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direction of the wire material is reversed from the first direction to a second direction opposite to the first direction; and a second spiral portion arranged outside the first reverse portion and in which the wire material is wound in a plurality of turns in the second direction such that the distance thereof from the center is increased by each turn.

(57) 要約: 【課題】線材の収容効率を高めること。【解決手段】本開示に係る収容ユニットは、線材を巻き回した巻回体と、前記巻回体を収容する収容体とを備える。前記巻回体は、時計回り又は反時計回りである第1方向に前記線材が複数周に巻き回され、周回するごとに中心との距離が近くなる第1渦巻き部と、前記第1渦巻き部の内側に配置され、前記線材の巻回方向を前記第1方向から前記第1方向とは逆回りの第2方向に反転させる第1反転部と、前記第1反転部の外側に配置され、前記第2方向に前記線材が複数周に巻き回され、周回するごとに中心との距離が遠くなる第2渦巻き部とを有する。

DESCRIPTION

TITLE OF INVENTION: STORAGE UNIT AND WOUND BODY

5 TECHNICAL FIELD
[0001]

The present invention relates to a storage unit and a wound body.

10 The present application claims priority based on Japanese Patent Application No. 2021-108562 filed on June 30, 2021, the contents of which are incorporated herein by reference.

BACKGROUND ART
[0002]

15 The discussion of the background to the invention herein is intended to facilitate an understanding of the invention. However, it should be appreciated that the discussion is not an acknowledgement or admission that any aspect of the discussion was part of the common general knowledge as at the priority date
20 of the application.

[0002a]

25 Unless the context requires otherwise, where the term "comprising" is used in this specification (including the claims) it is to be interpreted as specifying the presence of the stated features, integers, steps or components, but not precluding the presence of one or more other features, integers, steps or components, or group thereof.

[0002b]

30 At the time of paying out an optical cable from a drum on which the optical cable is wound, the optical cable may get twisted if the optical cable is simply paid out linearly without rotating the drum. To address this, there are techniques for storing the optical cable in a figure eight. PTL 1 discloses an optical cable winding method with which the cable's wound shape
35 can be prevented from shifting and collapsing.

CITATION LIST

PATENT LITERATURE

[0003]

PTL 1: Japanese Patent Application Laid-open Publication
No. 2013-184795

SUMMARY

TECHNICAL PROBLEM

[0004]

In cases where a linear material (such as an optical cable) is wound in a figure eight and the wound layers are simply stacked, the intersection points of the linear material will overlap one another in the stacking direction, which will impair storage volumetric efficiency. Even when a linear material is stored according to the winding method disclosed in PTL 1, the intersection points of the linear material will overlap one another in the stacking direction, thus impairing storage volumetric efficiency.

[0005]

It is desirable to improve storage volumetric efficiency of a linear material.

SOLUTION TO PROBLEM

[0006]

According to one form of the present invention there is provided a storage unit comprising a wound body formed by winding a linear material; and a storage body configured to store the wound body, wherein the wound body includes a first spiral part wherein the linear material is wound in a plurality of turns, a direction in which the linear material of the first spiral part is wound around a center such that a distance between the linear material and the center decreases is a first direction, and the first direction is either clockwise or counterclockwise, a first inversion part located inside the first spiral part, a winding

direction of the linear material being inverted at the first inversion part from the first direction to a second direction which is opposite to the first direction, a second spiral part located outside the first inversion part, wherein the linear material is wound in a plurality of turns in the second direction, and the second direction is a direction in which the linear material of the second spiral part is wound around the center such that the distance between the linear material and the center increases, and a third spiral part wherein the linear material extends continuously from the second spiral part and is wound in a plurality of turns in the second direction, the second direction being a direction in which the linear material of the third spiral part is wound around the center such that the distance between the linear material and the center decreases.

[0006a]

According to another form of the present invention there is provided a wound body comprising a first spiral part wherein a linear material is wound in a plurality of turns, a direction in which the linear material of the first spiral part is wound around a center such that a distance between the linear material and the center decreases is a first direction, and the first direction is either clockwise or counterclockwise; a first inversion part located inside the first spiral part, a winding direction of the linear material being inverted at the first inversion part from the first direction to a second direction which is opposite to the first direction; a second spiral part located outside the first inversion part, wherein the linear material is wound in a plurality of turns in the second direction, and the second direction is a direction in which the linear material of the second spiral part is wound around the center such that the distance between the linear material and the center increases; and a third spiral part wherein the linear material extends continuously from the second spiral part and is wound in a plurality of turns in the

second direction, the second direction being a direction in which the linear material of the third spiral part is wound around the center such that the distance between the linear material and the center decreases.

5 [0007]

Other features of the invention will become apparent from the following description of the present Specification and Drawings.

10 EFFECTS OF INVENTION

[0008]

The present invention can improve storage volumetric efficiency of a linear material.

BRIEF DESCRIPTION OF DRAWINGS

5 [0009]

[Fig. 1] Fig. 1 is an explanatory diagram of a storage unit 1 according to the present embodiment.

[Fig. 2] Fig. 2A is an explanatory diagram of a wound body 20 according to the present embodiment. Fig. 2B is a cross-sectional explanatory diagram of the wound body 20 according to
10 the present embodiment.

[Fig. 3] Fig. 3 is an explanatory diagram of a layered structure of the wound body 20 according to the present embodiment.

[Fig. 4] Fig. 4 is an explanatory diagram of a method for winding a linear material 10 in a first layer 31 and a second layer 32.
15

[Fig. 5] Fig. 5A is an explanatory diagram of a configuration of the linear material 10 constituting a first spiral part 311 within a region surrounded by the dotted lines in Fig. 2B. Fig. 5B is an explanatory diagram of a configuration of the linear material 10 according to a first modified example. Fig. 5C is an explanatory diagram of a configuration of the linear material 10 according to a second modified example.
20

[Fig. 6] Fig. 6A is an explanatory diagram of a holding part 42. Figs. 6B to 6D are explanatory diagrams of holding parts 42 according to modified examples.

[Fig. 7] Fig. 7A is a cross-sectional view of a linear material 10. Fig. 7B is a cross-sectional view of a linear material 10 according to a modified example.
30

[Fig. 8] Fig. 8 is an explanatory diagram of a wound body 20' according to a comparative example.

DESCRIPTION OF EMBODIMENTS

35 [0010]

At least the following features are disclosed in the Specification and Drawings as described below.

[0011]

Disclosed is a storage unit including: a wound body formed
5 by winding a linear material; and a storage body configured to
store the wound body, wherein the wound body includes: a first
spiral part wherein the linear material is wound in a plurality
of turns in a first direction which is either clockwise or
counterclockwise, and the distance between the linear material
10 of the first spiral part and the center decreases as the linear
material is spirally wound; a first inversion part located inside
the first spiral part, and configured to invert a winding
direction of the linear material from the first direction to a
second direction which is opposite to the first direction; and
15 a second spiral part located outside the first inversion part,
wherein the linear material is wound in a plurality of turns in
the second direction, and the distance between the linear
material of the second spiral part and the center increases as
the linear material is spirally wound. With this storage unit,
20 it is possible to improve the storage volumetric efficiency of
the linear material.

[0012]

It is preferable that at least a portion of the linear
material constituting the second spiral part is located in a
25 space between the linear material constituting the first spiral
part. In this way, it is possible to improve the storage
volumetric efficiency of the linear material. In addition, it is
preferable that the linear material constituting the first spiral
part is disposed with intervals therebetween in the radial
30 direction. By disposing the linear material constituting the
first spiral part with intervals therebetween in the radial
direction and also locating at least a portion of the linear
material constituting the second spiral part in a space between
the linear material constituting the first spiral part, it is
35 possible to both improve storage volumetric efficiency and

suppress twisting accumulated in the linear material when the linear material is drawn out.

[0013]

It is preferable that the linear material constituting the first spiral part and the linear material constituting the second spiral part are in contact with one another. It is possible to further improve the storage volumetric efficiency of the linear material.

[0014]

It is preferable that the wound body further includes: a third spiral part wherein the linear material extends continuously from the second spiral part and is wound in a plurality of turns in the second direction, and the distance between the linear material of the third spiral part and the center decreases as the linear material is spirally wound; a second inversion part located inside the third spiral part, and configured to invert the winding direction of the linear material from the second direction to the first direction; and a fourth spiral part located outside the second inversion part, wherein the linear material is wound in a plurality of turns in the first direction, and the distance between the linear material of the fourth spiral part and the center increases as the linear material is spirally wound. In this way, it is possible to improve the storage volumetric efficiency of the linear material.

[0015]

It is preferable that a layer constituted by the first spiral part and the second spiral part and a layer constituted by the third spiral part and the fourth spiral part are stacked. In this way, it is possible to improve the storage volumetric efficiency of the linear material.

[0016]

It is preferable that the layer constituted by the first spiral part and the second spiral part and the layer constituted by the third spiral part and the fourth spiral part are stacked alternately and repeatedly. In this way, it is possible to

improve the storage volumetric efficiency of the linear material.
[0017]

It is preferable that the linear material in the layer constituted by the first spiral part and the second spiral part and the linear material in the layer constituted by the third spiral part and the fourth spiral part are in contact with one another in a stacking direction. In this way, it is possible to improve the storage volumetric efficiency of the linear material.
[0018]

It is preferable that the storage body includes an outer periphery holding part configured to hold an outer periphery of a spirally-wound part constituted by the linear material wound outside the first inversion part and the second inversion part. In this way, it is possible to suppress the linear material in the spirally-wound part from collapsing.
[0019]

It is preferable that the storage body further includes an inner periphery holding part configured to hold an inner periphery of the spirally-wound part. In this way, it is possible to suppress the linear material in the spirally-wound part from collapsing inward.
[0020]

It is preferable that the storage body further includes an inversion holding part configured to hold the first inversion part and the second inversion part. In this way, it is possible to suppress the linear material in the inversion part from collapsing.
[0021]

It is preferable that the flexural rigidity with respect to a neutral axis of the spirally-wound linear material is smaller than the flexural rigidity with respect to an axis orthogonal to the neutral axis. In this way, it is easier to retain the shape of the wound body.
[0022]

Also disclosed is a wound body including: a first spiral

part wherein a linear material is wound in a plurality of turns in a first direction which is either clockwise or counterclockwise, and the distance between the linear material of the first spiral part and the center decreases as the linear material is spirally wound; a first inversion part located inside the first spiral part, and configured to invert a winding direction of the linear material from the first direction to a second direction which is opposite to the first direction; and a second spiral part located outside the first inversion part, wherein the linear material is wound in a plurality of turns in the second direction, and the distance between the linear material of the second spiral part and the center increases as the linear material is spirally wound. With this wound body, it is possible to improve the storage volumetric efficiency of the linear material.

