The invention has purposes of increasing length of a wound body in a roll by efficiently using a space formed in a container and of improving strength as a unit by reducing the space.

In a roll (1) in which a wound body (2) is wound around a specified axis for plural times, a spacer (3) is provided in a portion of a region between turns of the wound body (2).
\[ LN_1 = \frac{2\pi r}{4} \]
\[ LN_2 = \frac{2\pi (r+t)}{4} \]

2(n) turn

2(n+1) turn

\[ r \]
\[ t \]
$\text{LA}_2 = \frac{2\pi r}{4} + 2t$

$\text{LA}_1 = \frac{2\pi r}{4}$

2\((n+1)\) turn

2\((n)\) turn
\[ \text{LB}_2 = \frac{2\pi r_2}{4} + 2s \]

\[ \text{LB}_1 = \frac{2\pi r_1}{4} \]

2\,(n + 1)\,\text{turn}

2\,(n)\,\text{turn}
ROLL AND METHOD FOR MANUFACTURING ROLL

BACKGROUND OF THE INVENTION

[0001] The invention relates to a roll and a method for manufacturing a roll.

[0002] A roll that is configured by winding a belt-shaped wound body around a core material has widely been known. The wound body is wound in preset length, and the roll is then accommodated in a container.

[0003] A shape of the roll depends on an outer peripheral shape of the core material, which serves as a mandrel for winding the wound body. However, no matter what shape the outer peripheral shape of the core material is, the roll is rounded as number of turns is increased. Thus, the shape of the roll eventually resembles a column (for example, see JP-A-2002-42854, JP-A-2003-157888).

[0004] By the way, the container for accommodating the roll is sometimes formed in a columnar shape so as to correspond to a final shape of the roll and is the other times formed in a prismatic shape in consideration of stacking.

SUMMARY OF THE INVENTION

[0005] Here, an outer edge of the container is formed in an arc shape. Thus, in the cases where the rolls are respectively accommodated in the columnar containers and the containers are aligned, a clearance is generated between the adjacent containers. This causes a problem of degraded space efficiency when plural units, each of which is configured by accommodating the roll in the container, are stacked.

[0006] Meanwhile, when a columnar roll 102 is accommodated in a prismatic container 101 as depicted in FIG. 14, a space 103 is formed between an inner wall of the container 101 and the roll 102. This causes a problem of restriction in number of turns of the roll 102 despite availability of the space 103 in the container 101. The generation of the space 103 in the container 101 also leads to such a problem that sufficient strength cannot be retained when the units are stacked.

[0007] The invention has been made in view of the above problems and therefore has a purpose of providing a roll and a method for manufacturing a roll capable of increasing length of a wound body in the roll by efficiently using a space that is generated in a container and improving strength as a unit by reducing the space.

[0008] In order to solve the above problems, the invention is a roll in which a wound body is wound around a specified axis for plural times, and is characterized in that a spacer is provided in a portion of a region between the wound bodies.

[0009] The roll preferably has: plural corner sections that are bent by the spacers; and a linear section between two each of the corner sections.

[0010] Mounting intervals of the spacers are preferably equally spaced intervals.

[0011] The spacers are preferably provided at every 90° with the specified axis being a center when the roll is seen in a vertical cross section along a winding direction of the wound body.

[0012] The spacers are preferably provided at every 60° with the specified axis being the center when the roll is seen in the vertical cross section along the winding direction of the wound body.

[0013] The spacers are preferably provided at every 120° with the specified axis being the center when the roll is seen in the vertical cross section along the winding direction of the wound body.

[0014] The spacer is preferably formed of curable ink or gel.

[0015] The spacer is preferably formed of plastic.

[0016] All of the spacers are preferably formed in the same size.

[0017] At least some of the spacers are preferably formed in different size from the other spacers.

[0018] The wound body is preferably a belt-shaped laminated body.

[0019] The belt-shaped laminated body is preferably a power-generating element body that has a positive electrode sheet, a negative electrode sheet, and a separator that is arranged between the positive electrode sheet and the negative electrode sheet.

[0020] The wound body is preferably a wire member.

[0021] The invention is a method for manufacturing a roll and is characterized by including the steps of: feeding a wound body to a core material for winding the wound body; sequentially providing the spacers in advance at preset intervals on a surface of the wound body during feeding of the wound body; and sequentially winding the wound body, which is provided with the spacers, around the core material.

