

DESCRIPTION

WINDING CORE, WINDING REEL AND STRIP WINDING METHOD

Technical Field

[0001] The present invention relates to a winding core, a
5 winding reel and a strip winding method for use in taking
up a strip such as carrier tape etc.

Background Art

[0002] The carrier tape used in mounting electronic parts
onto circuit boards and in other cases is wound on the winding
10 core of a winding reel. Herein, in view of reducing the
frequency of replacement of the winding reel and improving
production efficiency in the production stage of the carrier
tape and in the storing stage of electronic parts, a longer
carrier tape is spooled. The winding reel of this kind is
15 comprised of a winding core 1A and a carrier tape 10 that
is traverse wound on this winding core 1A to hold multiple
electronic parts, as shown in FIGS. 21 and 22.

[0003] As shown in FIGS. 21 and 22, winding core 1A is formed
in a cylindrical shape with flanges 3 on both the left and
20 right end faces thereof, having a width greater than the width
of carrier tape 10. On the other hand, carrier tape 10 is
formed with multiple pockets 12 that are arrayed in the
longitudinal direction of a long tape 11, has a plurality
of sprocket holes 13 perforated at intervals along one side
25 in the longitudinal direction of tape 11 so as to be continuously

taken up on a peripheral surface 2A of winding core 1A.

[0004] A covering tape is adhered in a removable manner on the surface of tape 11 after electronic parts have been put into pockets 12. This covering tape prevents the electronic parts from dislodging from pockets 12, and is peeled off from tape 11 when carrier tape 10 is reeled out.

This winding reel is constructed so that carrier tape 10 is taken up with the one side overlapped on the other side of the wound carrier tape in order to improve the winding density of carrier tape 10 when carrier tape 10 is transverse wound on an empty winding core 1A and prevent the winding of the tape from collapsing during storage and transportation (see Patent Documents 1 and 2).

Prior Art Documents

Patent Documents

[0005]

Patent Document 1:

Japanese Patent Application Laid-open 2001-247158

Patent Document 2:

Japanese Patent Application Laid-open H09-315628

Summary of the Invention

Problems to be Solved by the Invention

[0006] The winding reel in the prior art is thus configured so that the carrier tape 10 is taken up simply by laying one side part of carrier tape 10 over the other side part of the

wound carrier tape 10. Accordingly, with this overlap winding, one side of carrier tape 10 is inclined to the other with respect to the peripheral surface 2A of winding core 1A, producing difference in wound length and causing distortion in winding carrier tape 10, thus the carrier tape 10 becomes likely to skew to a certain direction.

[0007] As a result of this, an error would occur when pocket 12 of carrier tape 10 is positioned so as to insert an electronic part therein, or there is a risk that the task of adhering the covering tape onto the tape 11 surface of carrier tape 10 is impeded so that it becomes impossible to smoothly spool out the carrier tape 10 when the electronic parts are mounted.

[0008] The present invention has been devised in view of the above, it is therefore an object of the invention to provide a winding core, a winding reel and a strip winding method, which can suppress a strip from becoming likely to skew in a certain direction due to occurrence of distortion in winding the strip as a result of the strip being skewed and the difference in winding length thus generated.

Means for Solving the Problems

[0009] In order to solve the above problems, the present invention provides a winding core having an approximately cylindrical shape, winding a strip in such a manner that one side of the strip overlaps the side of the wound strip when the strip is traverse wound on a curved peripheral surface,

characterized in that

the curved peripheral surface is inclined radially outwards as it goes from one end to the other, the inclination θ of the peripheral surface is based on $0 < \theta \leq 2 \arctan$ [the thickness of the strip/the traverse pitch].

[0010] Here, flanges may be provided on end faces, and a mis-attachment preventing means may be arranged at least one of the flanges and the curved peripheral surface.

Further, nonslip strip grooves formed on the peripheral surface in the circumferential direction may be arranged from one side end to the other.

It is also preferable that a inner core and a cylindrical outer core fitted on the inner core are provided and the outer peripheral surface of the outer core is inclined radially outwards.

[0011] The strip may be a carrier tape comprising: a long tape; a plurality of storing cavities arrayed and formed at intervals in the longitudinal direction of the tape; and a plurality of feed holes placed at intervals along at least one longitudinal side of the tape.