[0023]

Present Embodiment:

Fig. 1 is an explanatory diagram of a storage unit 1 according to the present embodiment. Fig. 1 illustrates how a linear material 10 is drawn out from the storage unit 1. Fig. 2A is an explanatory diagram of a wound body 20 according to the present embodiment. Fig. 2B is a cross-sectional explanatory diagram of the wound body 20 according to the present embodiment. Fig. 3 is an explanatory diagram of a layered structure of the wound body 20 according to the present embodiment.

[0024]

The storage unit 1 is a member (unit) configured to store a linear material 10. The linear material 10 is a linear member. The linear material 10 may encompass, for example, linear members such as cables (electric cables, optical cables, etc.) and wires. In this example, the linear material 10 is an optical cable (described below; see Fig. 7A). The linear material 10 may be constituted by a single continuous member having no joint, or may be constituted by connecting a plurality of members. A linear material 10 with no joint is advantageous in that the linear

material 10 can be stored with high density. On the other hand, in cases where a single linear material 10 is made by connecting a plurality of members, it is possible to make a long linear material 10 from short members.

5 [0025]

The storage unit 1 includes the linear material 10 and a storage body 40 configured to store the linear material 10. In the storage unit 1, the linear material 10 is stored in a wound state. The wound linear material 10 is referred to as "wound
10 body". So, the storage unit 1 includes the wound body 20 and the storage body 40.

[0026]

In the description below, as illustrated in Fig. 1, the axial direction of the substantially circular-cylindrical wound
15 body 20 is referred to as "Z direction". The Z direction may be referred to also as "stacking direction" or "height direction". In the Z direction, the side of the leading end 20B as viewed from the base end 20A of the linear material 10 is referred to as "plus (+) side". It should be noted that the "base end 20A"
20 is the end part on the side where winding of the linear material 10 is started. The "leading end 20B" is the end part of the linear material 10 on the opposite side from the base end 20A. The leading end 20B is the end part (terminal end) on the side where winding of the linear material 10 is ended. When drawing
25 out the linear material 10 from the storage unit 1, drawing is started from the leading end 20B (see Fig. 1), whereas the base end 20A is drawn out at the end.

[0027]

In the description below, the direction around the axis of
30 the substantially circular-cylindrical wound body 20 is referred to as "circumferential direction". The linear material 10 is mainly wound along the circumferential direction. As viewed from the plus side in the Z direction, the counterclockwise direction in the circumferential direction is referred to as "plus (+)
35 side", whereas the clockwise direction is referred to as "minus

(-) side". In the description below, as viewed from the plus side in the Z direction, the clockwise winding direction may be referred to as "first direction", whereas the counterclockwise winding direction may be referred to as "second direction". (Note, however, that the counterclockwise winding direction may be defined as "first direction" and the clockwise winding direction may be defined as "second direction".) In Fig. 2B, the cross section of the linear material 10 wound in the first direction is indicated by a minus (-) sign, whereas the cross section of the linear material 10 wound in the second direction is indicated by a plus (+) sign.

In the description below, the direction of the radius of the substantially circular-cylindrical wound body 20 is referred to as "radial direction". The side farther from the center of the wound body 20 in the radial direction is referred to as "plus (+) side".

[0028]

In the present embodiment, as illustrated in Fig. 1, the linear material 10 can be drawn out by pulling the linear material 10 toward the plus side in the Z direction. Such a method of drawing out (paying out) the linear material 10 may be referred to as "flyer pay-off". In the present embodiment, the linear material 10 is stored in a manner that, when the linear material 10 is drawn out as illustrated in Fig. 1, twisting of the drawn-out linear material 10 is suppressed.

[0029]

As illustrated in Figs. 2A and 2B, the wound body 20 includes a spirally-wound part 21 and an inversion part 22.

The spirally-wound part 21 is a part wherein the linear material 10 is spirally wound round and round in the circumferential direction. The spirally-wound part 21 includes the linear material 10 wound clockwise, and the linear material 10 wound counterclockwise. As will be described below, the spirally-wound part 21 is constituted by a first spiral part 311, a second spiral part 312, a third spiral part 321, and a fourth

spiral part 322 (see Fig. 4). It should be noted that, although the spirally-wound part 21 illustrated in the figure is substantially circular cylindrical, the linear material 10 may be wound such that the spirally-wound part 21 has a square pillar shape with rounded corners.

The inversion part 22 is a part wherein the linear material 10 is wound so as to invert the winding direction. As will be described below, the inversion part 22 is constituted by a first inversion part 313 and a second inversion part 323 in which the linear material 10 is wound in an S-shape or an inverted S-shape (Z-shape) (see Fig. 4).

[0030]

As illustrated in Fig. 3, the wound body 20 has a layered structure in which a plurality of layers are stacked. The wound body 20 has a structure in which a first layer 31 formed by winding the linear material 10 according to a predetermined winding method and a second layer 32 formed by winding the linear material 10 according to a winding method different from that of the first layer 31 are stacked alternately. Fig. 3 illustrates each of the layers in a separated state, but actually, the linear material 10 constituting each layer is continuous with the linear material 10 in the adjacent layer in the Z direction. In Fig. 3, the linear material 10 constituting each layer is wound such that each of the layers is perpendicular to the Z direction. Note, however, that each layer does not have to be perfectly perpendicular to the Z direction. Further, a portion of the linear material 10 constituting each layer may be wound in a manner deviating in the Z direction with respect to a plane perpendicular to the Z direction.

[0031]

Fig. 4 is an explanatory diagram of a method for winding the linear material 10 in the first layer 31 and the second layer 32. Fig. 4 illustrates the linear material 10 in each part in a separated state, but actually, the linear material 10 constituting each part is continuous with the linear material 10

constituting the adjacent part.

[0032]

The linear material 10 constituting the first layer 31 includes, in order from the base end side, a first spiral part 311, a first inversion part 313, and a second spiral part 312. The first layer 31 is a layer constituted by the first spiral part 311 and the second spiral part 312.

[0033]

The first spiral part 311 is a part wherein the linear material 10 is spirally wound in a plurality of turns in the first direction (clockwise). In the first spiral part 311, the linear material 10 is wound in a manner that the distance between the linear material 10 and the center decreases as the linear material is spirally wound. In the first spiral part 311, the linear material 10 is spirally wound from the outer side toward the inner side. It should be noted that, when the linear material 10 is spirally wound in a plurality of turns, the length of the linear material 10 per turn on the outer side becomes longer than the length of the linear material 10 per turn on the inner side. At an end part (end part on the leading end side) on the inner side of the first spiral part 311, the linear material 10 continuously transitions from the first spiral part 311 to the first inversion part 313.

[0034]

The first inversion part 313 is a part located inside the first spiral part 311 (and the second spiral part 312). In the first inversion part 313, the winding direction of the linear material 10 is inverted from the first direction (clockwise) to the second direction (counterclockwise). In this example, when the first inversion part 313 is viewed from the plus side in the Z direction, the linear material 10 is wound in an inverted S-shape. At one end (end part on the base end side) of the first inversion part 313, the linear material 10 continuously transitions from the first spiral part 311 to the first inversion part 313. At the other end (end part on the leading end side) of

the first inversion part 313, the linear material 10 continuously transitions from the first inversion part 313 to the second spiral part 312.

[0035]

5 The second spiral part 312 is a part wherein the linear material 10 is spirally wound in a plurality of turns in the second direction (counterclockwise). In the second spiral part 312, the linear material 10 is wound in a manner that the distance between the linear material 10 and the center increases as the
10 linear material is spirally wound. In the second spiral part 312, the linear material 10 is spirally wound from the inner side toward the outer side. At an end part (end part on the base end side) on the inner side of the second spiral part 312, the linear material 10 continuously transitions from the first inversion
15 part 313 to the second spiral part 312. It should be noted that, at an end part (end part on the leading end side) on the outer side of the second spiral part 312, the linear material 10 continuously transitions from the second spiral part 312 to the third spiral part 321. Stated differently, the linear material
20 10 continuously transitions between the first layer 31 and the second layer 32 (i.e., the second layer 32 adjacent on the plus side in the Z direction).

[0036]

25 When the linear material 10 of the first layer 31 is drawn out in the Z direction, the linear material 10 constituting the second spiral part 312 is drawn out first. In the second spiral part 312, the linear material 10 is wound along the second direction, and therefore, when the linear material 10 of the second spiral part 312 is drawn out, the drawn-out linear
30 material 10 will be twisted in a predetermined direction. After the linear material 10 of the second spiral part 312 is drawn out, the linear material 10 of the first inversion part 313 and the first spiral part 311 will be drawn out. In the first spiral part 311, the linear material 10 is wound along a direction
35 (first direction) opposite from the second spiral part 312, and

therefore, when the linear material 10 of the first spiral part 311 is drawn out, twisting of the linear material 10 will be canceled out. As described above, in the present embodiment, the linear material 10 is stored in a manner that, when the linear material 10 is drawn out as illustrated in Fig. 1, twisting of the drawn-out linear material 10 is suppressed.

[0037]

Another method for winding the linear material 10 capable of suppressing twisting of the linear material 10 is a winding method of winding the linear material 10 in a figure eight, as illustrated in Fig. 8. Note, however, that according to the method for winding the linear material 10 as illustrated in Fig. 8, the length of linear material 10 that can be stored within a plane perpendicular to the direction (Z direction)—in which the intersection points of the linear material 10 (the inversion parts for inverting the winding direction of the linear material 10) are stacked—becomes short. Thus, according to the winding method of the comparative example illustrated in Fig. 8, the storage volumetric efficiency of the linear material 10 is low.

In contrast, according to the present embodiment, in the first spiral part 311 and the second spiral part 312, the linear material 10 is spirally wound in a plurality of turns (approximately 4 turns in this example). Thus, according to the present embodiment, a greater amount of linear material 10 can be stored in the direction perpendicular to the Z direction compared to the comparative example illustrated in Fig. 8, and thus, the storage volumetric efficiency of the linear material 10 can be improved.

[0038]

Fig. 5A is an explanatory diagram of a configuration of the linear material 10 constituting the first spiral part 311 within a region surrounded by the dotted lines in Fig. 2B.