[0022] The spacer is preferably formed when curable ink is injected onto the surface of the wound body and the ink is cured.

[0023] The spacer is preferably formed when the spacer that is retained by a retainer is adhered to the surface of the wound body.

[0024] The invention is a method for manufacturing a roll and is characterized by including the steps of: feeding a wound body to a core material for winding the wound body; providing the spacers in advance at preset intervals on a surface of the wound body before feeding of the wound body; and sequentially winding the wound body, which is provided with the spacers, around the core material.

[0025] The invention is a method for manufacturing a roll and is characterized by including the steps of: feeding a wound body to a core material for winding the wound body; sequentially winding the wound body, which is fed, around the core material; and inserting and mounting the spacers at preset intervals between the wound bodies while the wound body is wound around the core material.

[0026] According to the invention, the wound body in the roll can be increased in length by efficiently using the space provided in the container, and the strength as the unit can be improved by reducing the space.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] FIG. 1 shows a view in which a substantially square roll is seen from one end side in a winding axis direction.

[0028] FIG. 2 shows a view for explaining a method for manufacturing the roll.

[0029] FIGS. 3(a) and 3(b) show views for explaining shapes of a spacer.

[0030] FIG. 4 shows an enlarged view of a portion of a wound body at a time when the spacer is not provided and the wound body is wound.
SECTION 11

[0031] FIG. 5 shows an enlarged view of a portion of the wound body when the spacer is provided and curvatures of surfaces in a turn and a +1 turn of the wound body are the same.

[0032] FIG. 6 shows an enlarged view of a portion of the wound body when the spacer is provided and the curvatures of the surfaces in the turn and the +1 turn of the wound body differ.

[0033] FIG. 7 shows a view of a state where the substantially square rolls are respectively accommodated in containers and these units are stacked.

[0034] FIG. 8 shows a view in which a substantially hexagonal roll is seen from the one end side in the winding axis direction.

[0035] FIG. 9 shows a view of a state where the substantially hexagonal rolls are respectively accommodated in containers and these units are stacked.

[0036] FIG. 10 shows a view in which a substantially triangular roll is seen from the one end side in the winding axis direction.

[0037] FIG. 11 shows a view of a state where the substantially triangular rolls are respectively accommodated in containers and these units are stacked.

[0038] FIG. 12 shows a view of another example at a time when the spacers are provided in the wound body.

[0039] FIG. 13 shows a view of the other example at a time when the spacers are provided in the wound body.

[0040] FIG. 14 shows a view for explaining a state at a time when a conventional roll is accommodated in a container.

DETAILED DESCRIPTION

[0041] A description will be made on a preferred embodiment of the invention with reference to the drawings. Note that all types of rolls are included as the roll according to the invention regardless of technical fields as long as a wound body is wound around a specified axis for plural times. However, in the following embodiment, a description will be made by raising a case where the roll is a battery as an example.

[0042] FIG. 1 is a view in which the roll is seen from one end side in a winding axis direction. As depicted in FIG. 1, a roll 1 is formed when a wound body 2 is wound around a specified axis for plural times, thereby forming concentric laminations of the wound body 2. The roll 1 includes the wound body 2 and spacers 3. The spacers are provided between adjacent laminations of the wound body 2.

[0043] The wound body 2 is a belt-shaped laminated body that is formed in a thin plate shape, for example. This belt-shaped laminated body is formed as one sheet of a belt-shaped member, in which a positive electrode sheet, a negative electrode sheet, a separator that is arranged between the positive electrode sheet and the negative electrode sheet are laminated to make four layers. The belt-shaped laminated body functions as a power-generating element body of the battery.

[0044] The power-generating element body with specified capacity can be formed by winding this wound body 2 around a winding roller (a core material) in predetermined length.