[0012] Further, in order to solve the above problems, the present invention may be characterized in that when a strip is traverse wound on the winding core according to any one of Claims 1 through 5, the strip is adapted to be wound so that one side of the strip overlaps the side of the wound

strip.

In order to solve the above problems, the present invention provides a strip winding method of traverse winding a strip on the winding core according to any one of
5 Claims 1 through 5, comprising the steps of:

winding the strip in such a manner that one side of the strip overlaps the side of the wound strip; and

winding the strip without laying one side of the strip over the wound strip,

10 the above steps being repeated alternately.

[0013] Here, the strip in the scope of Claims may, at least, include carrier tapes (emboss carrier tape, punched carrier tape, Surf tape), packaging tape, Japanese paper tape, aluminum tape, covering tape, magnetic tape and the like.

15 This strip can be taken up by combination of overlap winding, ordinary winding in which the strip is wound without overlapping one side end on the side end of the wound strip, and the like.

[0014] When a plurality of feed holes are formed in the strip,
20 the feed holes may be formed either along one side or along both sides in the longitudinal direction of the tape. The approximately cylindrical winding core may be either hollow or solid. This material of the winding core may be paper, corrugated board, metals, resins, etc., and is not particular
25 limited. Further, mis-attachment preventing means may be

formed by providing a single or plurality of marking, hollows such as engagement holes etc., projections such as engagement claws, and the like for the winding core, flanges, or both the winding core and flanges.

5 [0015] According to the present invention, since the peripheral surface of the winding core is inclined in the opposite direction to the inclination of the overlapped portion of the strip, less difference in winding length will take place due to inclination of the side part of the strip
10 relative to the peripheral surface of the winding core as the strip is wound in an overlapping manner.

Effect of the Invention

[0016] The present invention is effective to suppress a strip from becoming likely to skew in a certain direction due to
15 occurrence of distortion during winding the strip as a result of the strip being inclined and the difference in winding length thus generated.

[0017] Further, when flanges are provided on the end faces and a mis-attachment preventing means is provided for, at
20 least, one of the flanges and the curved peripheral surface, it is possible to grasp the direction of attachment of the winding core, the direction of inclination of the peripheral surface and the direction of the winding reel set relative to the machines of all kinds, and attach the winding reel
25 in the correct orientation.

Further, when nonslip strip grooves are formed in the circumferential direction on the peripheral surface of the winding core and the nonslip grooves are arranged from one side end to the other, it is possible to prevent winding collapse of the strip due to slippage of the strip.

[0018] Moreover, when an inner core and a cylindrical outer core that is fitted on the inner core are provided and the outer peripheral surface of the outer core is inclined radially outwards, it is possible to use the existing winding core as the inner core, hence it is possible to expect reduction in cost.

Brief Description of Drawings

[0019]

[FIG. 1] is an illustrative diagram schematically showing a carrier tape being wound in an overlapping manner in the embodiment of a winding core, winding reel and strip winding method according to the present invention.

[FIG. 2] is an illustrative diagram schematically showing a carrier tape being wound in an ordinary manner in the embodiment of a winding core, winding reel and strip winding method according to the present invention.

[FIG. 3] is an illustrative diagram schematically showing the relationship between a winding core and a carrier tape according to the present invention.

[FIG. 4] is an illustrative diagram schematically showing

the inclination at the time of taking up a carrier tape in an overlapping manner in the embodiment of a winding core, winding reel and strip winding method according to the present invention.

5 [FIG. 5] is an illustrative diagram schematically showing the embodiment of a winding core according to the present invention.

[FIG. 6] is a perspective illustrative diagram schematically showing a carrier tape in the embodiment of a winding core, winding reel and strip winding method according to the present invention.

[FIG. 7] is a perspective illustrative diagram schematically showing the second embodiment of a winding core and winding reel according to the present invention.

15 [FIG. 8] is a partial illustrative diagram schematically showing the second embodiment of a winding core and winding reel according to the present invention.

[FIG. 9] is an illustrative diagram schematically showing the third embodiment of a winding core and winding reel according to the present invention.

[FIG. 10] is an illustrative diagram schematically showing another marking in the third embodiment of a winding core and winding reel according to the present invention.

[FIG. 11] is an illustrative diagram schematically showing the fourth embodiment of a winding core and winding reel

according to the present invention.

