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(54) **METHOD FOR PRODUCING METAL THIN STRIP COIL, AND METAL THIN STRIP COIL**

(57) Provided are: a coil which is suppressed in scratches and deformation when a metal thin strip having a thin thickness is wound up around a wind-up ring, and which has suppressed low production cost, good workability and good maintenance properties; and a method for producing this metal thin strip coil. A method for producing a metal thin strip coil, by which a metal thin strip coil is obtained by having a metal thin strip wound up around a wind-up ring, and wherein a metal thin strip having a thickness of 0.3 mm or less is wound around a wind-up ring which has a high frictional resistance material that is formed of a rubber tape and bonded to at least a part of the outer circumferential surface thereof; and a metal thin strip coil.

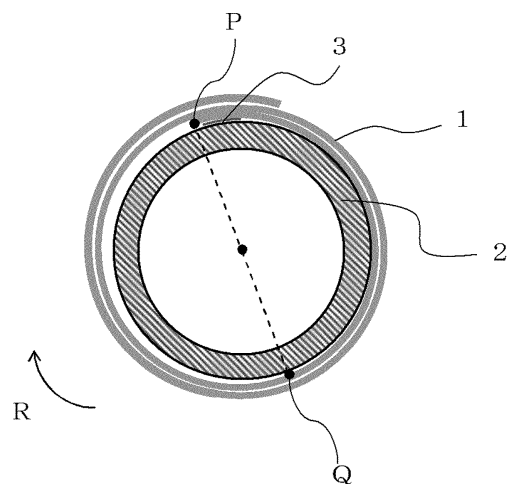


FIG. 1

Description

[Technical Field]

5 **[0001]** The present invention relates to a method for producing a thin metal strip coil and a thin metal strip coil obtained by winding a thin metal strip around a winding ring.

[Background Art]

10 **[0002]** A strip-shaped thin metal plate (thin metal strip) rolled using a rolling machine or the like to have a predetermined thickness is little used as a final product as is, and is subjected to secondary processing, for example, pressing, punching, bending/drawing, etching, or the like, to be molded into a final product to be used in a variety of industrial fields. Such a thin metal strip is generally wound around a ring-shaped reel (which will also be referred to as a winding ring below) and transported to the next processing in the form of a thin metal strip coil. Typical methods of fixing such a thin metal strip to a winding ring include a method of bonding a tip of a thin metal strip directly to a winding ring using tape, a method of roughening an outer circumferential surface of a winding ring by performing knurling or shot blasting, a method of making a slit groove in a winding ring and inserting a tip of a thin metal strip thereinto, and the like.

15 **[0003]** In addition, Patent Literature 1 discloses a steel strip winding method in which, in order to reduce a fold (which will also be referred to as set bending or a top mark) of the tip of a steel strip, a rubber sleeve having a substantially strip-shaped soft layer, which is formed of a softer elastic material than the main body of the rubber sleeve on an outer circumference in the longitudinal direction of the rubber sleeve is used, and the tip of the steel strip is positioned in a range of the soft layer of the rubber sleeve. In addition, Patent Literature 2 discloses a long object winding frame having a metal cylinder as the core with an outer circumferential surface coated with a resin layer to wind up a metal plate into a coil shape without slip from and damage to the surface when the metal plate is wound.

[Reference List]

[Patent Literature]

30 **[0004]**

[Patent Literature 1]

Japanese Patent Laid-Open No. H7-16648

[Patent Literature 2]

35 Japanese Patent Laid-Open No. H11-165955

[Summary of Invention]

[Technical Problem]

40 **[0005]** Such a thin metal strip described above is required to have a good surface quality to enable the thin metal strip wound in a coil shape to be used up to the tip thereof, in addition to avoid a problem arising during secondary processing. However, in the winding method of the related art, an innermost circumferential part of the wound thin metal strip is susceptible to scratches, deformation, or the like, and thus the thin metal strip is unlikely to be used up to the tip. Such scratches and deformation tend to occur as a plate becomes thinner, and in the above-described Patent Literature 1, a plate thickness of the example is 0.8 mm, for example, a thin metal strip having a thin plate thickness of 0.3 mm or less is not discussed, and there is no proposal for a means for curbing scratches or deformation that is likely to occur in the innermost circumferential part of the thin metal strip wound into a coil shape. In addition, even if such a proposal had been made, a structure or a means would be complicated as in Patent Literature 2, and thus problems of high production costs and deterioration in workability and maintenance properties would arise.