[0045] The spacer 3 is provided on one surface of the wound body 2, and a plurality thereof is arranged in a portion of a region between adjacent wound bodies 2 in a thickness direction (a radial direction) of the roll 1. All of the spacers 3 are formed in the same size and mounted at equally spaced intervals. The spacers 3 are not provided to cover the one entire surface of the wound body 2 but are provided at every 90° with a winding axis O being a center when the roll 1 is seen in a vertical cross section along a winding direction of the wound body 2, as depicted in FIG. 1, for example. With such arrangement of the spacers 3, the spacers 3 are arranged linearly along the thickness direction of the roll 1 with the wound body 2 being interposed between two each of these. Lines L1, L2 connecting centers of the spacers 3 become straight lines, the spacers 3 opposing each other with the winding axis O being interposed therebetween. These straight lines L1, L2 cross each other at right angles at the winding axis O. The region in the wound body 2 where the spacer 3 is provided has increased curvature because only a corresponding portion is pushed outward by thickness of the spacer 3. Thus, the portion is brought into a slightly pointed state when compared to an arc. Accordingly, the four regions where the spacers 3 are arranged along the thickness direction are each formed as a corner section 21 that is bent and rounded by the spacers 3. By forming this corner section 21, the other region (a region that connects between the corner sections 21) in the wound body 2 serves as a linear section 22 that extends linearly. As a result, the substantially square roll 1 with the four corner sections 21, which are not perfect corners, is formed.

[0046] The spacer 3 is formed by injecting and curing curable ink onto the one surface of the wound body 2, for example. Note that the spacer 3 is not limited to the curable ink but may be a material in a gel form or another material such as plastic, metal, paper, fiber, ceramic, or rubber. In summary, any material can be used thereof as long as the curvature of the wound body 2 is changed when a space is formed between the adjacent wound bodies 2 in the thickness direction of the roll 1.

[0047] Next, a method for manufacturing the roll 1 will be described. FIG. 2 is a view for explaining the method for manufacturing the roll, and FIG. 3 includes views for explaining shapes of the spacer.

[0048] As depicted in FIG. 2, the wound body 2 that is wound in a roll shape is pulled out from one end of the wound body 2, and the wound body 2 is fed to a roller 10 that serves as the core material for winding the wound body 2. When being fed to the roller 10, the wound body 2 extends linearly along a surface direction thereof and is fed. The spacers 3 are provided on an upper surface of the wound body 2 in this feeding path. The spacers 3 are formed when the curable ink in a liquid form is injected from a nozzle 11 onto the wound body 2 and this ink is then cured. The curable ink can freely be selected from ultraviolet curable ink, thermosetting curable ink, and the like.

[0049] The ink is injected at preset time intervals, and the spacers 3 can thus sequentially be provided on the wound body 2 at preset intervals. The intervals of the spacers 3 are determined in consideration of required intervals thereof in each turn such that the spacers 3 are arranged on the straight line along the thickness direction of the roll 1 when the wound body 2 is wound around the roller 10.

[0050] As depicted in FIG. 3, the spacer 3 may be formed linearly along a width direction (a short-side direction that crosses a longitudinal direction at right angles) of the wound body 2 that is formed in the belt shape (see FIG. 3(a)), or
may be formed in a scattered manner at specified intervals along the width direction of the wound body 2 (see FIG. 3(b)).

[0051] The ink that is injected onto the wound body 2 is cured before being wound around the roller 10, and the wound body 2, which is provided with the spacers 3, is sequentially wound around the roller 10. The wound body 2 is wound around the roller 10 in such a state that constant tension is applied to the wound body 2. Thus, the wound body 2 is sequentially wound around the roller 10 while neither sagging nor a clearance is generated in the roll 1. However, due to the thickness of the spacer 3, a space is formed around the spacer 3 in the region where the spacer 3 is provided. As a result, the curvature of the wound body 2 is changed.

[0052] Next, a description will be made on an increase in total length of the wound body 2, which is caused by provision of the spacers 3.

[0053] FIG. 4 is an enlarged view of a portion of the wound body 2 at a time when the spacer 3 is not provided and the wound body 2 is wound. FIG. 5 is an enlarged view of a portion of the wound body 2 at a time when the spacer 3 is provided and curvatures of the surface in n turn and n+1 turn of the wound body 2 are the same. FIG. 6 is an enlarged view of a portion of the wound body 2 at a time when the spacer 3 is provided and the curvatures of the surface in n turn and n+1 turn of the wound body 2 differ.

