wound up therearound is required to be discarded, which causes a decrease in yield.

[0021] An optical fiber winding device disclosed in Patent Literature 1 can reduce an influence caused by the wire hitting by using a cover provided on an outer circumference of the bobbin. However, as an amount of the optical fiber wound around the bobbin increases, a bobbin winding body diameter becomes large, such that the optical fiber introduced from a roller to the bobbin and the cover provided on the outer circumference of the bobbin may hit each other. In order to prevent this problem, an opening of the cover is required to become large, but when the opening thereof becomes large, the optical fiber bent at the time of being broken easily damages the optical fiber on a bobbin surface. Therefore, it is desirable that a size of the opening thereof is made as small as possible.

[0022] The present disclosure has been made in consideration of the above-described circumstances, and an object thereof is to provide a winding device and a winding method in which a cover covering a bobbin can be prevented from contacting a striatum wound up around the bobbin and smooth winding-up of the striatum can be performed.

Advantageous Effects of the Present Disclosure

[0023] According to the present disclosure, it is possible to obtain a winding device and a winding method in which a cover covering a bobbin can be prevented from contacting a striatum wound up around the bobbin and smooth winding-up of the striatum can be performed.

Description of Embodiments of the Present Disclosure

[0024] First, embodiments of the present disclosure will be listed and described.

[0025] (1) A winding device according to one aspect of the present disclosure includes:

[0026] a bobbin that winds up a striatum;

[0027] a cover that covers the bobbin and includes a slit parallel to an axial direction of the bobbin such that the striatum is inserted;

[0028] a roller that guides the striatum directly to the bobbin; and

[0029] a mechanism for moving the roller relative to the bobbin or moving a location of the slit of the cover in a circumferential direction, depending on a bobbin winding body diameter of the striatum of the bobbin.

[0030] Accordingly, it is possible to prevent the cover covering an outer circumference of the bobbin from contacting the striatum wound up around the bobbin, such that smooth winding-up of the striatum can be performed.

[0031] (2) A direction of relative movement between the bobbin and the roller may be a direction including a component orthogonal to a direction of the striatum at the start of winding and an axial direction of the roller.

[0032] Accordingly, it is possible to simply calculate a required movement distance of the bobbin or the roller.

[0033] (3) The bobbin winding body diameter may be calculated from a winding-up length of the striatum, or (4) may be calculated from a weight of the striatum wound around the bobbin.

[0034] Accordingly, it is possible to calculate the bobbin winding body diameter of the striatum wound around the bobbin with various methods.

[0035] (5) A winding method according to one aspect of the present disclosure is a winding method of a winding device including a bobbin that winds up a striatum, a cover that covers the bobbin and includes a slit parallel to an axial direction of the bobbin such that the striatum is inserted, and a roller that guides the striatum directly to the bobbin, in which the roller is moved relative to the bobbin or a location of the slit of the cover is moved in a circumferential direction, depending on a bobbin winding body diameter of the striatum of the bobbin.

[0036] Accordingly, it is possible to prevent the cover covering an outer circumference of the bobbin from contacting the striatum wound up around the bobbin, such that smooth winding-up of the striatum can be performed.

Details of Embodiments of the Present Disclosure

[0037] Hereinafter, desirable embodiments according to a winding device and a winding method of the present disclosure will be described with reference to the drawings. An optical fiber is described as an example of a striatum, and in the case of the striatum, the striatum may be not limited to the optical fiber but may be another striatum such as an electric wire or the like. In the following description, a configuration denoted by the same reference sign in different drawings will be regarded as the same configuration, and description thereof may be omitted. As long as a combination of a plurality of embodiments can be performed, the present disclosure includes a combination of any of the embodiments.

[0038] The scope of the present invention is not limited to the example of the present disclosure but is indicated by the scope of the claims, and is intended to include all the modifications within the meaning equivalent to the scope of the claims and within the scope thereof.

First Embodiment

[0039] FIG. **1** is a diagram illustrating a configuration example of a winding device according to an embodiment of the present disclosure. FIG. **1**A is a diagram illustrating disposition of a bobbin and a roller viewed from the side, and FIG. **1**B is a cross-sectional view taken along an arrow line B-B of FIG. **1**A.