[FIG. 12] is an illustrative diagram schematically showing the fifth embodiment of a winding core and winding reel according to the present invention.

5 [FIG. 13] is an illustrative diagram showing the conditions of wound carrier tapes in the embodiment of a winding core, winding reel and strip winding method according to the present invention and in a comparative example.

10 [FIG. 14] is a graph showing the result of measurement in the embodiment of a winding core, winding reel and strip winding method according to the present invention and in a comparative example.

15 [FIG. 15] is a graph showing the result of measurement in example 1 of a winding core, winding reel and strip winding method according to the present invention.

[FIG. 16] is a graph showing the result of measurement in example 2 of a winding core, winding reel and strip winding method according to the present invention.

20 [FIG. 17] is a graph showing the result of measurement in comparative example 1 of a winding core, winding reel and strip winding method according to the present invention.

[FIG. 18] is a graph showing the result of measurement in comparative example 2 of a winding core, winding reel and strip winding method according to the present invention.

25 [FIG. 19] is a graph showing the result of measurement in

comparative example 3 of a winding core, winding reel and strip winding method according to the present invention.

[FIG. 20] is a graph showing the result of measurement in comparative example 4 of a winding core, winding reel and strip winding method according to the present invention.

[FIG. 21] is an illustrative diagram schematically showing a conventional winding reel.

[FIG. 22] is an illustrative diagram schematically showing a conventional winding core.

Mode for Carrying Out the Invention

[0020] Next, the embodiment of the present invention will be described with reference to the drawings. As shown in FIGS. 1 to 6, a winding reel of the present embodiment includes a winding core 1 having directivity depending on the difference in diameter along the axial direction and a carrier tape 10 that holds multiple electronic parts therein and is transverse wound on this winding core 1. When the electronic parts are mounted to circuit boards, carrier tape 10 is reeled out and delivered from winding core 1 so that the electronic parts of this tape carrier 10 are mounted to the circuit boards.

[0021] As shown in FIGS. 1, 2 and 5, winding core 1 is formed of, for example a molding material containing predetermined resins into a hollow approximately frustoconical shape with its peripheral surface 2 slightly inclined or made greater in outside diameter from one horizontal end to the other,

or as it goes in the axial direction, and is set in a drive shaft of a winding machine. The molding material of this winding core 1 is not particularly limited, but examples may include ABS resin, polystyrene, expanded polystyrene (PSP),
5 polyolefin, expanded polyolefin, etc., which are excellent in moldability and light in weight. The left and right end faces of winding core 1 are formed open so that a disk-formed flange 3 is removably attached to each.

[0022] For attachment of this flange 3, a plurality of
10 engagement claws may be projectively formed on each end face of winding core 1 while engagement holes 9 that become engaged with the engagement claws may be formed in flange 3.

Alternatively, a plurality of engagement grooves may be formed on each end face of winding core 1 while flange 3 may be formed
15 with engagement claws that become engaged with the engagement grooves.

[0023] As shown in FIGS. 1, 2 and 6, carrier tape 10 includes a flexible long tape 11, on which a plurality of bottomed rectangular parallelepiped pockets 12 for holding electronic
20 parts are arranged in the longitudinal direction. A plurality of sprocket holes 13 are formed at intervals along one side in the longitudinal direction of tape 11. The carrier tape is continuously taken up on a curved peripheral surface 2 of winding core 1 as it moves traverse in the left-and-right
25 direction by the function of a guide roller 20 of the winding

machine that can slide left and right.

[0024] Carrier tape 10 is formed to be 1200 m or longer, of a molding material such as polystyrene, polyethylene terephthalate, polycarbonate or the like, optionally added with electro-conductivity as necessary. Applied on the surface of tape 11 after electronic parts having been put in pockets 12 is an unillustrated covering tape, which may be enclosed by thermal or ultrasonic sealing, or removably adhered. This covering tape prevents the electronic parts from coming off from pockets 12 and is peeled off from tape 11 when carrier tape 10 is reeled out. The electronic parts are not particularly limited; examples may include LEDs, ceramic capacitors, chip resistors, electric connectors, transistors and the like.