[0054] As depicted in FIG. 4, a portion (a 1/4 turn) of the roll 1 is cut out for consideration. When a radius up to an outer periphery of the wound body 2 in the n turn is set as r and thickness of the wound body 2 is set as t, length LN1 of the outer periphery of the wound body 2 in the n turn and length LN2 of the outer periphery of the wound body 2 in the n+1 turn are:

\[ LN_1 = 2\pi r / 4 \]
\[ LN_2 = 2\pi (r + t) / 4. \]

[0055] As depicted in FIG. 5, a case where the spacer 3 is provided between the wound body 2 in the n turn and the wound body 2 in the n+1 turn will be considered by cutting the portion (the 1/4 turn) of the roll 1 as in a similar manner to FIG. 4. The wound body 2 is wound such that a radius of an arc portion of the wound body 2 in the n turn is equal to a radius of an arc portion of the wound body 2 in the n+1 turn, that is, curvatures thereof are equal to each other. In addition, a radius up to the outer periphery of the wound body 2 in the n turn is set as r and thickness of the wound body 2 is set as t. In such a case, length LA1 of the outer periphery of the wound body 2 in the n turn and length LA2 of the outer periphery of the wound body 2 in the n+1 turn are:

\[ LA_1 = 2\pi r / 4 \]
\[ LA_2 = 2\pi (r + t) / 4 + 2t. \]

[0056] Here, when it is assumed that the length LA2 and the length LN2 described above have a relationship of \( LA_2 = LN_2 \), this equation will be simplified as follows:

\[ 2\pi r + 2t > 2\pi (r + t) / 4 \]
\[ 2\pi r + 8t > 2\pi r + 2t \]
\[ \pi > 2t \]
\[ 8t > 2t \]
\[ t > r \]
\[ t > r \]

Here, because \( t > r \), it is understood that this relationship is established.

[0057] Here, because \( t > r \), it is understood that this relationship is established.

[0058] Thus, in the case where the rolls 1 in the same number of the turns are compared, it is understood that the total length of the wound body 2 is increased when the spacers 3 are provided.

[0059] As depicted in FIG. 6, a case where the spacer 3 is provided between the wound body 2 in the n turn and the wound body 2 in the n+1 turn will be considered by cutting the portion (the 1/4 turn) of the roll 1 as in the similar manner to FIG. 4 and FIG. 5. The wound body 2 is wound such that the arc portion of the wound body 2 in the n+1 turn has a smaller radius, that is, has a larger curvature than the arc portion of the wound body 2 in the n turn. In addition, a radius up to the outer periphery of the wound body 2 in the n turn is set as \( r_1 \), a radius up to an outer periphery of the arc portion of the wound body 2 in the n+1 turn is set as \( r_2 \), a linear portion that extends from each end of the arc portion of the wound body 2 in the n+1 turn is set as \( s \), and the thickness of the wound body 2 is set as \( t \). In such a case, length LB1 of the outer periphery of the wound body 2 in the n turn and length LB2 of the outer periphery of the wound body 2 in the n+1 turn are:

\[ LB_1 = 2\pi r_1 / 4 \]
\[ LB_2 = 2\pi r_2 / 4 + 2s. \]

[0060] Here, when it is assumed that the length LB2 and the length LN2 described above have a relationship of \( LB_2 = LN_2 \), where \( r_1 > r_2 \), \( s = (r_1 - r_2) \), this equation will be simplified as follows:

\[ 2\pi r_1 + 2s = 2\pi (r_2 + t) / 4 \]
\[ 2\pi r_2 + 2(r_1 - r_2) > 2\pi (r_2 + t) \]
\[ 2\pi r_2 + 8r_1 - 8r_2 > 2\pi r_2 + 2s \]
\[ 8r_1 > 2s \]
\[ 8r_1 > 2\pi r_2 - 2\pi r_2 - 8r_2, 8r_1, 8r_2 \]
\[ (8-2\pi r_1) > (8-2\pi r_2) \]
\[ t > r_2 - r_1 > 0. \]

Here, because \( t > 0 \) and \( r_1 > r_2 \), it is understood that this relationship is established.

[0061] Here, because \( t > 0 \) and \( r_1 > r_2 \), it is understood that this relationship is established.

[0062] Thus, in the cases where the rolls 1 in the same number of the turns are compared and the curvature of the wound body 2 is increased, it is understood that the total length of the wound body 2 in the roll 1 is increased when the spacers 3 are provided.