[0040] A winding device **1** includes a bobbin **10**, a cover **13** for preventing wire hitting, and a roller **20**.

[0041] The bobbin **10** includes a body portion **11** and flange portions **12** provided at opposite ends of the body portion **11**. The roller **20** is disposed immediately before an upstream side of the bobbin **10**. The cover **13** covers an outer circumference of the bobbin **10** that corresponds to an outer side in a radial direction of the bobbin **10**. The cover **13** has an approximately cylindrical shape, and includes a slit **14** through which an optical fiber **30** is inserted and parallel to an axial direction of the bobbin **10**. The bobbin **10** is rotated counterclockwise in FIG. **1**A by a drive apparatus not illustrated in the drawing, and winds up, for example, the optical fiber **30** after drawing.

[0042] The above-described "immediately before the upstream side" does not indicate that locations of the roller **20** and the bobbin **10** are close to each other, but indicates that, as illustrated in FIG. **1**A, there are no other members such as a roller or the like in contact with the optical fiber **30** between the roller **20** and the bobbin **10** on the upstream side of the bobbin **10**. That is, the roller **20** is a roller that directly guides the optical fiber **30** to the bobbin **10**. As long as the roller **20** is the roller that directly guides the optical fiber **30** thereto, for example, the roller **20** may be provided at a location away from the bobbin **10** to a certain extent.

[0043] Next, a location relationship between the bobbin and the roller in the embodiment will be described. FIG. **2**A is a diagram illustrating a location relationship between the bobbin and the roller in the winding device **1**, and illustrates locations of the bobbin and the roller at the time of the start of winding the optical fiber **30**. FIG. **2**B illustrates locations of the bobbin and the roller when a bobbin winding body diameter becomes large by winding up the optical fiber **30** having a predetermined length in the winding device **1** of FIG. **2**A.

[0044] As illustrated in FIG. **2**A, the optical fiber **30** guided by the roller **20** is wound around the outer circumference of the body portion **11** of the bobbin **10**. In the winding device **1**, the locations of the bobbin **10** and the roller **20** are adjusted such that the optical fiber **30** passes through a center location of the slit **14** provided in the cover **13** at the start of winding. It is assumed that a path (a movement path) of the optical fiber **30** at the start of winding coincides with an X-axis direction. As a winding-up amount (a length) of the optical fiber **30** wound up around the bobbin

10 increases, a bobbin winding body diameter Dn becomes large. When the bobbin winding body diameter Dn becomes large and the location of the roller **20** does not move from a winding start location, the path of the optical fiber **30** is at a location indicated by an alternate long and two short dashes line in FIG. **2**B and contacts the cover **13**.

[0045] In the embodiment, the location of the roller **20** is caused to move in a Y-axis direction as the bobbin winding body diameter Dn becomes large. As a result, the optical fiber **30** passes through the center location of the slit **14** of the cover **13** even though the winding-up amount thereof increases, and the optical fiber **30** does not contact the cover.

[0046] In the embodiment, a movement amount a of the roller **20** is controlled depending on the bobbin winding body diameter Dn of the optical fiber **30**. In order to perform this control, it is required to investigate a relationship between a winding-up length (a drawing length) of the optical fiber **30** drawn in advance and the bobbin winding body diameter Dn of the bobbin **10**. Next, based upon the relationship therebetween, feedforward control may be performed by determining to what extent a relative location of the roller **20** should be moved with respect to the winding-up length of the optical fiber **30**. An actual movement direction of the roller **20** is not required to coincide with the Y-axis direction. In this case, the movement direction of the roller **20** may be any direction including a Y-axis component. A movement amount of the Y-axis direction component at that time may be the movement amount a.

[0047] The relationship between the bobbin winding body diameter Dn of the bobbin **10** and the winding-up length (the drawing length) of the optical fiber **30** may be obtained by experiment, or may be obtained by numerical calculation. In the embodiment, the bobbin winding body diameter Dn of the bobbin **10** is obtained from the length of the optical fiber **30** by the numerical calculation, and the movement amount of the roller **20** is determined from the bobbin winding body diameter Dn as follows. The winding-up length of the optical fiber **30** may be measured separately. FIG. **3** is a diagram illustrating a relationship between the length of the optical fiber wound up around the bobbin and the bobbin winding body diameter.

