

DESCRIPTION

Title of Invention

CARRIER TAPE

5

Technical Field

[0001]

The present invention relates to a carrier tape. Priority is claimed on Japanese Patent Application No. 2016-135298, filed July 7, 2016, the content of which is

10 incorporated herein by reference.

Background Art

[0002]

Carrier tapes, in which recessed storage portions for storing products such as electronic components are provided at regular intervals, are widely used when the

15 electronic components and the like are kept, transported, and mounted.

After products are stored in storage portions, a carrier tape is sealed with a cover tape and is used by being wound around reels having various sizes (PTL 1).

Before products are stored in the storage portions, a carrier tape is present in a state of being wound around the reel. At this time, since the wound carrier tape is in a

20 state where the carrier tapes overlap each other, the storage portions of the upper carrier tape overlap and are fitted to the storage portions of the lower carrier tape, thereby resulting in a problem that the storage portions of the lower carrier tape are widened and deformed.

Citation List

25 Patent Literature

[0003]

[PTL 1] Japanese Unexamined Patent Application, First Publication No.
2011-225257

Summary of Invention

5 Technical Problem

[0004]

The present invention has been made in consideration of the foregoing
circumstances, and an object thereof is to provide a carrier tape in which storage portions
of the carrier tape wound around a reel are unlikely to be fitted to each other and
10 deformation of the storage portions is minimized.

Solution to Problem

[0005]

In order to realize the object described above, the present invention employs the
following configurations.

15 [1] A carrier tape which is a sheet, including a flat portion, and a recessed
storage portion that is formed in the flat portion, in which an area of a rear surface of the
storage portion corresponds to a size of 90% or larger of an area of an opening portion of
the storage portion.

[2] The carrier tape according to [1], in which a radius of curvature of an
20 opening peripheral edge portion of the storage portion is half or smaller of a thickness of
the sheet of the flat portion.

[3] The carrier tape according to [1] or [2], in which a thickness of the sheet in a
part forming a bottom surface of the storage portion is smaller than a thickness of the
sheet of the flat portion.

25 [4] The carrier tape according to any one of [1] to [3], in which a difference

obtained by subtracting a thickness of the sheet in a part forming a side portion of the storage portion from a thickness of the sheet in the part forming the bottom surface of the storage portion is a value smaller than 0.05 mm.

[5] The carrier tape according to [1] to [4] further including a groove portion
5 that is provided between a side portion of the storage portion and the flat portion, on a rear side of the sheet.

Advantageous Effects of Invention

[0006]

According to the carrier tape of the present invention, the storage portions of the
10 carrier tape wound around a reel are unlikely to be fitted to each other and deformation of the storage portions is minimized.

Brief Description of Drawings

[0007]

FIG. 1A is a plan view of a carrier tape according to a first embodiment of the
15 present invention.

FIG. 1B is a cross-sectional view taken along X1-X1 in FIG. 1A.

FIG. 1C is a cross-sectional view taken along Y1-Y1 in FIG. 1A.

FIG. 2A is a plan view of a carrier tape according to a second embodiment of the
present invention.

20 FIG. 2B is a cross-sectional view taken along X2-X2 in FIG. 2A.

FIG. 2C is a cross-sectional view taken along Y2-Y2 in FIG. 2A.

FIG. 3A is a part of a cross-sectional view illustrating an example of a
manufacturing apparatus for the carrier tape according to the first embodiment of the
present invention.

25 FIG. 3B is a plan view of a second die of the manufacturing apparatus in FIG.

3A.

FIG. 4A is an example of the carrier tape of the present invention before a bottom portion of a storage portion is pressed.

FIG. 4B is an example of the carrier tape of the present invention.

5 FIG. 5A is a part of a cross-sectional view illustrating an example of a manufacturing apparatus for the carrier tape according to the second embodiment of the present invention.

FIG. 5B is a plan view of a second die of the manufacturing apparatus in FIG.

5A.

10 FIG. 5C is a cross-sectional view taken along X3-X3 in FIG. 5B.

FIG. 5D is a cross-sectional view taken along Y3-Y3 in FIG. 5B.

Description of Embodiments

[0008]

(Carrier tape)

15 A carrier tape of a first embodiment of the present invention will be described below with reference to the drawings.

As illustrated in FIGS. 1A to 1C, a carrier tape 10 has a plurality of recessed storage portions 2 which are open on one surface (which will also be referred to as a front surface) of an elongated sheet 1. In the sheet 1, the plurality of storage portions 2 are arranged in a length direction of the sheet 1 such that they are separated from each other. In addition to the length direction of the sheet 1, the plurality of storage portions 2 may also be arranged in a width direction such that they are separated from each other (not illustrated). In addition, in the sheet 1, a plurality of sprocket holes (feeding holes) 4 are arranged between the storage portions 2 and a side edge of the sheet 1 in the length direction of the sheet 1 such that they are separated from each other. In the sheet 1, a

20

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part other than parts forming the storage portions 2 and the sprocket holes 4 will be referred to as a flat portion 3. The front surface and a rear surface of the flat portion 3 are flat surfaces.