45 **[0006]** An objective of the present invention is to provide a method for producing a thin metal strip coil and a thin metal strip coil in which scratches and deformation that are likely to occur when a thin metal strip having a thin thickness of 0.3 mm or less is wound around a winding ring are curbed, with a low production cost, good workability, and good maintenance properties.

[Solution to Problem]

55 **[0007]** An aspect of the present invention is a method for producing a thin metal strip coil of winding a thin metal strip

around a winding ring to obtain a thin metal strip coil in which a thin metal strip having a plate thickness of 0.3 mm or less is wound around the winding ring having at least a part of an outer circumferential surface to which a high friction resistance material that is formed of a rubber tape is bonded.

[0008] Preferably, the rubber tape has a static friction coefficient of 3.0 or higher.

[0009] Preferably, a base material made of rubber of the rubber tape is made of silicone rubber.

[0010] Preferably, the rubber tape has a base material made of rubber and an adhesive layer formed on one surface of the base material, and the rubber tape has an adhesive layer side bonded to the winding ring and a surface that comes in contact with the thin metal strip being the rubber base material.

[0011] Preferably, a thickness of the rubber tape is 0.05 to 0.5 mm.

[0012] Preferably, the thin metal strip is wound such that a peripheral portion of a tip of the thin metal strip comes in contact with the rubber tape.

[0013] Another aspect of the present invention is a thin metal strip coil obtained by winding a thin metal strip around a winding ring, in which a plate thickness of the thin metal strip is 0.3 mm or less, and a high friction resistance material that is formed of a rubber tape is bonded to at least a part of an outer circumferential surface of the winding ring.

[0014] Preferably, the rubber tape has a static friction coefficient of 3.0 or higher.

[0015] Preferably, a base material made of rubber of the rubber tape is made of silicone rubber.

[0016] Preferably, the rubber tape has a base material made of rubber and an adhesive layer formed on one surface of the base material, and the rubber tape has an adhesive layer side bonded to the winding ring and a surface that comes in contact with the thin metal strip being the rubber base material.

[0017] Preferably, a thickness of the rubber tape is 0.05 to 0.5 mm.

[0018] Preferably, in a range from a tip for beginning winding of the thin metal strip to half a circumference of the winding ring, the high friction resistance material that is formed of the rubber tape is bonded to at least a part of the outer circumferential surface of the winding ring.

[Advantageous Effects of Invention]

[0019] According to the present invention, when a thin metal strip having a plate thickness of 0.3 mm or less is wound in a coil shape, it is possible to obtain a good-quality thin metal strip coil in which scratches and deformation that are likely to occur in an innermost circumferential part of the coil are curbed while reducing a production cost.

[Brief Description of Drawings]

[0020]

Fig. 1 is a schematic side view for describing a method for production of the present invention.

Fig. 2 is an enlarged view of a peripheral portion of a tip of a thin strip of Fig. 1.

[Description of Embodiments]

[0021] An embodiment of the present invention will be described below.