[0063] According to the roll 1 and the method for manufacturing the roll 1 as described so far, when the spacer 3 is provided between the adjacent wound bodies 2 in the thickness direction of the roll 1, only the portion of the region in the wound body 2 where the spacer 3 is provided is pushed outward for the thickness of the spacer 3. As a result, this region in the wound body 2 obtains the increased curvature and is brought into the slightly pointed state when compared to the arc. Accordingly, the four positions, at
which the spacers 3 are arranged along the thickness direction of the roll 1, are each formed as the corner section 21 that is bent and rounded by the spacer 3. By forming this corner section 21, the other region (the region that connects between the corner sections) in the wound body 2 serves as the linear section 22 that extends linearly. As a result, the substantially square roll 1 with the four corner sections 21, which are not the perfect corners, is formed.

[0064] In this way, as depicted in FIG. 7, when the roll 1 is accommodated in a general prismatic container 4, the linear section 22 substantially abuts against an inner wall of the container 4. In addition, the corner section 21 is pointed when compared to the arc. Thus, a dead space in the container 4 is significantly reduced. Accordingly, the roll 1 suited for the container 4 can be formed, and the length of the wound body 2 in the roll 1 can be increased by efficiently using the space formed in the container 4. Furthermore, strength as a unit can be improved by reducing the space. Thus, the roll 1 is suited for stacking of the units.

[0065] Moreover, as described above, the total length of the wound body 2 can be increased by providing the spacers 3 even when the number of the turns is the same. Thus, the capacity of the battery can be increased.

[0066] Note that the above embodiment has been described by raising the substantially square roll as the example. However, as will be described below, the roll may be formed in a substantially polygonal shape or a substantially triangular shape.

[0067] FIG. 8 is a view in which a substantially hexagonal roll is seen from the one end side in the winding axis direction, and FIG. 9 is a view of a state where the substantially hexagonal rolls are respectively accommodated in containers and these units are stacked.

[0068] As depicted in FIG. 8, spacers 3a are provided at every 60° with the winding axis O being the center when a roll 1a is seen in a vertical cross section along a winding direction of a wound body 2a. When the spacers 3a are arranged just as described, the spacers 3a are arranged linearly along a thickness direction of the roll 1a with the wound body 2a being interposed between two each of these. In addition, six positions, at which the spacers 3a are arranged along the thickness direction, are each formed as a corner section 21a that is bent and rounded by the spacers 3a. By forming this corner section 21a, the other region (a region that connects between the corner sections 21a) in the wound body 2a serves as a linear section 22a that extends linearly. As a result, the substantially triangular roll 1a with the six corner sections 21a, which are not perfect corners, is formed.

[0069] As depicted in FIG. 9, such rolls 1a are respectively accommodated in containers 4a in the same hexagonal shapes. In this way, when these units are stacked, a honeycomb structure is formed. Thus, the units can be arranged with no clearance, and the strength of the units can significantly be improved.

[0070] FIG. 10 is a view in which a substantially triangular roll is seen from the one end side in the winding axis direction, and FIG. 11 is a view of a state where the substantially triangular rolls are respectively accommodated in containers and these units are stacked.

[0071] As depicted in FIG. 10, spacers 3b are provided at every 120° with the specified winding axis O being the center when a roll 1b is seen in a vertical cross section along a winding direction of a wound body 2b. When the spacers 3b are arranged just as described, the spacers 3b are arranged linearly along a thickness direction of the roll 1b with the wound body 2b being interposed between two each of these. In addition, three positions, at which the spacers 3b are arranged along the thickness direction, are each formed as a corner section 21b that is bent and rounded by the spacers 3b. By forming this corner section 21b, the other region (a region that connects between the corner sections 21b) in the wound body 2b serves as a linear section 22b that extends linearly. As a result, the substantially triangular roll 1b with the three corner sections 21b, which are not perfect corners, is formed.

[0072] As depicted in FIG. 11, such rolls 1b are respectively accommodated in containers 4b in the same triangular shapes. In this way, when these units are stacked, the units can be arranged with no clearance, and the strength of the units can significantly be improved.

[0073] Note that the invention is not limited to the above embodiment. The shape of the roll is not limited to the above examples. The above-described effects can be exerted as long as the roll is in a substantially polygonal shape with plural corner sections.

[0074] FIG. 12 and FIG. 13 are views, each of which depicts another example at a time when the spacers are provided on the wound body.