[0048] A diameter of the body portion **11** of the bobbin **10** is defined as R, an axial length is defined as L, a diameter of the optical fiber **30** is defined as r, and a bobbin winding body diameter of an n-th layer is defined as Dn (n is an integer). It is assumed that the optical fibers **30** are tightly wound around the body portion **11** of the bobbin **10** without any gaps therebetween. Next, a bobbin winding body diameter D1 of a first layer, a bobbin winding body diameter D2 of a second layer, and the bobbin winding body diameter Dn of the n-th layer can be represented by the following Equation 1. The bobbin winding body diameter Dn corresponds to a distance between a center of the optical fiber **30** located on an outmost circumstance wound up around the bobbin **10** and a center of the optical fiber **30** located on an outmost circumstance on an opposite side of a center of the bobbin **10**. An example of the optical fiber **30** includes the one formed in such a manner that a glass fiber having a diameter of 125 μm is coated with a primary coating layer and a secondary coating layer formed of an ultraviolet curable resin, respectively, and an outermost circumference of the glass fiber is further coated with a colored layer formed of ultraviolet curable ink to form the diameter r of 250 μm.

[Equation 1]

$$D1=R+r$$

$$D2=R+r+\sqrt{3}r$$

$$Dn=R+r+(n-1)\sqrt{3}r \quad \text{(Equation 1)}$$

The number of turns of the optical fiber **30** per layer is defined as k. A winding-up length A1 of the optical fiber of the first layer, a winding-up length A2 of the optical fiber of the second layer, and a winding-up length An (n is an integer) of the optical fiber of the n-th layer can be represented by the following Equation 2.

[Equation 2]

$$\begin{aligned} k &= \frac{L}{r} \quad \text{(Equation 2)} \\ A1 &= k\pi(R+r) \\ A2 &= A1 + k\pi\left(R+r+\sqrt{3}\,r\right) \\ An &= A(n-1) + k\pi\left\{R+r+(n-1)\sqrt{3}\,r\right\} \end{aligned}$$

[0049] From the winding-up length of the optical fiber **30**, the number of layers (the n-th layer) of the bobbin **10** around which the optical fiber **30** is wound is calculated from Equation 2, and the number of layers n is applied to Equation 1, thereby making it possible to obtain the bobbin winding body diameter Dn. FIG. **4** is a diagram illustrating a relationship between a calculated value and an actually measured value with respect to the relationship between the winding-up length (the drawing length) of the optical fiber wound up around the bobbin and the bobbin winding body diameter. A broken line shows the calculated value obtained by Equation 2, and a ◇ mark indicates the actually measured value. In FIG. **4**, the bobbin winding body diameter is shown as a ratio (a ratio of the body diameter at the start of winding to the body diameter of the n-th layer), and the calculated value and the actually measured value almost coincide with each other such that the bobbin winding body diameter Dn can be known from the winding-up length of the optical fiber.

[0050] Depending on a change in the bobbin winding body diameter Dn, the movement amount a for causing the roller **20** to move in the Y-axis direction is obtained so that the optical fiber **30** does not contact the cover **13**. As illustrated in FIG. **2**A, when a distance in the X-axis direction between the center of the bobbin **10** and a center of the roller **20** is defined as Lx, a distance from a contact point S of the bobbin **10** of the optical fiber **30** at the time of the start of winding to a middle point P of the slit **14** of the cover **13** is defined as La, and a diameter of the cover **13** is defined as Lb (specifically, a diameter between middle points of a thickness of the cover **13**), a distance Ly from the middle point P of the slit **14** of the cover **13** to a contact point of the roller **20** can be represented by the following Equation 3.