[0022] A plate thickness of a thin metal strip that is a subject of the present invention is set to 0.3 mm or less. When a plate thickness of the thin metal strip is adjusted such that it is within the above-described range, the thin metal strip can be stably wound around a winding ring due to a frictional force of a rubber tape, which will be described below. A plate thickness is preferably 0.2 mm or less, and more preferably 0.1 mm or less. In addition, although no particular lower limit value is defined, when a plate thickness is extremely thin, set bending at the tip cannot be prevented, and deformation of the thin metal strip is highly likely to occur, and therefore, a plate thickness is preferably set to 0.03 mm or greater. When a plate thickness of the thin metal strip exceeds 0.3 mm and the thin metal strip is wound around a winding ring to which a high friction resistance material is bonded, it tends to be difficult to wind the thin metal strip around the winding ring due to an elastic force of the thin metal strip depending on a material of the thin metal strip. In addition, a surface roughness of the thin metal strip is preferably set to an arithmetic mean roughness Ra defined by JIS-B-0601 of 0.6 μm or less. When a surface roughness of the thin metal strip is excessively high, a contact area with the rubber tape becomes small, and thus the thin metal strip tends to have a lower frictional force, but when the surface roughness is adjusted to be within the above-described range of Ra, a more stable frictional force with respect to the rubber tape tends to be obtained. As a surface roughness becomes lower, a contact area with the rubber tape increases and a frictional force becomes higher, which is a trend in which the effects of the invention are more likely to be exhibited. Thus, a surface roughness Ra is more preferably 0.3 μm or less, and even more preferably 0.2 μm or less. A lower limit value of a surface roughness is not particularly limited, and may be set to, for example, Ra of 0.001 μm or greater. A "metal" to be applied to the present invention may be selected from, as examples, steel such as carbon steel, stainless

steel, and alloy steel and non-ferrous metals such as aluminum, titanium, copper, and zinc, or may be an alloy of the above-described metals. In addition, the method for production of the present invention can be applied to a material obtained by joining (pressure welding, welding, or brazing) a first metal with a dissimilar material other than the first metal.

[0023] In the present embodiment, a high friction resistance material formed of a rubber tape is bonded to an outer circumferential surface of a winding ring (a surface on which a thin metal strip is wound). Fig. 1 illustrates a schematic side surface view for describing the method for production according to the present embodiment. In the present embodiment illustrated in Fig. 1, a rubber tape 3 is bonded to a winding ring 2, and a thin metal strip 1 is wound therearound. The reason for using a rubber tape in the present embodiment is to fix the thin metal strip thereto using a frictional force of the rubber tape so that the wound thin metal strip does not slip from the surface of the winding ring. A static friction coefficient of the rubber tape that can be applied to the present embodiment here is set to 3.0 or higher, and a high friction resistance material is preferably used therefor. A static friction coefficient is more preferably 4.0 or higher, and even more preferably 5.0 or higher. The occurrence of scratches caused by slipping of the thin metal strip due to a frictional force of the rubber tape and failure (deformation) such as bending when the thin metal strip is set on the winding ring can be avoided. In addition, a complicated mechanism is not necessary, and since an effect of fixing the thin metal strip onto the outer circumferential surface of the winding ring is obtained simply by bonding the rubber tape to the outer circumferential surface, the workability is excellent. Furthermore, since good maintenance properties can be obtained due to the replaceable rubber tape, it is possible to reuse the winding ring repeatedly, and thus the thin metal strip can be used to the tip with good quality while curbing any increase in costs. In addition, no adhesive is applied to the surface with which the thin metal strip comes in contact because the thin metal strip is fixed thereto with a frictional force of the rubber tape, damage to a press mold and etching failure caused by a remaining adhesive on the thin metal strip as well as a line problem that may occur due to the thin metal strip not separating from the winding ring can be prevented, and therefore more advantageous effects than those of a method for fixation in the related art can be exhibited. The rubber tape used in the present embodiment can be applied to a generally used winding ring regardless of a material or a surface roughness of the winding ring as long as a rubber tape can be bonded to the winding ring. The present invention is particularly effective for a roll made of a metal without a step or irregularity that is greater than or equal to a thickness of a thin plate to be applied.

[0024] The rubber tape of the present embodiment has a base material made of rubber and an adhesive layer formed on one surface of the base material. As a material of the base material, natural rubber, nitrile rubber, fluorine rubber, urethane rubber, silicone rubber, or the like can be used as long as it meets the requirements for the above-described static friction coefficient. Preferably, silicone rubber with which an adhesive effect is able to be exhibited without causing failures of slipping or the like even for a thin metal strip coated with processing oil or anti-rust oil, has a moderate elastic force that is sufficient for preventing the thin metal strip from deforming, and is affordable at a low cost, is used. When a material other than a rubber tape such as paper, fabric, any of various plastic film (PE, PET, PVC, or the like), or a metal tape is used for a base material of an adhesive tape, a frictional force with respect to the thin metal strip tends to be lower and slip tends to occur.