[0039]

Fig. 5A illustrates a dotted line L1 that connects the upper edges of the linear material 10 constituting the first

spiral part 311. Fig. 5A also illustrates a dotted line L2 that connects the lower edges of the linear material 10 constituting the first spiral part 311. As illustrated in Fig. 5A, a space S is formed between the linear material 10 constituting the first spiral part 311. The space S is a space surrounded by the side surfaces of the linear material 10 and the lines L1 and L2. Fig. 5A shows the interval (distance) C of the narrowest part of the space S in the radial direction.

The linear material 10 constituting the first spiral part 311 is spirally wound from the outer side toward the inner side in the first direction. Therefore, the space S formed by the first spiral part 311 becomes a spiral-shaped space extending from the outer side toward the inner side along the first direction. Therefore, when the space S is viewed along the second direction, the space S formed by the first spiral part 311 takes the form of a spiral-shaped space extending from the inner side toward the outer side along the second direction. So, according to the present embodiment, the linear material 10 constituting the second spiral part 312 can be disposed along the spirally-shaped space S formed by the first spiral part 311. By disposing the linear material 10 of the second spiral part 312 along the space S formed by the first spiral part 311, in the present embodiment, the linear material 10 constituting the first spiral part 311 (the linear material 10 indicated by the minus sign in the figure) and the linear material 10 constituting the second spiral part 312 (the linear material 10 indicated by the plus sign in the figure) are disposed alternately in the radial direction in the first layer 31, as illustrated in Fig. 2B. Further, in order to dispose the linear material 10 constituting the second spiral part 312 between the linear material 10 constituting the first spiral part 311, it is preferable that the number of turns of the linear material 10 of the first spiral part 311 is the same as the number of turns of the linear material 10 of the second spiral part 312.

[0040]

In the present embodiment, the linear material 10 constituting the second spiral part 312 is disposed in the space S (see Fig. 5A) between the linear material 10 constituting the first spiral part 311 (see Fig. 2B). As illustrated in Fig. 5A, in the present embodiment, the interval C of the narrowest part of the space S in the radial direction is set substantially equal to the diameter D of the linear material 10, and the linear material 10 of the second spiral part 312 is disposed inside the space S, as illustrated in Fig. 2B. By disposing the linear material 10 of the second spiral part 312 within the space S formed by the first spiral part 311, unnecessary space within the wound body 20 can be reduced, and thus, storage volumetric efficiency can be improved. Note, however, that not all the parts of the linear material 10 of the second spiral part 312 have to be disposed inside the space S. It should be noted that, by disposing the linear material 10 constituting the second spiral part 312 inside the space S (see Fig. 5A) between the linear material 10 constituting the first spiral part 311, the layer constituted by the first spiral part 311 can be in the same layer as the layer constituted by the second spiral part 312. Therefore, the layer thickness (dimension in the Z direction) of the first layer 31 constituted by the first spiral part 311 and the second spiral part 312 can be reduced. Stated differently, by disposing the linear material 10 constituting the second spiral part 312 inside the space S (see Fig. 5A) between the linear material 10 constituting the first spiral part 311, the layer thickness of the first layer 31 can be made substantially equal to the layer thickness of the first spiral part 311 and the layer thickness of the second spiral part 312.

[0041]

Fig. 5B is an explanatory diagram of a configuration of the linear material 10 according to a first modified example. In the first modified example, the interval C of the narrowest part of the space S in the radial direction is shorter than the diameter D of the linear material 10. Therefore, in the first

modified example, the entire linear material 10 of the second spiral part 312 cannot be disposed inside the space S, and only a portion of the linear material 10 of the second spiral part 312 is disposed inside the space S. However, even with the configuration of the first modified example, unnecessary space within the wound body 20 can be reduced and storage volumetric efficiency can thus be improved, compared to cases where the linear material 10 of the second spiral part 312 is not disposed in the space S at all. So, it is preferable that at least a portion of the linear material 10 constituting the second spiral part 312 is located in the space S (see Fig. 5A) between the linear material 10 constituting the first spiral part 311.

[0042]

Fig. 5C is an explanatory diagram of a configuration of the linear material 10 according to a second modified example. In the second modified example, the linear material 10 constituting the first spiral part 311 is mutually in contact in the radial direction. Stated differently, in the second modified example, the linear material 10 constituting the first spiral part 311 is not disposed with intervals therebetween in the radial direction (the aforementioned interval C is substantially zero). Therefore, in the second modified example, the linear material 10 of the second spiral part 312 (the linear material 10 with the plus sign in the figure) substantially cannot be disposed inside the space S. However, even with the configuration of second modified example, unnecessary space within the wound body 20 can be reduced, and thus, storage volumetric efficiency can be improved.

[0043]

According to the configurations illustrated in Figs. 2B and 5B, since the linear material 10 of the first spiral part 311 is disposed with intervals C therebetween, the number of turns in the first spiral part 311 (and the second spiral part 312) becomes smaller than that in the second modified example, and thus, at the time of drawing out the linear material 10 from

the storage unit 1, twisting accumulated in the linear material 10 can be suppressed. Further, according to the configurations illustrated in Figs. 2B and 5B, since at least a portion of the linear material 10 constituting the second spiral part 312 is located between the linear material 10 constituting the first spiral part 311, the storage volumetric efficiency is not impaired, even though the number of turns in the first spiral part 311 or the second spiral part 312 is reduced (i.e., even though there are intervals C between the linear material 10 of the first spiral part 311 (or the second spiral part 312)). Therefore, in order to both improve storage volumetric efficiency and suppress twisting accumulated in the linear material 10, it is preferable to dispose the linear material 10 constituting the first spiral part 311 (and the second spiral part 312) with intervals C therebetween and also locate at least a portion of the linear material 10 constituting the second spiral part 312 between the linear material 10 constituting the first spiral part 311.

[0044]

In Fig. 2B, the position, in the Z direction, of the linear material 10 constituting the first spiral part 311 is illustrated at the same position as the position, in the Z direction, of the linear material 10 constituting the second spiral part 312. Note, however, that the first spiral part 311 and the second spiral part 312 may be slightly misaligned from one another in the Z direction. (For example, they may be misaligned in the Z direction by a distance smaller than the diameter of the linear material 10.) Further, a portion of the linear material 10 constituting the first spiral part 311 or the second spiral part 312 may be slightly misaligned in the Z direction. It should be noted that, in cases where the layer constituted by the first spiral part 311 and the layer constituted by the second spiral part 312 are misaligned in the Z direction as illustrated in Figs. 5B and 5C, the layer thickness (the dimension in the Z direction) of the first layer 31 will increase. Therefore, it

is preferable that the layer constituted by the first spiral part 311 and the layer constituted by the second spiral part 312 are located in the same layer as illustrated in Fig. 5A by locating the linear material 10 constituting the second spiral part 312 within the space S between the linear material 10 constituting the first spiral part 311.

[0045]

Further, as illustrated in Fig. 2B, in the present embodiment, the linear material 10 constituting the first spiral part 311 and the linear material 10 constituting the second spiral part 312 are in contact with one another. Particularly, in the present embodiment, the linear material 10 constituting the second spiral part 312 (or the first spiral part 311) is in contact with the linear material 10 constituting the first spiral part 311 (or the second spiral part 312) on both sides in the radial direction. In this way, the linear material 10 can be stored with high density in the direction perpendicular to the Z direction. Note, however, that there may be a gap formed between the linear material 10 constituting the first spiral part 311 and the linear material 10 constituting the second spiral part 312.

[0046]

The linear material 10 constituting the second layer 32 includes, in order from the base end side, a third spiral part 321, a second inversion part 323, and a fourth spiral part 322.

[0047]

The third spiral part 321 is a part wherein the linear material 10 is spirally wound in a plurality of turns in the second direction (counterclockwise). In the third spiral part 321, the linear material 10 is wound in a manner that the distance between the linear material 10 and the center decreases as the linear material is spirally wound. In the third spiral part 321, the linear material 10 is spirally wound from the outer side toward the inner side. At an end part (end part on the base end side) on the outer side of the third spiral part 321, the linear

material 10 continuously transitions from the second spiral part 312 to the third spiral part 321. At an end part (end part on the leading end side) on the inner side of the third spiral part 321, the linear material 10 continuously transitions from the
5 third spiral part 321 to the second inversion part 323.

[0048]

The second inversion part 323 is a part located inside the third spiral part 321 (and the fourth spiral part 322). In the second inversion part 323, the winding direction of the linear
10 material 10 is inverted from the second direction (counterclockwise) to the first direction (clockwise). In this example, when the second inversion part 323 is viewed from the plus side in the Z direction, the linear material 10 is wound in an S-shape. At one end (end part on the base end side) of the
15 second inversion part 323, the linear material 10 continuously transitions from the third spiral part 321 to the second inversion part 323. At the other end (end part on the leading end side) of the second inversion part 323, the linear material 10 continuously transitions from the second inversion part 323
20 to the fourth spiral part 322.

[0049]

The fourth spiral part 322 is a part wherein the linear material 10 is spirally wound in a plurality of turns in the first direction (clockwise). In the fourth spiral part 322, the
25 linear material 10 is wound in a manner that the distance between the linear material 10 and the center increases as the linear material is spirally wound. In the fourth spiral part 322, the linear material 10 is spirally wound from the inner side toward the outer side. At an end part (end part on the base end side)
30 on the inner side of the fourth spiral part 322, the linear material 10 continuously transitions from the second inversion part 323 to the fourth spiral part 322. It should be noted that, at an end part (end part on the leading end side) on the outer side of the fourth spiral part 322, the linear material 10
35 continuously transitions from the fourth spiral part 322 to the

first spiral part 311. Stated differently, the linear material 10 continuously transitions between the second layer 32 and the first layer 31 (i.e., the first layer 31 adjacent on the plus side in the Z direction).