[Equation 3]

$$\begin{aligned} Ly &= Lx - La \quad \text{(Equation 3)} \\ &= Lx - \frac{\left(\sqrt{Lb^2 - R^2}\right)}{2} \end{aligned}$$

[0051] Next, as illustrated in FIG. 2B, the roller **20** is caused to move in the Y-axis direction by the movement amount a when the bobbin winding body diameter Dn becomes large, such that the path of the optical fiber **30** inclines by an angle θ with respect to the X-axis. By using the inclination angle θ at this time, the movement amount a can be obtained by the following Equation 4.

[Equation 4]

$$a = Ly \times \tan\theta = \left(Lx - \frac{\left(\sqrt{Lb^2 - R^2}\right)}{2}\right) \times \tan\theta \quad \text{(Equation 4)}$$

[0052] When the distance in the X-axis direction between the center of the bobbin **10** and the center of the roller **20** is defined as Lx, the diameter Lb of the cover **13** and the diameter R of the bobbin are already known, such that the angle θ may be obtained in order to obtain the movement amount a from Equation 4.

[0053] FIG. **5** is a diagram illustrating the bobbin winding body diameter and a winding-up angle of the optical fiber. An angle formed by a tangent line from the middle point P of the slit **14** to the body portion **11** of the bobbin **10** and a line connecting the center of the bobbin **10** is defined as α. The bobbin winding body diameter Dn of the n-th layer can be obtained from Equation 1. A distance from the center of the bobbin **10** to the center of the optical fiber **30** wound around the outermost side is defined as Dn/2. The following Equation 5 is established with respect to a triangle OPQ and a triangle OPS illustrated in FIG. **5**. Here, O is a center point of the bobbin **10**, and Q is a tangential contact point from the middle point P of the slit **14** to the center of the optical fiber **30** wound around the outermost circumference of the bobbin **10**.

[Equation 5]

$$\sin(\theta + \alpha) = \frac{Dn}{Lb} \quad \text{(Equation 5)}$$

$$\sin\alpha = \frac{R}{Lb}$$

[0054] Accordingly, an angle θ is obtained by the following Equation 6.

[Equation 6]

$$\theta = \sin^{-1}\left(\frac{Dn}{Lb}\right) - \sin^{-1}\left(\frac{R}{Lb}\right) \quad \text{(Equation 6)}$$

[0055] In Equation 6, since the diameter r of the optical fiber **30**, the diameter R of the body portion **11** of the bobbin **10**, and the diameter Lb of the cover **13** are already known, the angle θ can be obtained from the bobbin winding body diameter Dn obtained from Equation 1. The movement amount a of the roller **20** can be obtained by substituting the angle θ obtained in Equation 6 into Equation 4.

[0056] FIG. **6** is a diagram illustrating a relationship between a calculated value of the movement amount of the roller with respect to the winding-up length of the optical fiber wound up around the bobbin and an actually measured value of the actual roller movement. In FIG. **6**, a broken line is a plot of the movement amount of the roller **20** calculated from Equation 4 based upon the winding-up length of the optical fiber **30** being drawn. A ◇ mark indicates the actually measured value of the movement amount of the roller **20** when the roller **20** is caused to move so as to allow the optical fiber **30** to pass through the center of the slit **14** at some winding-up lengths of the optical fiber **30** during the actual drawing. As illustrated in FIG. **6**, the actually measured value and the calculated value almost coincide with each other. As a result of placing an actual location of the roller **20** at a location of a value calculated by the calculated value, it is confirmed that the optical fiber **30** can be wound up without contacting the cover **13** at points of all the actually measured values.

Second Embodiment

[0057] The first embodiment describes the method of calculating the bobbin winding body diameter Dn from the winding-up length of the optical fiber **30**, and the bobbin winding body diameter Dn changes depending on a weight of the optical fiber **30** wound up around the bobbin **10**. Therefore, instead of calculating the bobbin winding body diameter Dn from the winding-up length of the optical fiber **30**, the bobbin winding body diameter Dn may be calculated from the weight of the optical fiber **30** wound around the bobbin **10**. In order to obtain the weight of the optical fiber **30** wound around the bobbin **10**, the weight of the bobbin **10** in a state where the optical fiber **30** is wound therearound may be measured, and the weight of the bobbin **10** itself measured in advance may be subtracted therefrom. The bobbin winding body diameter Dn may be calculated from the weight of the optical fiber **30** wound around the bobbin **10** obtained as described above.