[0025] When the rubber tape used in the present embodiment has an excessive tape thickness, the thin metal strip that is wound around the rubber tape is likely to deform, and thus a thickness of the rubber tape is preferably set to 0.5 mm or less. A thickness thereof is more preferably set to 0.2 mm or less, which enables a deformation curbing effect to be increased. A thickness thereof is even more preferably 0.1 mm or less. In addition, a thickness of the rubber tape set to 0.05 mm or greater may impart sufficient rigidity to the tape and improve deformation resistance, and thus it is preferable. Therefore, a thickness of the tape is preferably 0.05 to 0.5 mm. A thickness of the tape can be changed depending on a material type of the thin metal strip, and a thickness of the tape is preferably set to be thick (over 0.2 mm and 0.5 mm or less) in a range from 0.05 mm to 0.5 mm, for example, for a thin metal strip with a high hardness (e.g., 200 HV or greater). As a structure of the rubber tape, a structure in which a side bonded to the winding ring has an adhesive and a surface in contact with the thin metal strip is rubber is preferably used. In addition, a composite tape using a film or the like in an intermediate layer or a self-fusing rubber tape may be applied.

[0026] A length of the rubber tape in a width direction (corresponding to a width direction of the thin metal strip) used in the present embodiment can be appropriately adjusted in accordance with a width of the thin metal strip to be wound. When the rubber tape of the present embodiment is used, although effects can be exhibited regardless of a width of the thin metal strip to be wound due to a frictional force, a tape mark is likely to be generated depending on a material of the thin metal strip, and thus a width as close as possible to a width of the thin metal strip to be wound is preferable. Specifically, when a width of the thin metal strip to be wound is set to X mm and a length of the rubber tape in the width direction is set to 0.7X to X mm, the effects of the present invention can be sufficiently exhibited. Furthermore, a lower limit of a length thereof in the width direction is preferably 0.8X mm.

[0027] A length of the rubber tape of the present embodiment in a circumferential direction (corresponding to a length direction of the thin metal strip) can be appropriately adjusted in accordance with a size of the rubber tape or a material type of the thin metal strip such that it can be fixed due to a frictional force generated on the contact surface between the rubber tape and the thin metal strip. Meanwhile, when the rubber tape is bonded to the entire circumference of the

winding ring, a sufficient frictional force is ensured, however, a binding force to the thin metal strip is likely to be excessively strong. For this reason, when the thin metal strip is set to be slightly misaligned with the winding ring in the width direction when the thin metal strip is set on the winding ring, the thin metal strip is wound with the width misalignment in the innermost circumferential part unmodified due to the excessively strong binding force, and thus failure in winding or deformation is likely to be caused. For this reason, a length of the rubber tape is preferably set to be less than 10% of a perimeter of the winding ring. A length thereof is more preferably set to 5% or less and even more preferably 3% or less than the perimeter of the ring.

[0028] In addition, in the present embodiment, the thin metal strip to be wound is preferably wound such that a peripheral portion of the tip thereof is adjusted to come in contact with the rubber tape. Fig. 2 illustrates a schematic view of a peripheral portion of a tip of the thin metal strip of the present embodiment. In Fig. 2, that represented by reference numeral 4 is a tip of the thin metal strip according to the present embodiment. Because the tip of the thin metal strip is reasonably close to the position of the rubber tape, resistance to set bending of the tip can be improved and winding work can be easier. Here, the peripheral portion of the tip of the thin metal strip refers to the range from the tip (point P in Fig. 1) of the thin metal strip that has been wound around the winding ring to the position (point Q in Fig. 1) of the thin metal strip advanced halfway around the outer circumference of the winding ring in the winding direction (direction R in Fig. 1) of the thin metal strip. That is, in Fig. 1, the arc PQ tracing the first layer of the thin metal strip in the R direction (clockwise) is "the peripheral portion of the tip of the thin metal strip" and it is preferable for at least a part of the arc PQ (the peripheral portion of the tip of the thin metal strip) to be disposed to come in contact with the rubber tape 3. Thus, when producing a thin metal strip coil obtained by winding the thin metal strip with a thickness adjusted to be in a predetermined thickness range, a high quality thin metal strip coil with curved scratches or bending that may occur in the innermost circumferential part of the coil can be obtained while reducing production costs. A more preferable position of the point Q is in the range from the point P to the point corresponding to 1/4 of the circumference (90°), and an even more preferable position is in the range from the point P to the point corresponding to 1/5 of the circumference (72°). Although the effects of the present invention can be exhibited when the rubber tape comes in contact with the tip of the thin metal strip as described above, it is more preferable for the entire rubber tape to be disposed to be included in the peripheral portion of the tip.