[0025] In winding carrier tape 10, overlap winding in which one side of carrier tape 10 is laid over the other side of the wound carrier tape 10 (see FIG. 1) and ordinary winding in which carrier tape 10 is wound side by side without overlapping the other side of wound carrier tape 10 (see FIG. 2) are repeated alternately. For example, when carrier tape 10 is taken up from the left end to the right end of winding core 1, carrier tape 10 is wound in the overlapping manner, whereas carrier tape 10 is wound ordinarily when carrier tape 10 is taken up from the right end to the left end of winding core 1.

[0026] Next, peripheral surface 2 of winding core 1 is formed inclined in the opposite direction to the inclination of the overlapped portion of carrier tape 10 (see FIG. 3). The inclination θ of this peripheral surface 2 is determined based on $0 < \theta \leq 2 \arctan [\text{the thickness of the carrier tape} / \text{the traverse pitch}]$. This is because the inclination θ_c of tape carrier 10 at the time of overlap winding is considered as $\theta_c = \arctan [\text{the thickness of the carrier tape} / \text{the traverse pitch}]$.

[0027] For example, the inclination θ_c of carrier tape 10 is calculated as $\theta_c \approx 2.5$ when the thickness of carrier tape 10 is 0.25 mm and the transverse pitch is 5.7 mm. As a result, the optimal inclination θ of peripheral surface 2 of winding core 1 can be considered on the whole as falling within $0 < \theta \leq 2\theta_c$, though it becomes different depending on the thickness of carrier tape 10, the traverse pitch and the emboss configuration of the product. Specifically, θ should fall within a range of 1° to 5° , preferably 1.5 to 5, more preferably around 1.5° .

[0028] In the above configuration, when carrier tape 10 is traverse wound on winding core 1 of the winding reel, empty winding core 1 is fitted to the drive shaft of the winding machine, the end of carrier tape 10 is wound on this winding core 1, and carrier tape 10 is tensioned and wound on guide roller 20 of the winding machine. Then, as the winding machine is driven, carrier tape 10 may be taken up on peripheral surface

2 of winding core 1 while the tape is being moved leftward or rightward.

[0029] As a result, winding core 1 turns and takes up carrier tape 10, and repeats overlap winding of this carrier tape 10, ordinary winding, overlap winding, ordinary winding, ..., alternately until the entire carrier tape 10 is transverse wound on winding core 1. That is, carrier tape 10 is wound in the overlapping manner from the left end of winding core 1 where it is small in diameter to the right end where it is large in diameter, and then the tape is taken up in the ordinary manner from the right end to the left end, thus these different winding manners are repeated alternately.

[0030] Accordingly, when carrier tape 10 is wound in the overlapping manner, it is possible to constantly keep a fixed angle of inclination ($0 < \theta \leq 2\theta_c$) without causing the angle of inclination of winding core 1 to be smaller than 0° . As a result, it is possible to greatly expect efficient decrease of the skew of carrier tape 10.

[0031] When this carrier tape 10 is taken up, peripheral surface 2 of winding core 1 inclines in the opposite direction to that of the overlapped portion of carrier tape 10, so that it is possible to remarkably alleviate the inclination of the overlapped portion of carrier tape 10, whereby it is possible to avoid dissimilarity in wound length and diameter due to inclination of the side portion

of carrier tape 10 relative to peripheral surface 2 of winding core 1 as the tape is wound.

[0032] Accordingly, it is possible to avoid distortion of wound carrier tape 10 and resultantly prevent the carrier tape from skewing to a certain direction. As a result of this, it is possible to suppress and prevent occurrence of errors when pocket 12 of carrier tape 10 is positioned and the electronic part is put into this pocket 12. It is also possible to readily and easily adhere a covering tape to the tape 11 surface of carrier tape 10 and reel out the wound carrier tape 10 smoothly when electronic parts are mounted.

[0033] Next, FIGS. 7 and 8 show the second embodiment of the present invention. In this case, winding core 1 is configured of a cylindrical inner core 4 with a peripheral surface having an inclination of 0° and a cylindrical outer core 5 fitted on the outer peripheral surface of the inner core 4. The outer peripheral surface 6 of this outer core 5 is inclined radially outwards and formed with multiple nonslip grooves 7 in the circumferential direction of the outer peripheral surface 6. The nonslip grooves 7 are arranged from one side end to the other end of outer core 5, or in the axial direction, forming an approximately step-like configuration.