Third Embodiment

[0058] In the first and second embodiments, the bobbin winding body diameter Dn is obtained from the winding-up length of the optical fiber **30** and the weight of the optical fiber **30** wound around the bobbin **10**, and the bobbin winding body diameter Dn may be directly obtained. As a method of obtaining the bobbin winding body diameter Dn, for example, the bobbin winding body diameter Dn can be obtained through the slit **14** of the cover **13** by using an optical rangefinder.

Fourth Embodiment

[0059] In the first embodiment, as the bobbin winding body diameter Dn becomes large, the roller **20** is caused to move in the Y-axis direction, and instead of causing the roller **20** to move, the bobbin **10** and the cover **13** may be caused to move in the Y-axis direction. The roller **20** and both the bobbin **10** and the cover **13** may be caused to move. In this manner, the roller **20**, the bobbin **10**, and the cover **13** may be caused to move relatively.

Fifth Embodiment

[0060] FIG. **7** is a diagram illustrating a configuration example of a winding device according to a fifth embodiment of the present disclosure. In the first embodiment, the roller **20** is caused to move in the Y-axis direction as the bobbin winding body diameter Dn becomes larger, and in a winding device **1'** of the fifth embodiment, as the bobbin winding body diameter Dn becomes larger, the location of the slit **14** of the cover **13** is caused to move in a circumferential direction (an arrow A direction) by a drive apparatus not illustrated in the drawing. As a result, it is possible to prevent the cover **13** covering the outer circumference of the bobbin **10** from contacting the optical fiber **30** wound up around the bobbin **10**.

[0061] Even though any one of methods described in the embodiments is used, the winding device **1** (**1'**) includes the following (a), (b), and (c) inside winding device **1** (**1'**) or as a separate apparatus.

[0062] (A) A memory for storing specifications of respective components such as, for example, the diameter r of the optical fiber **30**, the diameter R of the body portion of the bobbin **10**, the distance Lx in the X-axis direction between the center of the bobbin **10** and the center of the roller **20**, the distance La from the contact point S of the bobbin **10** of the optical fiber **30** at the time of the start of winding to the middle point P of the slit **14** of the cover **13**, the diameter Lb of the cover **13**, or the like.

[0063] (B) A memory for storing a program for performing each calculation.

[0064] (C) A calculation apparatus for processing the winding-up length of the optical fiber **30** and the bobbin weight or a measurement signal from the optical rangefinder.

REFERENCE SIGNS LIST

[0065] **1**, **1'**: winding device

[0066] **10**: bobbin

[0067] **11**: body portion

[0068] **12**: flange portion

[0069] **13**: cover

[0070] **14**: slit

[0071] **20**: roller

[0072] **30**: optical fiber

1: A winding device, comprising:

a bobbin that winds up a striatum;

a cover that covers the bobbin and includes a slit parallel to an axial direction of the bobbin such that the striatum is inserted;

a roller that guides the striatum directly to the bobbin; and

a mechanism for moving the roller relative to the bobbin or moving a location of the slit of the cover in a circumferential direction, depending on a bobbin winding body diameter of the striatum of the bobbin.

2: The winding device according to claim **1**,

wherein a direction of relative movement between the bobbin and the roller is a direction including a component orthogonal to a direction of the striatum at the start of winding and an axial direction of the roller.

3: The winding device according to claim **1**,

wherein the bobbin winding body diameter is calculated from a winding-up length of the striatum.

4: The winding device according to claim **1**,

wherein the bobbin winding body diameter is calculated from a weight of the striatum wound around the bobbin.

5: A winding method for a winding device including a bobbin that winds up a striatum, a cover that covers the bobbin and includes a slit parallel to an axial direction of the bobbin such that the striatum is inserted, and a roller that guides the striatum directly to the bobbin, the method comprising:

moving the roller relative to the bobbin or moving a location of the slit of the cover in a circumferential direction, depending on a bobbin winding body diameter of the striatum of the bobbin.

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