Examples

(Example 1)

[0029] The present invention will be described in more detail in the following examples.

[0030] First, various tape materials shown in Table 1 were prepared, the tapes were bonded to the outer circumferential surfaces of winding rings, thin metal strips were wound around the winding rings, whether the thin metal strips slipped was observed, and thereby the winding was evaluated. To evaluate winding of the various tape materials, tape dimensions (a thickness of 0.1 mm $\times$ a width of 20 mm), winding rings (iron rings with a perimeter of ϕ 280 mm), and thin metal strips to be wound (martensitic stainless steel with a thickness of 0.1 mm $\times$ a width of 25 mm) were made uniform. A length of the tapes was set to 20 mm, the tapes were bonded to winding rings such that the tips of the tapes were located at the position 10 mm away from the tips of the thin metal strips to be wound in the winding direction (the R direction in Fig. 1), and then the thin metal strips were wound therearound. After the winding rings were set in a winding device, the thin metal strips were manually wound twice therearound in advance and wound over 30 meters with a winding tension set value set to 20 N. Static friction coefficients of each of the tapes were measured in advance in a method based on JIS-K-7125. The measurement results are also shown in Table 1. The results obtained by performing the winding evaluation three times are shown in Table 1. It was confirmed that, when a silicone tape, which is a present invention example, was applied, winding was satisfactorily performed with no occurrence of slip in all three tests, and thus the effects of a high friction resistance material were exhibited. In contrast, slip occurred in all three tests with examples other than the present invention example, and thus in these cases it was not possible to fix the thin metal strips to the winding rings.

[Table 1]

Tape materials	Winding evaluation (whether slip occurred)			Static friction coefficient	Remarks
	First test	Second test	Third test		
Silicone tape	○	○	○	5.79	Present invention example 1-1
PE film tape	X	X	X	0.39	Comparative example 1-1

EP 3 753 643 A1

(continued)

Tape materials	Winding evaluation (whether slip occurred)			Static friction coefficient	Remarks
	First test	Second test	Third test		
PET film tape	X	X	X	0.37	Comparative example 1-2
Masking tape	X	X	X	0.44	Comparative example 1-3
PVC tape	X	X	X	1.66	Comparative example 1-4

(Example 2)

[0031] Next, using silicone tapes, the tape thickness, the material of the thin metal strip, the plate thickness of the thin metal strip, the presence/absence of anti-rust oil, the material of the winding ring, and a tape bonding method were varied to ascertain conditions for satisfactorily winding the thin metal strip. The arithmetic mean roughness Ra of the thin metal strips were checked in advance at an evaluation length of 4 mm in accordance with the measurement method defined in JIS-B-0601. The result was that it was ascertained that all thin plates had a roughness Ra of 0.6 μm or less. After a tape length was set to 20 mm and winding rings were set for winding using the above-mentioned winding device, the thin metal strips were manually wound two laps in advance and wound for 4000 meters with a winding tension set value set to 20 N. For the evaluation, a winding evaluation for confirming the presence or absence of slipping, and a quality evaluation for confirming the quality of winding, and the presence or absence of defects in the thin metal strip on the innermost circumferential part were performed by unwinding the wound thin metal strip. Table 2 shows the conditions and evaluation results thereof. As a result of measuring hardness of the various thin metal strips in advance, stainless steel had a hardness of 300 HV, a Fe-Ni alloy had a hardness of 190 HV, and a Cu alloy had a hardness of 160 HV. In addition, the "peripheral portion of the tip" in the "bonding position" in Table 2 represents a "position 10 mm away from the tips of the thin metal strips to be wound" as in Example 1, and the "position at 180° from the tip" in the bonding position of present invention example 2017 represents a "position at which the thin metal strip has advanced half the circumferential length of the winding ring from the tip of the thin metal strip in the winding direction (R direction)."