[0034] As inner core 4, a new core may be used or an existing winding core 1 may be used. Outer core 5 is configured so as to be removably fitted on inner core 4 or may be bonded

to inner core 4. Nonslip grooves 7 may be formed by directly cutting out steps on outer peripheral surface 6 of outer core 5 or by winding a cord such as tape, string or the like thereon. The other parts are approximately the same as those in the above embodiment so that description is omitted.

[0035] Also in this embodiment, it is possible to expect the same operational effect as in the above embodiment. Besides, since winding core 1 is configured of separate inner core 4 and outer core 5, it is obvious to achieve reduction in cost by using an existing multi-purpose winding core 1 as the inner core 4. Further, since a plurality of nonslip grooves 7 are formed on outer peripheral surface 6 of outer core 6, it is possible to prevent winding collapse of carrier tape 10 due to slippage of carrier tape 10.

[0036] Next, FIGS. 9 and 10 show the third embodiment of the present invention. In this case, at least one of winding core 1 having directivity and flanges 3 is formed with a marking 8 showing a predetermined meaning.

[0037] Marking 8 is formed of a visible predetermined pattern (e.g., letters, figure, arrow, etc.) on the peripheral surface of winding core 1, for example by a laser marking, ink-jet technique, pad printing, two color formation and the like so as to provide a function of indicating the direction of attachment of winding core 1, the tapering direction of winding core 1, the direction of insertion of the winding reel relative

to the winding machine or the molding machine of carrier tape 10. The other parts are approximately the same as those in the above embodiment so that description is omitted.

[0038] Also in this embodiment, it is possible to expect the same operational effect as in the above embodiment. Besides, since marking 8 is given on winding core 1 or flange 3, it is apparent that the direction of inclination of peripheral surface 2 of winding core 1 can be simply discriminated, attachment work of the winding reel can be smoothly carried out and mis-attachment can be easily prevented.

[0039] Next, FIG. 11 shows the fourth embodiment of the present invention. In this case, a plurality of engagement holes 9 for attachment that mate the engagement claws on the corresponding end face of winding core 1 are formed near the center of each of a pair of flanges 3 so that the engagement holes 9 in the flange 3 on the large-diametric side of winding core 1 and the engagement holes 9 in the flange 3 on the small-diametric side of winding core 1 become different in shape, so as to prevent against human error or the winding reel from being attached in opposite direction.

[0040] Each engagement hole 9 in the flange 3 on the large-diametric side of winding core 1 is formed with a triangle hole while each engagement hole 9 in the flange 3 on the small-diametric side of winding core 1 is formed with a long hole. The other parts are approximately the same as those

in the above embodiment so that description is omitted.

Also in this embodiment, it is possible to expect the same operational effect as in the above embodiment. Besides, since the shapes of engagement holes 9 in a pair of flanges 3 are made different so as to prohibit attachment in the opposite direction when flanges 3 are assembled, it is always possible to attach them in the correct position.

[0041] Next, FIG. 12 shows the fifth embodiment of the present invention. In this case, a plurality of engagement holes 9 for attachment that mate the engagement claws on the corresponding end face of winding core 1 are formed in each of a pair of flanges 3 so that the engagement holes 9 in the flange 3 on the large-diametric side of winding core 1 and the engagement holes 9 in the flange 3 on the small-diametric side of winding core 1 are made different in position, so as to prevent against human error or the winding reel from being attached in the opposite direction.

[0042] Each engagement hole 9 in the flange 3 on the large-diametric side of winding core 1 is formed near the boundary between the center and the periphery of flange 3 while each engagement hole 9 in the flange 3 on the small-diametric side of winding core 1 is formed near the center of flange 3. The other parts are approximately the same as those in the above embodiment so that description is omitted.

Also in this embodiment, it is possible to expect the same operational effect as in the above embodiment. Besides, since the positions of engagement holes 9 in a pair of flanges 3 are made different so as to prohibit attachment in the opposite direction when flanges 3 are assembled, it is possible to always possible to attach them in the correct positions.

[0043] Here, in the above embodiment, winding core 1 is formed as a hollow approximately frusto-conical shape but may be formed in a solid approximately frusto-conical shape.

Further, winding core 1 may be formed by inclining peripheral surface 2 in the radially outward direction and applying a nonslip treatment such as surface texturing on the peripheral surface 2. In the above embodiment, peripheral surface 2 of winding core 1 is inclined radially outwards, but peripheral surface 2 of winding core 1 may be formed with a curvature and inclined radially outwards.