5 [0050]

When the linear material 10 of the second layer 32 is drawn out in the Z direction, the linear material 10 constituting the fourth spiral part 322 is drawn out first. In the fourth spiral part 322, the linear material 10 is wound along the second direction, and therefore, when the linear material 10 of the fourth spiral part 322 is drawn out, the drawn-out linear material 10 will be twisted in a predetermined direction. After the linear material 10 of the fourth spiral part 322 is drawn out, the linear material 10 of the second inversion part 323 and the third spiral part 321 will be drawn out. In the third spiral part 321, the linear material 10 is wound along a direction (first direction) opposite from the fourth spiral part 322, and therefore, when the linear material 10 of the third spiral part 321 is drawn out, twisting of the linear material 10 will be canceled out. It should be noted that, as described above, after the linear material 10 of the third spiral part 321 is drawn out, the linear material 10 of the first layer 31 will be drawn out. [0051]

The linear material 10 constituting the third spiral part 321 is spirally wound from the outer side toward the inner side in the second direction. Therefore, the space S formed by the third spiral part 321 becomes a spiral-shaped space extending from the outer side toward the inner side along the second direction. Therefore, when the space S is viewed along the first direction, the space S formed by the third spiral part 321 takes the form of a spiral-shaped space extending from the inner side toward the outer side along the first direction. So, similar to the first spiral part 311 and the second spiral part 312, also in the third spiral part 321 and the fourth spiral part 322, the linear material 10 constituting the fourth spiral part 322 can

be disposed along the spirally-shaped space S formed by the third spiral part 321. By disposing the linear material 10 of the fourth spiral part 322 along the space S formed by the third spiral part 321, the linear material 10 constituting the third spiral part 321 (the linear material 10 indicated by the plus sign in the figure) and the linear material 10 constituting the fourth spiral part 322 (the linear material 10 indicated by the minus sign in the figure) are disposed alternately in the radial direction in the second layer 32, as illustrated in Fig. 2B. Further, in order to dispose the linear material 10 constituting the fourth spiral part 322 between the linear material 10 constituting the third spiral part 321, it is preferable that the number of turns of the linear material 10 of the third spiral part 321 is the same as the number of turns of the linear material 10 of the fourth spiral part 322.

[0052]

Similar to the first spiral part 311 and the second spiral part 312, also in the third spiral part 321 and the fourth spiral part 322, the linear material 10 is spirally wound in a plurality of turns. Thus, similar to the first layer 31, also in the second layer 32, the storage volumetric efficiency of the linear material 10 can be improved, compared to the comparative example illustrated in Fig. 8. Further, also in the third spiral part 321 and the fourth spiral part 322, at least a portion of the linear material 10 constituting one of the spiral parts is located in the space S formed by the linear material 10 constituting the other spiral part. In this way, unnecessary space within the wound body 20 can be reduced, and thus, the storage volumetric efficiency of the linear material 10 can be improved. Further, similar to the first spiral part 311 and the second spiral part 312, in order to both improve storage volumetric efficiency and suppress twisting accumulated in the linear material 10, it is preferable to dispose the linear material 10 constituting the third spiral part 321 (and the fourth spiral part 322) with intervals C therebetween and also

locate at least a portion of the linear material 10 constituting the fourth spiral part 322 between the linear material 10 constituting the third spiral part 321.

[0053]

5 In Fig. 2B, the position, in the Z direction, of the linear material 10 constituting the third spiral part 321 is illustrated at the same position as the position, in the Z direction, of the linear material 10 constituting the fourth spiral part 322, but a portion of the linear material 10 constituting the third spiral
10 part 321 or the fourth spiral part 322 may be slightly misaligned in the Z direction. Further, in the present embodiment, the linear material 10 constituting the third spiral part 321 and the linear material 10 constituting the fourth spiral part 322 are in contact with one another, but there may be a gap formed
15 between the linear material 10 constituting the third spiral part 321 and the linear material 10 constituting the fourth spiral part 322.

[0054]

20 It should be noted that, instead of constituting the second layer 32 by the third spiral part 321 and the fourth spiral part 322 (and the second inversion part 323), the second layer 32 may be constituted only by the third spiral part 321 without including the fourth spiral part (and the second inversion part 323). Also with this configuration, the linear material 10 can
25 be stored in a manner that twisting of the drawn-out linear material 10 is suppressed. Further, in cases of adopting this configuration, it is preferable to provide a layer in which the linear material 10 is wound along the opposite direction from the third spiral part 321, as a layer separate from the first
30 layer 31 and the second layer 32. In this way, twisting that occurs when drawing out the linear material 10 of the second layer 32 (the layer constituted only by the third spiral part 321) can be canceled out by the twisting that occurs when drawing out the linear material 10 of the separate layer (the linear
35 material 10 wound in the opposite direction from the third spiral

part 321).

[0055]

Further, in the present embodiment, the first layer 31 constituted by the first spiral part 311 and the second spiral part 312 (and the first inversion part 313) and the second layer 32 constituted by the third spiral part 321 and the fourth spiral part 322 (and the second inversion part 323) are stacked. By stacking the first layer 31 and the second layer 32, it is possible to improve the storage volumetric efficiency of the linear material 10. It should be noted that, in the present embodiment, since the winding direction of the linear material 10 is opposite from one another between the first layer 31 and the second layer 32, the linear material 10 can continuously transition between the second spiral part 312 of the first layer 31 and the third spiral part 321 of the second layer 32, and thus, the first layer 31 and the second layer 32 can be configured in a stacked manner. It should be noted that, in order to make the size of the first layer 31 and the second layer 32 the same, it is preferable that the number of turns is the same in all of the first spiral part 311, the second spiral part 312, the third spiral part 321, and the fourth spiral part 322.

[0056]

Further, as illustrated in Fig. 3, in the present embodiment, the first layer 31 and the second layer 32 are stacked alternately and repeatedly. In this way, it is possible to improve the storage volumetric efficiency of the linear material 10. It should be noted that, in the present embodiment, since the winding direction of the linear material 10 is opposite from one another between the first layer 31 and the second layer 32, the linear material 10 can continuously transition between the second spiral part 312 of the first layer 31 and the third spiral part 321 of the second layer 32, and also the linear material 10 can continuously transition between the fourth spiral part 322 of the second layer 32 and the first spiral part 311 of the first layer 31, and thus, the first layer 31 and the second

layer 32 can be stacked alternately and repeatedly.

[0057]

Further, as illustrated in Fig. 2B, in the present embodiment, the linear material 10 of the first layer 31 and the linear material 10 of the second layer 32 are in contact with one another in the Z direction (stacking direction; the up-down direction in Fig. 2B). In this way, the linear material 10 can be stored with high density in the Z direction. Note, however, that a gap may be formed in the Z direction (stacking direction; the up-down direction in Fig. 2B) between the linear material 10 of the first layer 31 and the linear material 10 of the second layer 32.

[0058]

The storage body 40 is a member configured to store the linear material 10. The storage body 40 of the present embodiment is a member configured to store the linear material 10 (wound body 20) wound as described above. In the present embodiment, the storage body 40 has a framework structure constituted by combining a multitude of frames (rod members). Note, however, that the storage body 40 may be formed in a box structure (casing-like structure) by plate-like members etc. As illustrated in Fig. 1, the storage body 40 stores the wound body 20, with the wound body 20's plus side in the Z direction open, and is thus configured such that the linear material 10 can be drawn out in the Z direction. Note, however, that in cases where the storage body 40 is formed in a casing-like structure, a hole (opening) may be formed in the plate-like member constituting the storage body 40, and the linear material 10 may be drawn out in the Z direction through this hole.

[0059]

The storage body 40 includes a base part 41 and a holding part 42. As illustrated in Fig. 2B, the base part 41 is a member configured to support the lowermost layer of the linear material 10 (wound body 20). For example, the base part 41 is constituted by a pallet. As illustrated in Fig. 1, the holding part 42 is a

member configured to hold the wound linear material 10 (wound body 20). Because the holding part 42 is in contact with the linear material 10 (wound body 20), the shape of the wound body 20 can be retained. Further, because the holding part 42 holds the linear material 10 (wound body 20), the wound body 20 can be suppressed from collapsing when the linear material 10 is being drawn out, thereby making it easy to draw out the linear material 10 from the storage body 40. As illustrated in Fig. 1, in the present embodiment, the holding part 42 is constituted by a plurality of rod members (e.g., pins) that rise up toward the plus side in the Z direction from the supporting surface of the base part 41. In this way, the holding part 42 can hold the wound body 20 while keeping the Z-direction plus side of the wound body 20 open.

[0060]

Fig. 6A is an explanatory diagram of the holding part 42. Figs. 6B to 6D are explanatory diagrams of holding parts 42 according to modified examples. The holding part 42 will be described below also with reference to Fig. 1.

[0061]

The holding part 42 includes an outer periphery holding part 421, an inner periphery holding part 422, and an inversion holding part 423.

[0062]

The outer periphery holding part 421 is a part configured to hold the outer periphery 21A of the spirally-wound part 21 (the part constituted by the linear material 10 wound outside the inversion part 22) of the wound body 20. The outer periphery holding part 421 is a part configured to hold the outer periphery of the first spiral part 311, the second spiral part 312, the third spiral part 321, and the fourth spiral part 322. The linear material 10, which is wound along the circumferential direction, attempts to expand in the radial direction, but because the outer periphery holding part 421 comes into contact with the outer periphery 21A of the wound body 20, the shape of the wound body

20 can be retained. As described below, in cases where the linear material 10 includes a tension member 13, the force with which the linear material 10 attempts to expand in the radial direction becomes greater, and therefore, it is particularly advantageous for the holding part 42 to include the outer periphery holding part 421. In the present embodiment, a plurality of rod members constituting the outer periphery holding part 421 are disposed substantially evenly in the circumferential direction so as to contact the outer periphery 21A of the substantially circular-cylindrical wound body 20. It should be noted that the outer periphery holding part 421 may be constituted by plate-like members. In this case, it is preferable that the inner surface of the plate-like members contacts the outer periphery 21A of the wound body 20. For example, in cases where the storage body 40 is formed in a casing-like structure by plate-like members, the inner surface of the plate-like members constituting the side surfaces of the storage body 40 may contact the outer periphery 21A of the wound body 20, and in this way, the plate-like members constituting the side surfaces of the storage body 40 may also function as the outer periphery holding part 421.

[0063]

The inner periphery holding part 422 is a part configured to hold the inner periphery 21B of the spirally-wound part 21 of the wound body 20. The annular space between the inner periphery holding part 422 and the outer periphery holding part 421 (i.e., the space surrounded by the two circular dotted lines in Fig. 6A) serves as a storage part for the spirally-wound part 21 of the wound body 20. The space inside the inner periphery holding part 422 (i.e., the space surrounded by the circular dotted line on the inner side in Fig. 6A) serves as a storage part for the inversion part 22 of the wound body 20. By holding the inner periphery 21B of the wound body 20 with the inner periphery holding part 422, the linear material 10 of the spirally-wound part 21 can be suppressed from collapsing toward the inside when the linear material 10 is being drawn out. Note, however, that

the holding part 42 does not have to include the inner periphery holding part 422, as illustrated in Figs. 6C and 6D.