[Table 2]

Tape thickness (mm)	Thin metal strip		Ring material	Bonding position	Winding evaluation (occurrence of slip)	Quality evaluation (scratches, bending, deformation, etc.)	Remarks
	Material	Plate thickness (mm)					
0.1	Stainless steel	0.1	Iron	Peripheral portion of tip	○	○	Present invention example 2-1
0.15	Stainless steel	0.1	Iron	Peripheral portion of tip	○	○	Present invention example 2-2
0.2	Stainless steel	0.1	Iron	Peripheral portion of tip	○	○	Present invention example 2-3
0.1	Fe-Ni alloy	0.1	Iron	Peripheral portion of tip	○	○	Present invention example 2-4
0.1	Cu alloy	0.1	Iron	Peripheral portion of tip	○	○	Present invention example 2-5
0.1	Stainless steel	0.15	Iron	Peripheral portion of tip	○	○	Present invention example 2-6
0.1	Stainless steel	0.08	Iron	Peripheral portion of tip	○	○	Present invention example 2-7
0.1	Fe-Ni alloy	0.05	Iron	Peripheral portion of tip	○	○	Present invention example 2-8
0.1	Stainless steel	0.08	Iron	Peripheral portion of tip	○	○	Present invention example 2-9

(continued)

Tape thickness (mm)	Thin metal strip		Presence/absence of anti-rust oil	Ring material	Bonding position	Winding evaluation (occurrence of slip)	Quality evaluation (scratches, bending, deformation, etc.)	Remarks
	Material	Plate thickness (mm)						
0.1	Stainless steel	0.1	Present	Iron	Peripheral portion of tip	○	○	Present invention example 2-10
0.1	Stainless steel	0.1	None	Plastic	Peripheral portion of tip	○	○	Present invention example 2-11
0.1	Stainless steel	0.1	None	Paper pipe	Peripheral portion of tip	○	○	Present invention example 2-12
0.4	Stainless steel	0.1	None	Iron	Peripheral portion of tip	○	○	Present invention example 2-13
0.4	Fe-Ni alloy	0.1	None	Iron	Peripheral portion of tip	○	Δ (Tape irregularity)	Present invention example 2-14
0.4	Cu alloy	0.1	None	Iron	Peripheral portion of tip	○	Δ (Tape irregularity)	Present invention example 2-15
0.1	Stainless steel	0.1	None	Iron	Entire ring circumference	○	Δ (Winding failure)	Present invention example 2-16
0.1	Stainless steel	0.1	None	Iron	Position at 180° from tip	○	Δ (Tip overhanging)	Present invention example 2-17
0.1	Stainless steel	0.38	None	Iron	Peripheral portion of tip	X (Rebound occurred)	-	Comparative example 2-1

[0032] When the thin metal strips were compared in terms of tape thickness, winding evaluation and quality evaluation were good regardless of materials of the thin metal strips as indicated in the present invention examples 2-1 to 2-5. Even when the tape thickness of stainless steel of the present invention example 2-13 was set to 0.4 mm, winding evaluation and quality evaluation were good. When a tape thickness of the thin metal strips having a hardness of 200 HV or less as indicated in the present invention examples 2-14 and 2-15 was set to 0.4 mm, the strip was wound without slip and winding evaluation was good, but tape irregularity occurred. According to the other results for the present invention examples, it is thought that, when a hardness was 200 HV or less, the quality could have been further improved by setting the plate thickness of the tape to 0.2 mm or less.

[0033] In terms of plate thickness of the thin metal strips, products having a thick plate thickness as indicated in the present invention example 2-6 and the thin metal strips having a thin plate thickness as indicated in the present invention examples 2-7 and 2-8 exhibited good winding and quality evaluation. However, in Comparative example 2-1 having a plate thickness of 0.38 mm, the elastic force of the thin metal strip was strong, and the thin metal strip rebounded, which made winding difficult.