[0009]

5 For example, the length of the sheet 1 forming the carrier tape 10 can range from 1 m to 4,000 m. For example, the width of the sheet 1 can range from 4 mm to 12 mm. The length direction and the width direction of the sheet 1 are orthogonal to each other.

For example, the interval between the adjacent storage portions 2 arranged in the length direction of the sheet 1 such that they are separated from each other can range
10 from 0.1 mm to 8 mm. For example, the interval between the adjacent sprocket holes 4 can range from 2 mm to 4 mm.

[0010]

The storage portion 2 is a recessed depression open on the front surface side of the sheet 1. In the storage portion 2, a bottom portion bulges on the other surface
15 (which will also be referred to as a rear surface) of the sheet 1.

The rear surface in a part of the sheet 1 constituting the bottom portion of the storage portion 2 will be referred to as an outer bottom surface 6, and the rear surface in a part of the sheet 1 constituting a side portion of the storage portion 2 will be referred to as an outer surface 7. The outer surface 7 includes a curved surface adjacent to the rear
20 surface of the sheet 1 in a part constituting the flat portion 3, and a curved surface adjacent to the outer bottom surface 6. The outer bottom surface 6 is a flat surface.

The area of the rear surface (which will hereinafter be referred to as a rear bottom surface area A) of the storage portion 2 indicates the area of the outer bottom surface 6. The rear bottom surface area A corresponds to the product of a width W1 of
25 the outer bottom surface 6 and a length L1 of the outer bottom surface 6. Here, the

width W1 of the outer bottom surface 6 is a length along a longitudinal direction of the sheet 1, and the length L1 of the outer bottom surface 6 is a length along the width direction of the sheet 1.

The front surface in the part of the sheet 1 constituting the bottom portion of the storage portion 2 will be referred to as an inner bottom surface 8, and the front surface in the part of the sheet 1 constituting the side portion of the storage portion 2 will be referred to as an inner surface 9. The inner surface 9 includes a curved surface adjacent to the front surface of the sheet 1 in the part constituting the flat portion 3, and a curved surface adjacent to the inner bottom surface 8. The inner bottom surface 8 is a flat surface.

A part on the rear surface of the sheet 1, in which the outer surface 7 of the storage portion 2 stands, will be referred to as an outer peripheral edge 11.

[0011]

The curved surface of the inner surface 9 adjacent to the flat surface on the front side of the sheet 1 in the part constituting the flat portion 3 will be referred to as an opening peripheral edge portion 5. A surface surrounded by a border line 5a between the opening peripheral edge portion 5 and the flat surface of the inner surface 9 on the middle side will be referred to as an open surface. The area of the open surface of the storage portion 2 will also be referred to as an area of an opening portion of the storage portion 2 (hereinafter, an opening area B). The opening area B corresponds to the product of a width W2 of the open surface and a length L2 of the open surface. The open surface has a substantially rectangular shape with the width direction of the sheet 1 as a long side and the length direction of the sheet 1 as a short side, in plan view. The width W2 of the open surface is a length along the longitudinal direction of the sheet 1, and the length L2 of the open surface is a length along the width direction of the sheet 1.

[0012]

According to the carrier tape of the present invention, the area of the rear surface of the storage portion 2 corresponds to a size of 90% or larger of the area of the opening portion. The value of the rear bottom surface area A/the opening area B, that is, the ratio of the size of the rear bottom surface area A to the opening area B preferably ranges from 90% to 110% and more preferably ranges from 97% to 103%.

If the value of the rear bottom surface area A/the opening area B is within the range described above, in a case where the carrier tape 10 is wound around a reel, the storage portions 2 are unlikely to be fitted to each other (that is, in two storage portions 2 vertically overlapping each other, the outer bottom surface 6 of the upper storage portion 2 is unlikely to be fitted to the opening portion of the lower storage portion 2).

[0013]

In the carrier tape 10 of the present embodiment, a radius R of curvature of the opening peripheral edge portion 5 is preferably half or smaller of the thickness of the sheet 1 of the flat portion 3 and is more preferably 1/4 or smaller of the thickness of the sheet 1 of the flat portion 3. If the radius R of curvature of the opening peripheral edge portion 5 is within the range described above, in a case where the carrier tape 10 is wound around a reel, the storage portions 2 are unlikely to be fitted to each other.