[0044] The peripheral surface 2 of winding core 1 may be inclined radially outwards and formed with multiple nonslip grooves 7 in the circumferential direction thereof, which are arranged from one side end to the other. Further, winding core 1 and flanges 3 may be integrally formed. Also, flange 3 may be shaped in a polygon or other forms than a disc form.

[0045] Moreover, a necessary number of passage holes are formed in the pair of flanges 3 while a removable separate plug may be selectively inserted to the passage hole of the

flange 3 on the large-diametric or small-diametric size of winding core 1 so that the inserted plug will be detected by a sensor when the winding reel is set on the winding machine. With this arrangement, when the winding reel is set on the winding machine, an alarm may be raised if the winding reel is set erroneously, by detecting the plugs inserted in flange 3 through the sensor, whereby it is possible to set the winding reel correctly.

[Examples]

[0046] Next, examples of the winding core, winding reel and strip winding method according to the present invention will be described together with comparative examples.

[Example 1]

First, the empty winding core was fitted to the drive shaft of the winding machine, the end of the carrier tape is wound on this winding core, and the carrier tape was tensioned and wound on the guide roller of the winding machine. The peripheral surface of the winding core was inclined radially outwards with an angle of 1.5° . Used as the carrier tape was a type having a tape width of 8 mm formed with pockets each having a depth of 1.42 mm and multiple sprocket holes arranged at intervals on one side part along the longitudinal direction thereof.

[0047] After the carrier tape was wound on the guide roller of the winding machine, the winding machine was driven so

as to take up the carrier tape on the peripheral surface of the winding core while moving the tape leftward or rightward. The skew of the carrier tape was measured. The result of measurement is summarized in the graphs in FIGS. 14 and 15.

5 When the carrier tape was taken up, overlap winding and ordinary winding of the carrier tape were repeated alternately, as shown in FIG. 13.

[0048] The inclination θ_c of the carrier tape was $\theta_c \approx 2.5$ when the tape was wound in an overlapping manner. In measuring
10 the skew of the carrier tape, the measurement was performed from one end of the overlap wound layer up to the original end of the ordinary winding layer. The skew of the carrier tape was evaluated as a positive value when the side along which sprocket holes are formed extends, whereas the skew
15 was evaluated as a negative value when the other side without sprocket holes extends. In FIG. 14, the left end represents the start point of measurement, the broken line around the center represents the vicinity of the flange on the opposite side and the right end represents the flange on the
20 start-of-measurement side. The broken line around the center in FIG. 15 indicates the point of change from the overlap winding of the carrier tape to the ordinary winding.

[0049] As a result of the measurement on the skew of the carrier tape, the skew of the carrier tape was really small, producing
25 markedly good results.

[0050] [Example 2]

This example is essentially the same as example 1 except that the peripheral surface of the winding core was inclined radially outwards with an angle of 5° . With the other conditions set the same as in example 1, the skew of the carrier tape was measured. The result of measurement is summarized in the graphs in FIGS. 14 and 16. The broken line around the center in FIG. 16 indicates the point of change from the overlap winding of the carrier tape to the ordinary winding.

As a result of the measurement on the skew of the carrier tape, the skew of the carrier tape was really small, producing markedly good results.

[0051] [Comparative Example 1]

This comparative example is essentially the same as example 1 except that the peripheral surface of the winding core was inclined radially outwards with an angle of 8° . With the other conditions set the same as in example 1, the skew of the carrier tape was measured. The result of measurement is summarized in the graphs in FIGS. 14 and 17. The broken line around the center in FIG. 17 indicates the point of change from the overlap winding of the carrier tape to the ordinary winding.

As a result of the measurement on the skew of the carrier tape, the inclination θ of the peripheral surface of the winding core is greater than $2\theta_c$, so that the carrier tape as a whole

skewed to the negative side, producing unpreferable results.

[0052] [Comparative Example 2]

5 This comparative example is essentially the same as example 1 except that the peripheral surface of the winding core was inclined with an angle of 0° . That is, the skew of the carrier tape when using the existing multi-purpose winding core was measured with the other conditions set the same as in example 1. The result of measurement is summarized in the graphs in FIGS. 14 and 18. The broken line around the
10 center in FIG. 18 indicates the point of change from the overlap winding of the carrier tape to the ordinary winding.