[0034] As a result of evaluating the thin metal strips (present invention examples 2-9 and 2-10) with anti-rust oil on surfaces, winding and quality evaluation were good even though anti-rust oil was applied on the surfaces of the thin metal strip. In addition, even in the present invention examples 2-11 and 2-12 in which ring materials were changed, the silicone tapes were bonded and thus evaluation was good.

[0035] In the present invention example 2-16 in which the silicone tape was bonded to the entire circumference of the ring as a tape bonding method, winding was favorably performed and improvement in comparison to comparative example 2-1 was recognized. Meanwhile, while the thin metal strip was wound, misalignment of the width of the thin metal strip occurred around the inner circumference. In addition, as a result of checking the thin metal strip at the innermost circumferential part by rewinding the wound thin metal strip, deformation of the thin metal strip on the inner circumference caused by width misalignment occurred. Next, also in the present invention example 2-17 in which the tape was bonded to a position 180° away from the tip of the thin metal strip in the inner circumferential direction, winding was favorably performed and improvement in comparison to comparative example 2-1 was recognized, but the tip overhung.

[0036] It has been ascertained from the above configuration that, only by bonding a rubber tape to an outer circumferential surface of a winding ring with the present invention applied and no complicated structure required, scratches caused by slip of a thin metal strip that may occur in an innermost circumference in winding can be prevented, set bending of the thin metal strip can be curbed due to a cushioning property of the rubber tape, and the present invention can be applied when a thin metal strip coil made of a wide variety of materials is produced.

[Reference Signs List]

[0037]

- 1 Thin metal strip
- 2 Winding ring
- 3 Rubber tape
- 4 Tip of thin metal strip

Claims

1. A method for producing a thin metal strip coil of winding a thin metal strip around a winding ring to obtain a thin metal strip coil, the method comprising:
winding a thin metal strip having a plate thickness of 0.3 mm or less around the winding ring having at least a part of an outer circumferential surface to which a high friction resistance material that is formed of a rubber tape is bonded.
2. The method for producing a thin metal strip coil according to claim 1, wherein the rubber tape has a static friction coefficient of 3.0 or higher.
3. The method for producing a thin metal strip coil according to claim 1 or 2, wherein a base material made of rubber of the rubber tape is made of silicone rubber.
4. The method for producing a thin metal strip coil according to any one of claims 1 to 3, wherein the rubber tape has a base material made of rubber and an adhesive layer formed on one surface of the base material, and

the rubber tape has an adhesive layer side bonded to the winding ring and a surface that comes in contact with the thin metal strip being the rubber base material.

- 5 **5.** The method for producing a thin metal strip coil according to any one of claims 1 to 4, wherein a thickness of the rubber tape is 0.05 to 0.5 mm.
- 6.** The method for producing a thin metal strip coil according to any one of claims 1 to 5, wherein the thin metal strip is wound such that a peripheral portion of a tip of the thin metal strip comes in contact with the rubber tape.
- 10 **7.** A thin metal strip coil obtained by winding a thin metal strip around a winding ring, wherein a plate thickness of the thin metal strip is 0.3 mm or less, and a high friction resistance material that is formed of a rubber tape is bonded to at least a part of an outer circumferential surface of the winding ring.
- 15 **8.** The thin metal strip coil according to claim 7, wherein the rubber tape has a static friction coefficient of 3.0 or higher.
- 9.** The thin metal strip coil according to claim 7 or 8, wherein a base material made of rubber of the rubber tape is made of silicone rubber.
- 20 **10.** The thin metal strip coil according to any one of claims 7 to 9, Wherein the rubber tape has a base material made of rubber and an adhesive layer formed on one surface of the base material, and The rubber tape has an adhesive layer side bonded to the winding ring and a surface that comes in contact with the thin metal strip being the rubber base material.
- 25 **11.** The thin metal strip coil according to any one of claims 7 to 10, wherein a thickness of the rubber tape is 0.05 to 0.5 mm.
- 30 **12.** The thin metal strip coil according to any one of claims 7 to 11, wherein, in a range from a tip for beginning winding of the thin metal strip to half a circumference of the winding ring, the high friction resistance material that is formed of the rubber tape is bonded to at least a part of the outer circumferential surface of the winding ring.