[0064]

The inversion holding part 423 is a part configured to hold the inversion part 22 of the wound body 20. In the inversion part 22 where the winding direction of the linear material 10 is inverted, the linear material 10 is likely to become unstable and collapse. So, by holding the inversion part 22 of the wound body 20 with the inversion holding part 423, it is possible to suppress collapsing of the shape of the inversion part 22. The inversion holding part 423 includes a first inversion holding part 423A and a second inversion holding part 423B.

The first inversion holding part 423A is configured to hold a part (linear material 10), of the linear material 10 constituting the first inversion part 313, wound in the first direction and a part (linear material 10) wound in the second direction. In this way, the first inversion holding part 423A can hold the linear material 10 constituting the first inversion part 313 in its inverted S-shape (or S-shape).

The second inversion holding part 423B is configured to hold a part (linear material 10), of the linear material 10 constituting the second inversion part 323, wound in the second direction and a part (linear material 10) wound in the first direction. In this way, the second inversion holding part 423B can hold the linear material 10 constituting the second inversion part 323 in its S-shape (or inverted S-shape).

[0065]

In the present embodiment, the first inversion holding part 423A and the second inversion holding part 423B are each constituted by a plurality of rod members. The rod members constituting the first inversion holding part 423A and the second inversion holding part 423B are located in the spaces surrounded by the first inversion part 313 and the second inversion part 323. Note, however, that the first inversion holding part 423A and the second inversion holding part 423B do not have to be

constituted by rod members. Further, the first inversion holding part 423A and the second inversion holding part 423B may be located outside the spaces surrounded by the first inversion part 313 and the second inversion part 323.

5 [0066]

The inner periphery holding part 422 illustrated in Fig. 6A (and Fig. 6B) includes first inner periphery holding parts 422A and second inner periphery holding parts 422B. The first inner periphery holding parts 422A come into contact with the inner periphery 21B of the spirally-wound part 21 of the wound body 20, and are located outside the spaces surrounded by the first inversion part 313 and the second inversion part 323. The second inner periphery holding parts 422B come into contact with the inner periphery 21B of the spirally-wound part 21 of the wound body 20, and are located within the spaces surrounded by the first inversion part 313 and the second inversion part 323. In this way, the second inner periphery holding parts 422B can have both the function of holding the inner side of the spirally-wound part 21 of the wound body 20 and the function of holding the first inversion part 313 and the second inversion part 323.

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15
20

[0067]

It should be noted that, as illustrated in Figs. 6B and 6D, the holding part 42 does not have to include the inversion holding part 423. In such cases, however, the linear material 10 is prone to become unstable and collapse in the inversion part 22 where the winding direction of the linear material 10 is inverted. Therefore, in cases where the holding part 42 does not include an inversion holding part 423, it is preferable to locate a portion (the second inner periphery holding part 422B) of the members constituting the inner periphery holding part 422 within the spaces surrounded by the first inversion part 313 and the second inversion part 323, as illustrated in Fig. 6B.

25
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[0068]

The holding part 42 described above includes an outer periphery holding part 421, an inner periphery holding part 422,

35

and an inversion holding part 423. Note, however, that the holding part 42 may have other configurations, so long as the wound body 20 can be held. For example, rod members (e.g., pins) may be located between the linear material 10 of the first spiral part 311 (or the third spiral part 321) and the linear material 10 of the second spiral part 312 (or the fourth spiral part 322), to thereby retain the shape of the wound body 20 (particularly the spirally-wound part 21).

[0069]

Further, the holding part 42 described above is constituted by a plurality of rod members. Note, however, that the shape of the wound body 20 may be retained by bundling the linear material 10 constituting the spirally-wound part 21 of the wound body 20 with a bundling member. In cases of constituting the holding body with a bundling member, however, there is a need to remove the bundling member at the time of drawing out the linear material 10 in the Z direction. Further, in the storage unit 1 described above, the wound body 20 formed by winding the linear material 10 is stored in the storage body 40. Note, however, that the wound body 20 does not have to be stored in a storage body 40 so long as the shape of the wound body 20 can be retained. Transportation efficiency can be improved if it is possible to ship the wound body 20 alone.

[0070]

Fig. 7A is a cross-sectional view of the linear material 10. As described above, in the present embodiment, the linear material 10 is an optical cable, and includes optical fibers 11 and an outer sheath 12 that houses the optical fibers 11. In the present embodiment, tension members 13 are embedded in the outer sheath 12.

[0071]

As illustrated in Fig. 7A, there are cases where a pair of tension members 13 is located so as to sandwich the housing part of the outer sheath 12. In the linear material 10 illustrated in Fig. 7A, the flexural rigidity differs depending

on the direction in which the linear material 10 is bent. "Flexural rigidity" is the product (EI) of the second moment of area (I) of the linear material 10 and the Young's modulus (E) of the linear material 10. In cases where the linear material 10 includes tension members 13, the flexural rigidity of the linear material 10 mainly depends on the configuration of the tension members 13. For example, as illustrated in Fig. 7A, when a line connecting the respective center parts of the pair of tension members 13 is defined as the y axis and a line passing through the center of the linear material 10 and perpendicular to the y axis is defined as the x axis, the flexural rigidity about the y axis becomes smaller than the flexural rigidity about the x axis. In cases where the flexural rigidity differs depending on the direction in which the linear material 10 is bent as described above, it is preferable to wind the linear material 10 by bending the linear material 10 in the direction with a smaller flexural rigidity. In the present embodiment, it is preferable to wind the linear material 10 such that the linear material 10 illustrated in Fig. 7A is bent about the y axis. By winding the linear material 10 in a manner that the y axis of the linear material 10 illustrated in Fig. 7A is along the Z axis illustrated in Fig. 1, it is easier to retain the shape of the wound body 20. If the linear material 10 illustrated in Fig. 7A is wound so as to be bent about the x axis, the linear material 10 is prone to collapse when the linear material 10 is drawn upward in the Z direction as illustrated in Fig. 1. Therefore, winding the linear material 10 in a manner that the linear material 10 illustrated in Fig. 7A is bent about the y axis is advantageous in that the wound body 20 can be suppressed from collapsing when the linear material 10 is being drawn out.

[0072]

Fig. 7B is a cross-sectional view of a linear material 10 according to a modified example. As illustrated in Fig. 7B, the linear material 10 may be an optical cable having a uniform flexural rigidity regardless of the bending direction by

disposing the tension members 13 evenly. Alternatively, the linear material 10 does not have to include a tension member 13. Alternatively, the linear material 10 does not have to be an optical cable.

5 [0073]

Others:

The foregoing embodiments are for facilitating the understanding of the present invention, and are not to be construed as limiting the present invention. The present
10 invention may be modified and/or improved without departing from the gist thereof, and it goes without saying that the present invention encompasses equivalents thereof.

REFERENCE SIGNS LIST

15 [0074]

1: Storage unit;
10: Linear material;
11: Optical fiber;
12: Outer sheath;
20 13: Tension member;
20: Wound body;
20A: Base end;
20B: Leading end;
21: Spirally-wound part;
25 21A: Outer periphery;
21B: Inner periphery;
22: Inversion part;
31: First layer;
311: First spiral part;
30 312: Second spiral part;
313: First inversion part;
32: Second layer;
321: Third spiral part;
322: Fourth spiral part;
35 323: Second inversion part;

40: Storage body;
41: Base part;
42: Holding part;
421: Outer periphery holding part;
5 422: Inner periphery holding part;
422A: First inner periphery holding part;
422B: Second inner periphery holding part;
423: Inversion holding part;
423A: First inversion holding part;
10 423B: Second inversion holding part.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

[Claim 1] A storage unit comprising:

a wound body formed by winding a linear material; and

a storage body configured to store the wound body, wherein
the wound body includes

a first spiral part wherein the linear material is
wound in a plurality of turns, a direction in which the
linear material of the first spiral part is wound around
a center such that a distance between the linear material
and the center decreases is a first direction, and the
first direction is either clockwise or counterclockwise,

a first inversion part located inside the first
spiral part, a winding direction of the linear material
being inverted at the first inversion part from the first
direction to a second direction which is opposite to the
first direction,

a second spiral part located outside the first
inversion part, wherein the linear material is wound in a
plurality of turns in the second direction, and the second
direction is a direction in which the linear material of
the second spiral part is wound around the center such
that the distance between the linear material and the
center increases, and

a third spiral part wherein the linear material
extends continuously from the second spiral part and is
wound in a plurality of turns in the second direction, the
second direction being a direction in which the linear
material of the third spiral part is wound around the
center such that the distance between the linear material
and the center decreases.

[Claim 2] The storage unit according to claim 1, wherein

at least a portion of the linear material constituting the
second spiral part is located in a space between the linear

material constituting the first spiral part.

[Claim 3] The storage unit according to claim 2, wherein
the linear material constituting the first spiral part is
disposed with intervals therebetween in a radial direction.

[Claim 4] The storage unit according to claim 2 or 3, wherein
the linear material constituting the first spiral part and
the linear material constituting the second spiral part are in
contact with one another.

[Claim 5] The storage unit according to claim 4, wherein
the wound body further includes
a second inversion part located inside the third
spiral part, the winding direction of the linear material
being inverted at the second inversion part from the second
direction to the first direction, and
a fourth spiral part located outside the second
inversion part, wherein the linear material is wound in a
plurality of turns in the first direction, the first
direction being a direction in which the linear material
of the fourth spiral part is wound around the center such
that the distance between the linear material and the
center increases.

[Claim 6] The storage unit according to claim 5, wherein
a layer constituted by the first spiral part and the second
spiral part and
a layer constituted by the third spiral part and the fourth
spiral part
are stacked.

[Claim 7] The storage unit according to claim 6, wherein
the layer constituted by the first spiral part and the

second spiral part and

the layer constituted by the third spiral part and the fourth spiral part are stacked alternately and repeatedly.

[Claim 8] The storage unit according to claim 6 or 7, wherein the linear material in the layer constituted by the first spiral part and the second spiral part and the linear material in the layer constituted by the third spiral part and the fourth spiral part are in contact with one another in a stacking direction.