As a result of the measurement on the skew of the carrier tape, the carrier tape skewed, producing unpreferable results.

[0053] [Comparative Example 3]

15 This comparative example is essentially the same as example 1 except that the peripheral surface of the winding core was inclined in the opposite direction, or radially inwards with an angle of -1.5° . With the other conditions set the same as in example 1, the skew of the carrier tape was measured. The result of measurement is summarized in the
20 graphs in FIGS. 14 and 19. The broken line around the center in FIG. 19 indicates the point of change from the overlap winding of the carrier tape to the ordinary winding.

As a result of the measurement on the skew of the carrier
25 tape, the carrier tape skewed greatly compared to the case

where the inclined angle was 0° , producing unpreferable results.

[0054] [Comparative Example 4]

This comparative example is essentially the same as example 1 except that the peripheral surface of the winding core was inclined in the opposite direction with an angle of -3° . With the other conditions set the same as in example 1, the skew of the carrier tape was measured. The result of measurement is summarized in the graphs in FIGS. 14 and 20. The broken line around the center in FIG. 20 indicates the point of change from the overlap winding of the carrier tape to the ordinary winding.

As a result of the measurement on the skew of the carrier tape, the carrier tape skewed greatly to the positive side compared to the case where the inclined angle was 0° , producing unpreferable results.

[0055] From the examples and comparative examples heretofore, it was confirmed that the skew of the carrier tape can be markedly suppressed when the inclination of the peripheral surface of the winding core is specified within a range of $0 < \theta \leq 2\theta_c$.

Description of Reference Numerals

[0056]

1 winding core

1A winding core

- 2 peripheral surface
- 2A peripheral surface
- 3 flange
- 4 inner core
- 5 5 outer core
- 6 outer peripheral surface
- 7 nonslip groove
- 8 marking (mis-attach preventing means)
- 9 engagement hole (mis-attach preventing means)
- 10 10 carrier tape (strip)
- 11 tape
- 12 pocket (storing cavity)
- 13 sprocket hole (feed hole)

CLAIMS

[Claim 1] A winding core having a cylindrical shape, winding a strip in such a manner that one side of the strip overlaps the side of the wound strip when the strip is traverse wound on a curved peripheral surface, characterized in that

the curved peripheral surface is inclined radially outwards as the peripheral surface goes from one end to the other end, an inclination θ of the peripheral surface is based on $0 < \theta \leq 2 \arctan [\text{thickness of the strip} / \text{traverse pitch}]$,

the winding core has the peripheral surface inclining radially outwards as the peripheral surface goes from the one end to the other end along a axial direction,

a diameter of the one end of the winding core is smaller than a diameter of the other end,

a strip is wound on the winding core in an overlap winding from the one end having the small diameter to the other end having the large diameter while the strip is wound on the winding core in an ordinary winding, in which the strip is wound side by side without overlapping, from the other end to the one end, and

the overlapping winding and the ordinary winding are repeated alternately.

[Claim 2] The winding core according to Claim 1, further comprising: flanges on end faces; and a mis-attachment preventing means arranged at least one of the flanges and the

curved peripheral surface.

[Claim 3] The winding core according to Claim 1, wherein nonslip strip grooves formed on the peripheral surface in a circumferential direction are arranged from one side end to the other.

[Claim 4] The winding core according to Claim 1 further comprising an inner core and a cylindrical outer core fitted on the inner core, the outer peripheral surface of the outer core being inclined radially outwards.

[Claim 5] A winding reel characterized in that when a strip is traverse wound on the winding core according to any one of Claims 1 through 4, the strip is adapted to be wound so that one side of the strip overlaps the side of the wound strip.

[Claim 6] The winding reel according to Claim 5, wherein the strip is a carrier tape comprising: a long tape; a plurality of storing cavities arrayed and formed at intervals in the longitudinal direction of the tape; and a plurality of feed holes placed at intervals along at least one longitudinal side of the tape.

[Claim 7] A strip winding method of traverse winding a strip on the winding core according to any one of Claims 1 through

4, comprising the steps of:

winding the strip in such a manner that one side of the strip overlaps the other side of the wound strip; and

winding the strip without laying one side of the strip over the other side of the wound strip,

the above steps being repeated alternately.