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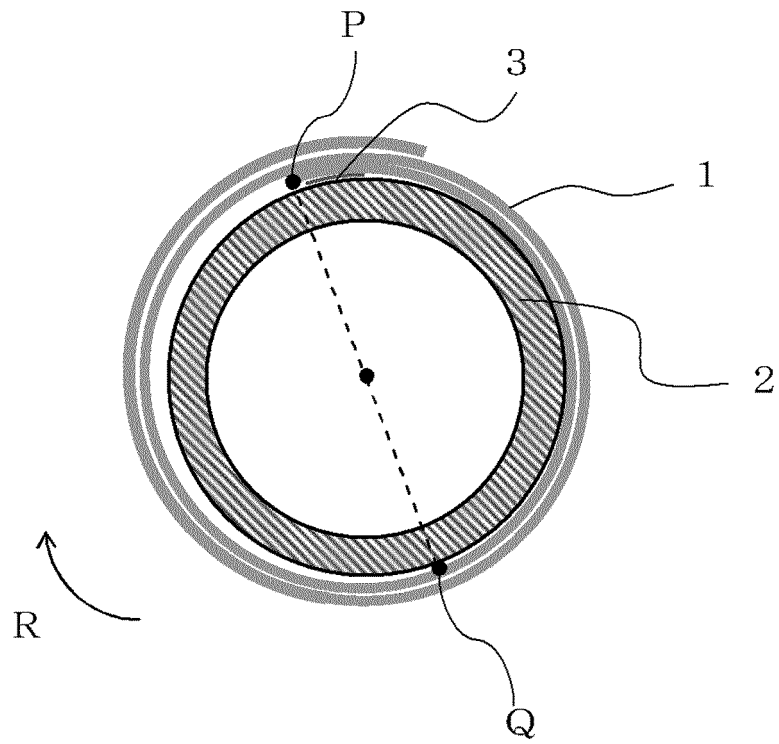


FIG. 1

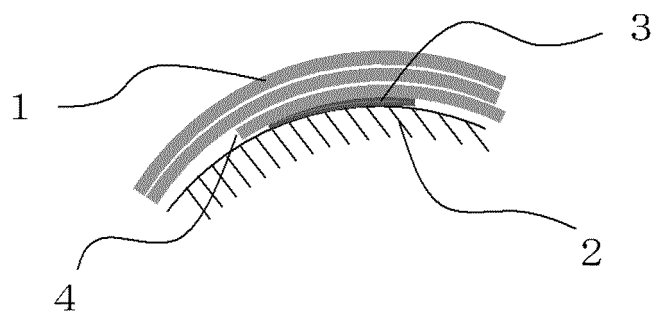


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2019/005115

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. B21C47/28 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. B21C47/00-B21C47/34, B65H75/26

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2019

Registered utility model specifications of Japan 1996-2019

Published registered utility model applications of Japan 1994-2019

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 7-124646 A (KAWASAKI STEEL CORP.) 16 May 1995, paragraphs [0011]-[0017], fig. 1-5 (Family: none)	1-12
Y	JP 6-71337 A (NKK CORP.) 15 March 1994, paragraphs [0018]-[0027] (Family: none)	1-12
Y	JP 59-147713 A (KAWASAKI STEEL CORP.) 24 August 1984, page 2, lower right column, line 2 to page 4, upper right column, line 3, fig. 4-9 (Family: none)	1-12
A	JP 5-285540 A (KAWASAKI STEEL CORP.) 02 November 1993, paragraphs [0011]-[0014], fig. 1-3 (Family: none)	1-12
A	JP 48-35255 Y1 (SUMITOMO METAL INDUSTRIES, LTD.) 24 October 1973, column 2, line 7 to column 3, bottom line, fig. 2-3 (Family: none)	1-12
A	JP 2004-130382 A (UNIE STAR KK) 30 April 2004, paragraphs [0028]-[0045], fig. 1-3 (Family: none)	1-12

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search
03 April 2019 (03.04.2019)

Date of mailing of the international search report
16 April 2019 (16.04.2019)

Name and mailing address of the ISA/
Japan Patent Office
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H716648 B [0004]
- JP H11165955 B [0004]