[Claim 9] The storage unit according to any one of claims 5 to 8, wherein

the storage body includes an outer periphery holding part configured to hold an outer periphery of a spirally-wound part constituted by the linear material wound outside the first inversion part and the second inversion part.

[Claim 10] The storage unit according to claim 9, wherein the storage body further includes an inner periphery holding part configured to hold an inner periphery of the spirally-wound part.

[Claim 11] The storage unit according to claim 9 or 10, wherein the storage body further includes an inversion holding part configured to hold the first inversion part and the second inversion part.

[Claim 12] The storage unit according to any one of claims 1 to 11, wherein a flexural rigidity with respect to a neutral axis of the spirally-wound linear material is smaller than a flexural rigidity with respect to an axis orthogonal to the neutral axis.

[Claim 13] A wound body comprising:

5 a first spiral part wherein a linear material is wound in a plurality of turns, a direction in which the linear material of the first spiral part is wound around a center such that a distance between the linear material and the center decreases is a first direction, and the first direction is either clockwise or counterclockwise;

10 a first inversion part located inside the first spiral part, a winding direction of the linear material being inverted at the first inversion part from the first direction to a second direction which is opposite to the first direction;

15 a second spiral part located outside the first inversion part, wherein the linear material is wound in a plurality of turns in the second direction, and the second direction is a direction in which the linear material of the second spiral part is wound around the center such that the distance between the linear material and the center increases; and

20 a third spiral part wherein the linear material extends continuously from the second spiral part and is wound in a plurality of turns in the second direction, the second direction being a direction in which the linear material of the third spiral part is wound around the center such that the distance between the linear material and the center decreases.