[0075] As depicted in FIG. 12, the following method may be used. When the spacers 3 are to be provided on the wound body 2, the spacers 3 are adhered in advance at preset intervals to a surface of a belt B in a spacer retainer 12 that is detachable from the wound body 2 while rotating. Then, the belt B is brought closer to the wound body 2 at specified timing, and the spacers 3 on the belt B are thereby adhered to the wound body 2.

[0076] In addition, as depicted in FIG. 13, the following method may be used. When the spacers 3 are to be provided on the wound body 2, the spacers 3 are provided in advance at specified preset intervals on the surface of the wound body 2 prior to feeding of the wound body 2 to the roller 10. Then, the pulled wound body 2 is sequentially fed to and wound around the roller 10.

[0077] Furthermore, the invention is not limited to the cases where the spacers are provided during feeding of the wound body as depicted in FIG. 2 and FIG. 12. While the wound body is wound around the core material, the spacers may be inserted at preset intervals between the wound body in the n turn and the wound body in the n+1 turn that are adjacent to each other.

[0078] Moreover, the wound body has been described as the belt-shaped member. However, the wound body may be a wire member as being used for a coil. In this case, a rod member or a plate member is used as the spacer. Before the wound body is wound for n layers, the spacer is set on the winding axis, and the wound body is wound. Then, before the wound body is wound for n+1 layers, the new spacer is inserted on the n layer, and the wound body is wound. In this way, the invention can be achieved.

[0079] The spacer does not have to be provided between two each of the adjacent wound bodies in the thickness direction, and a mounted position thereof can freely be changed. In addition, in regard to the size of the spacer, at least some of the spacers may be formed in different size from the other spacers. That is, positions where the spacers are provided and the size of the spacers can freely be changed in accordance with the shape of the container.
1. A roll in which a wound body is wound around a specified axis for plural times to form concentric laminations of the wound body, wherein a spacer is provided in a portion of a region between adjacent laminations of the wound body.

2. The roll according to claim 1, wherein the wound body has: plural corner sections bent by respective spacers; and a linear section between two each of the corner sections.

3. The roll according to claim 2, wherein mounting intervals of the spacers are equally spaced intervals.

4. The roll according to claim 2, wherein the spacers are provided at every 90° with the specified axis being a center when the roll is seen in a vertical cross section along a winding direction of the wound body.

5. The roll according to claim 2, wherein the spacers are provided at every 60° with the specified axis being a center when the roll is seen in a vertical cross section along a winding direction of the wound body.

6. The roll according to claim 2, wherein the spacers are provided at every 120° with the specified axis being a center when the roll is seen in a vertical cross section along a winding direction of the wound body.

7. The roll according to claim 1, wherein the spacer is formed of curable ink or gel.

8. The roll according to claim 1, wherein the spacer is formed of plastic.

9. The roll according to claim 2, wherein all of the spacers are formed in the same size.

10. The roll according to claim 2, wherein at least some of the spacers are formed in different size from the other spacers.

11. The roll according to claim 1, wherein the wound body is a belt-shaped laminated body.

12. The roll according to claim 11, wherein the belt-shaped laminated body is a power-generating element body that has a positive electrode sheet, a negative electrode sheet, and a separator that is arranged between the positive electrode sheet and the negative electrode sheet.

13. The roll according to claim 1, wherein the wound body is a wire member.

14. A method for manufacturing the roll according to claim 1, the method comprising: feeding the wound body to a core material for winding the wound body; sequentially providing spacers in advance at preset intervals on a surface of the wound body during feeding of the wound body; and sequentially winding the wound body, which is provided with the spacers, around the core material.

15. The method for manufacturing the roll according to claim 14, wherein the spacers are formed when curable ink is injected onto the surface of the wound body and the ink is cured.

16. The method for manufacturing the roll according to claim 14, wherein the spacers are formed when a spacer that is retained by a retainer is adhered to the surface of the wound body.

17. A method for manufacturing the roll according to claim 1, the method comprising: feeding the wound body to a core material for winding the wound body; providing spacers in advance at preset intervals on a surface of the wound body before feeding of the wound body; and sequentially winding the wound body, which is provided with the spacers, around the core material.

18. A method for manufacturing the roll according to claim 1, the method comprising: feeding the wound body to a core material for winding the wound body; sequentially winding the wound body, which is fed, around the core material; and inserting and mounting spacers at preset intervals between the wound bodies while the wound body is wound around the core material.

* * * * *