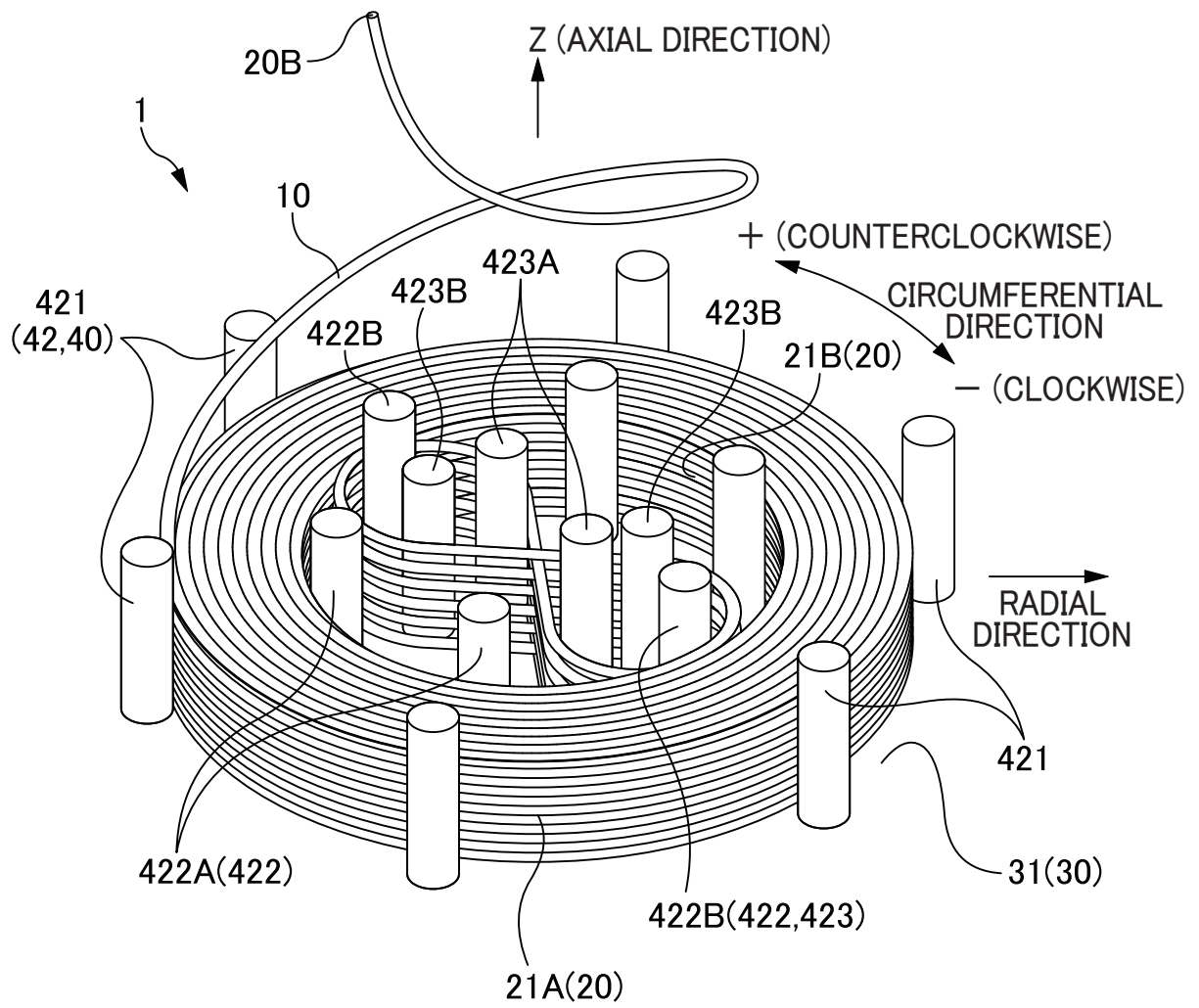


FIG. 1

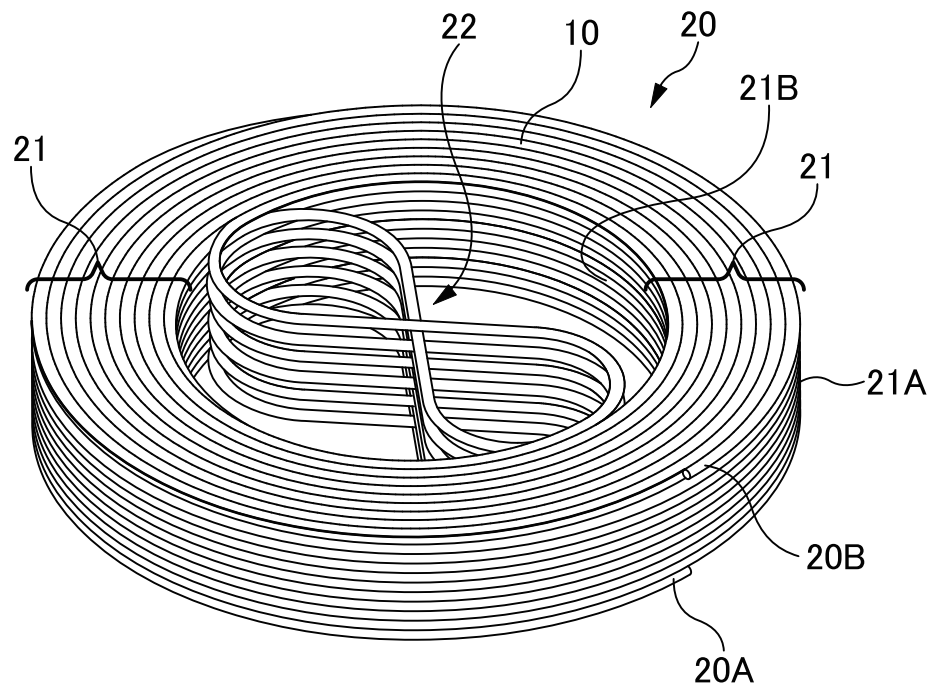


FIG. 2A

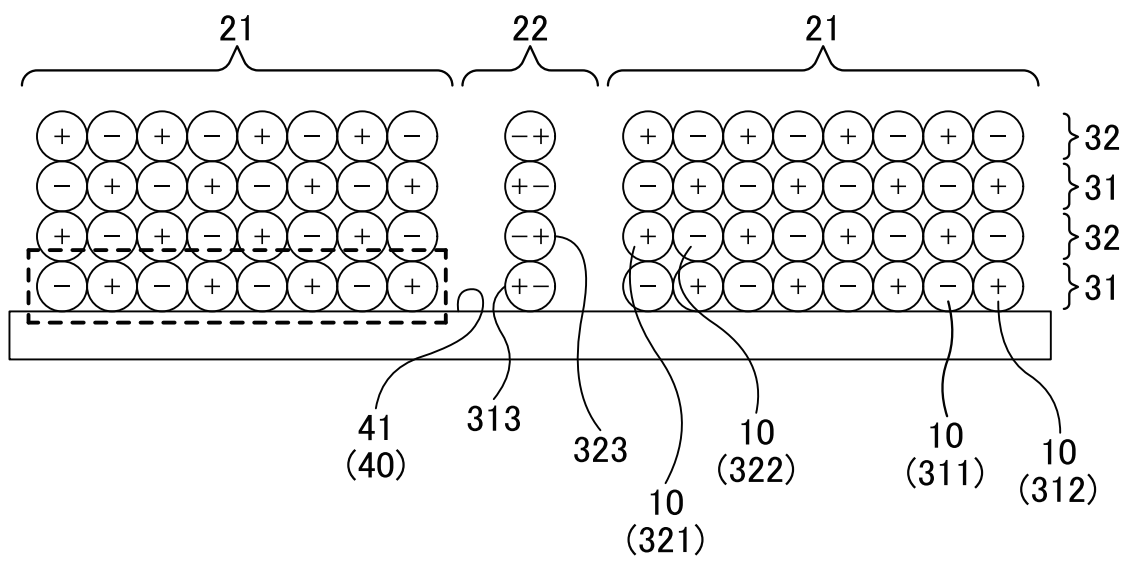


FIG. 2B

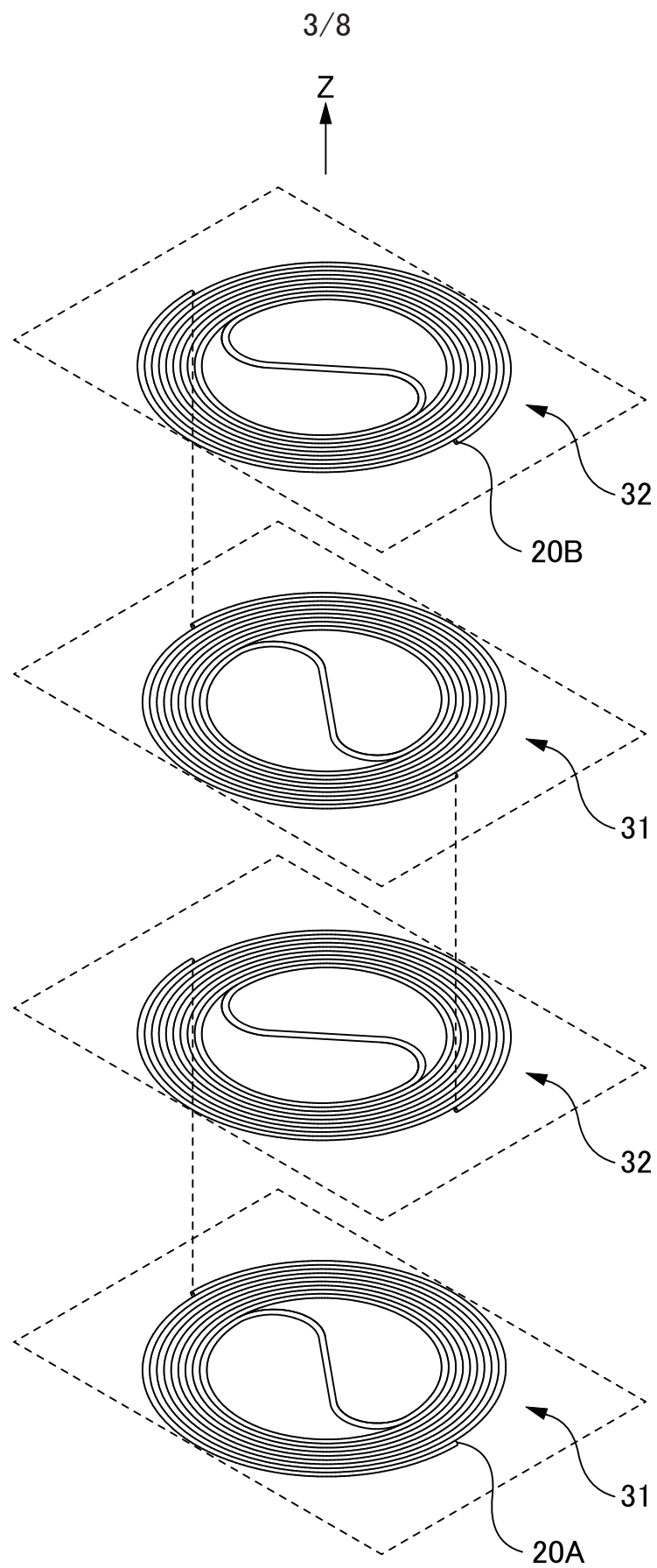


FIG. 3

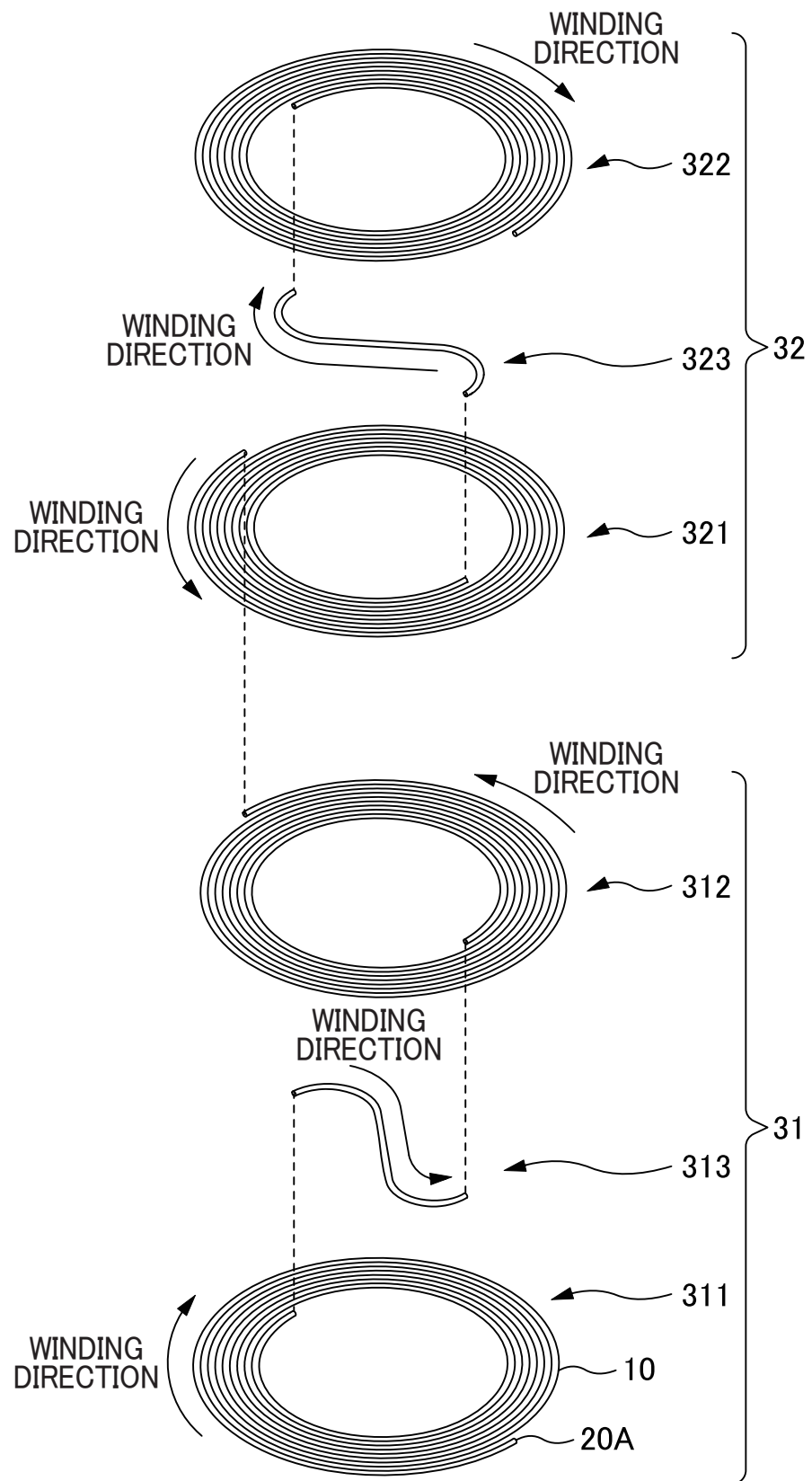


FIG. 4

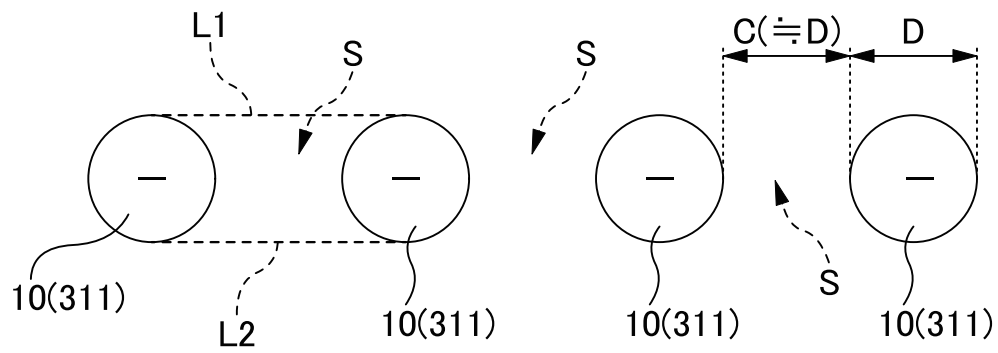


FIG. 5A

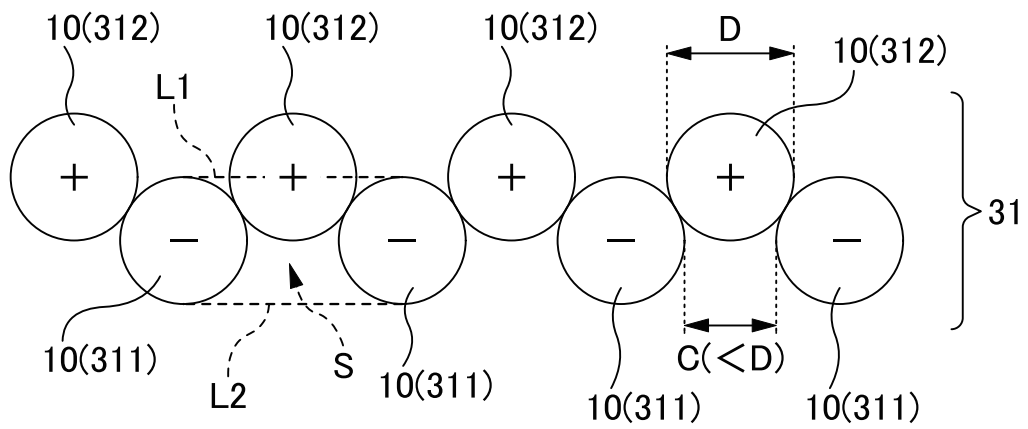


FIG. 5B

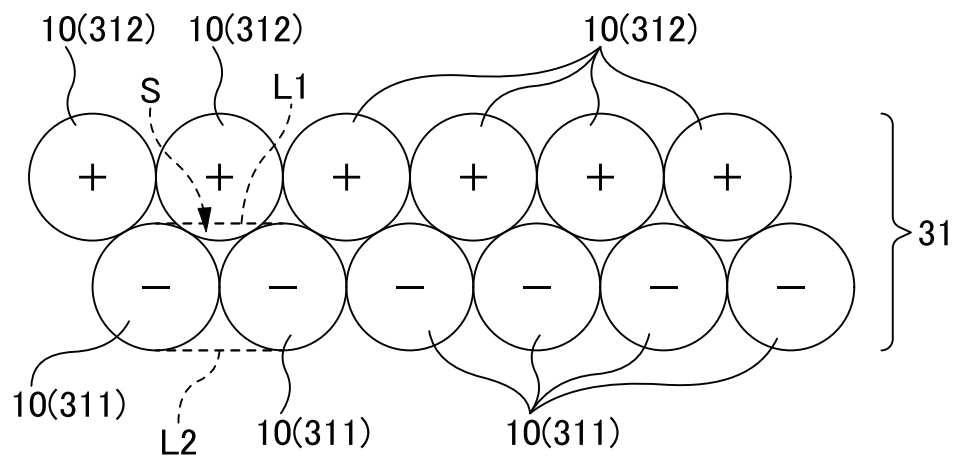
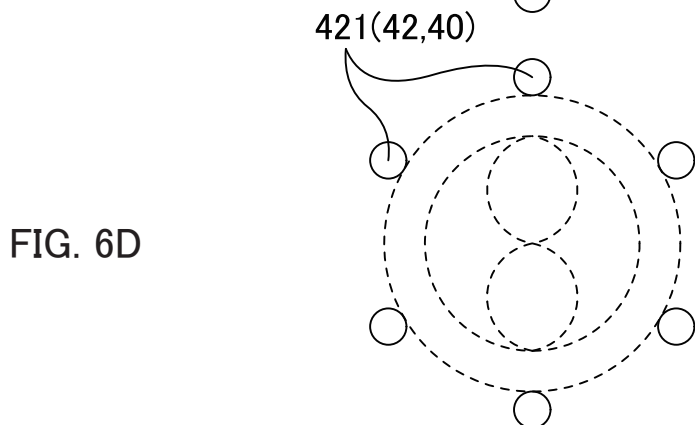
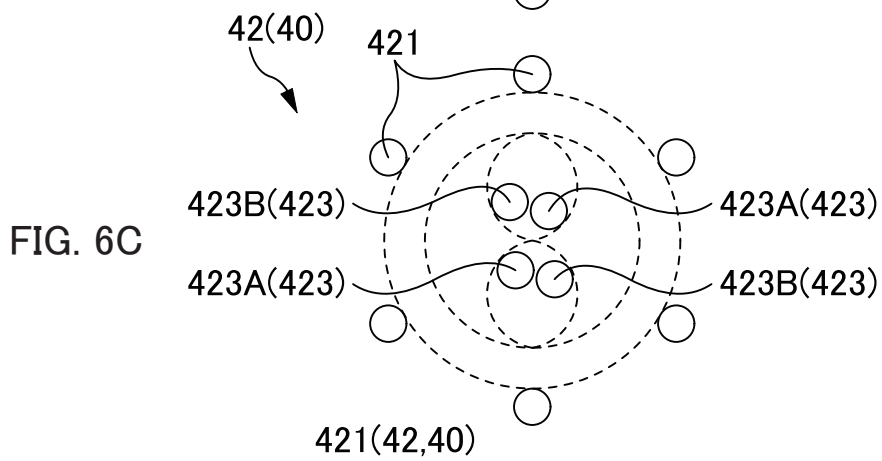
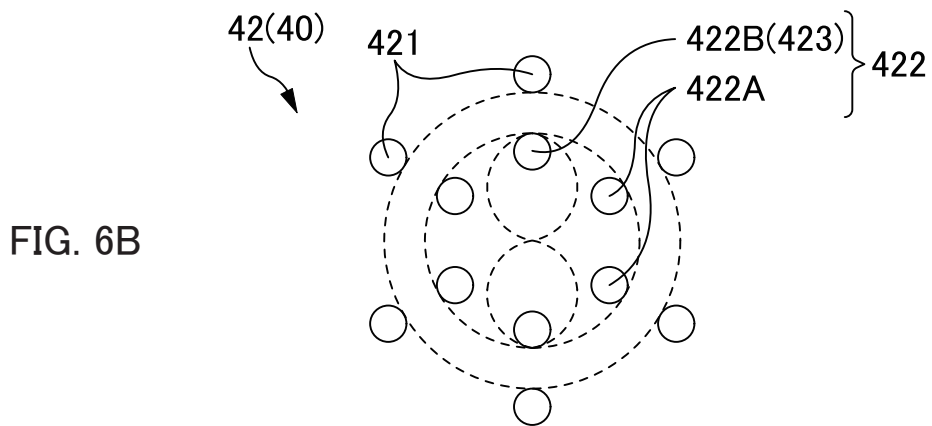
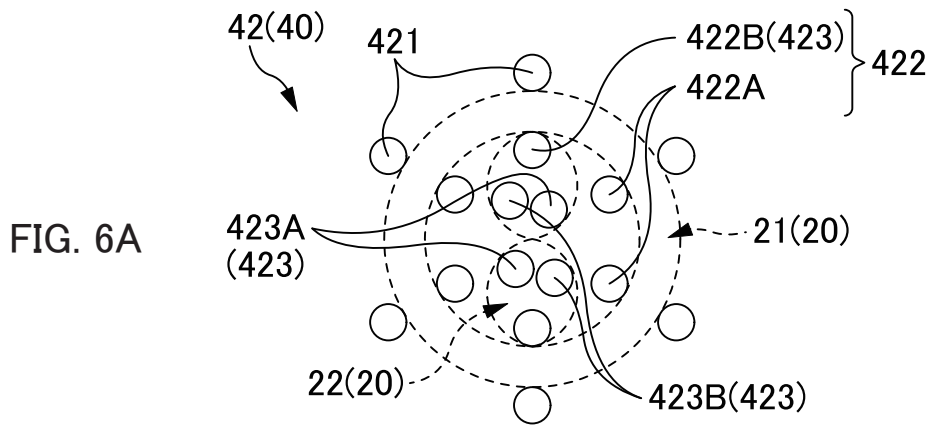


FIG. 5C



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FIG. 7A

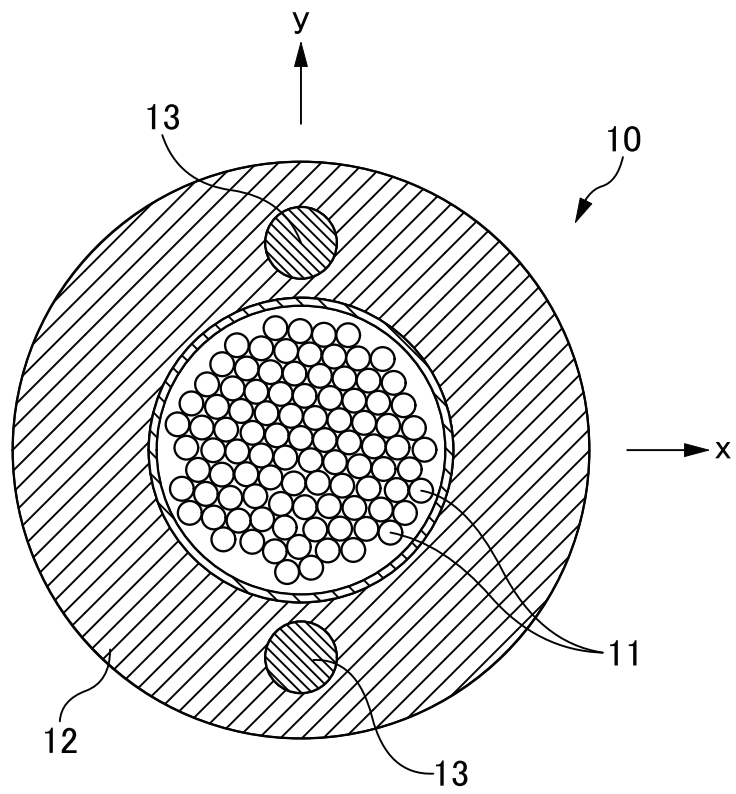
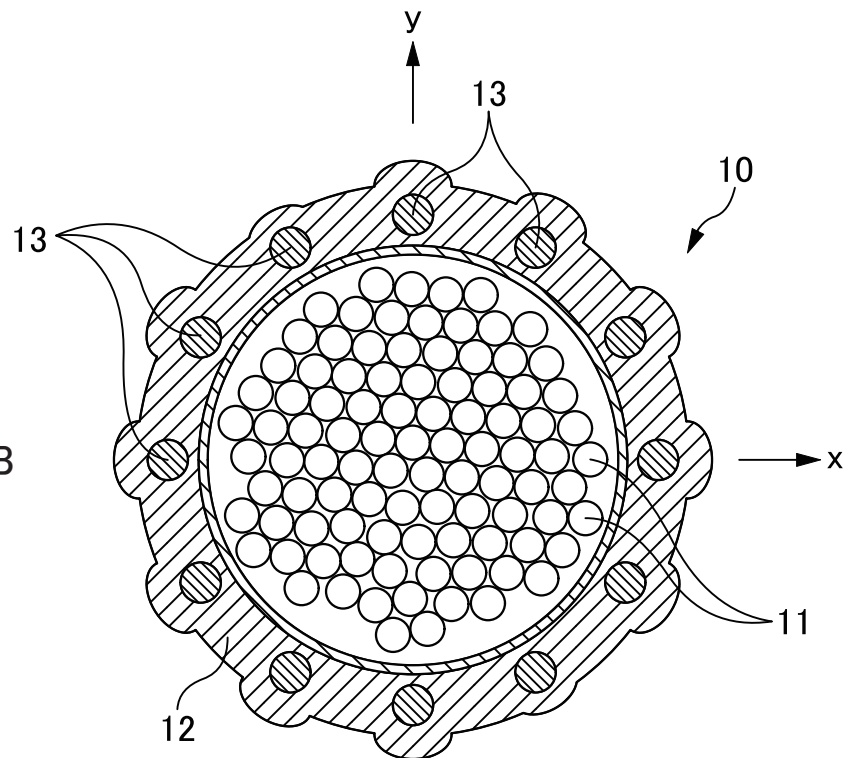


FIG. 7B



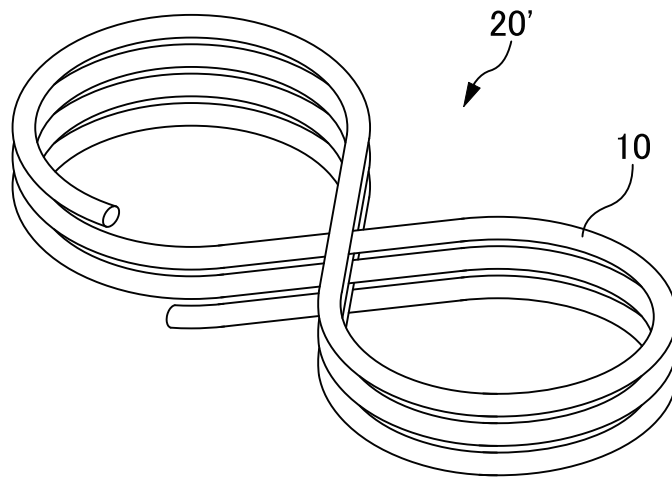


FIG. 8