[0014]

In the carrier tape 10 of the present embodiment, the thickness of the sheet (which will hereinafter be referred to as a thickness of the bottom portion) in the part forming the bottom surface of the storage portion 2 is preferably smaller than the thickness of the sheet 1 of the flat portion 3 (which will hereinafter be referred to as a thickness of the flat portion). The difference obtained by subtracting the thickness of the bottom portion from the thickness of the flat portion, that is, (thickness of flat

portion-thickness of bottom portion) is preferably 0.05 mm or greater, is more preferably 0.10 mm or greater, and is further preferably 0.15 mm or greater. The upper limit for (thickness of flat portion-thickness of bottom portion) is preferably 0.40 mm or smaller, and is more preferably 0.30 mm or smaller.

5 If the difference between the thickness of the bottom portion and the thickness of the flat portion, which serves as a reference, (thickness of flat portion-thickness of bottom portion) is within the range described above, the rear bottom surface area A of the storage portion 2 can be increased as disclosed below in a manufacturing method. Therefore, in a case where the carrier tape 10 is wound around a reel, the storage portions 10 2 are unlikely to be fitted to each other.

[0015]

In the carrier tape 10 of the present embodiment, it is preferable that the thickness of the sheet (which will hereinafter be referred to as a thickness of the side portion) in the part forming the side portion of the storage portion 2 be not extremely 15 thinned compared to the thickness of the bottom portion. The difference obtained by subtracting the thickness of the side portion from the thickness of the bottom portion, that is, (thickness of bottom portion-thickness of side portion) preferably corresponds to a value smaller than 0.05 mm, is more preferably 0 mm or smaller (that is, the thickness of the side portion is the same as the thickness of the bottom portion or is greater than the 20 thickness of the bottom portion), and is further preferably -0.05 mm or smaller (that is, the thickness of the side portion is greater than the thickness of the bottom portion exceeding 0.05 mm).

If (thickness of bottom portion-thickness of side portion) is within the range described above, the radius R of curvature of the opening peripheral edge portion 5 can 25 be reduced as disclosed below in the manufacturing method. Therefore, in a case where

the carrier tape 10 is wound around a reel, the storage portions 2 are unlikely to be fitted to each other.

For example, the lower limit for (thickness of bottom portion-thickness of side portion) is approximately -0.30 mm.

5 [0016]

A carrier tape of a second embodiment of the present invention will be described below with reference to the drawings.

As illustrated in FIGS. 2A to 2C, a carrier tape 20 is similar to the carrier tape 10 except for having groove portions 12. The groove portions 12 are depressions which
10 are present between the side portion of the storage portion 2 and the flat portion 3, on the rear side of the sheet 1. The groove portions 12 include two first groove portions 12a and two second groove portions 12b.

The first groove portions 12a extend in the width direction of the sheet 1 at the outer peripheral edge 11 of the storage portion 2 (that is, a part of the sheet 1 in which the
15 outer surface 7 of the storage portion 2 stands) on the rear surface of the sheet 1. The two first groove portions 12a are formed to face each other with the storage portion 2 interposed therebetween. The second groove portions 12b extend in the length direction of the sheet 1 at the outer peripheral edge 11 of the storage portion 2. The two second groove portions 12b are formed to face each other with the storage portion 2 interposed
20 therebetween. The first groove portions 12a and the second groove portions 12b may be connected to each other at corners of the outer peripheral edge 11 of the storage portion 2 or may be separated from each other.

Due to the groove portions 12 provided along the outer peripheral edge 11 seen from the rear surface of the sheet 1, the radius R of curvature of the opening peripheral
25 edge portion 5 can be reduced as disclosed below in the manufacturing method.

Therefore, in a case where the carrier tape 20 is wound around a reel, the storage portions 2 are unlikely to be fitted to each other.

[0017]

Lengths L10 of the two first groove portions 12a facing each other are preferably the same as each other. In a case where the two lengths L10 are different from each other, the ratio of these lengths preferably ranges from 0.9 to 1.1. Lengths L20 of the two second groove portions 12b facing each other are preferably the same as each other. In a case where the two lengths L20 are different from each other, the ratio of these lengths preferably ranges from 0.9 to 1.1.

When the length of each outer peripheral edge 11 along the length direction of each of the groove portions 12 is 100%, the length of each of the groove portions 12 in plan view seen from the rear surface of the sheet 1 preferably ranges from 50% to 120%, more preferably ranges from 60% to 110%, and further preferably ranges from 70% to 100%. In a case where there is a region in which the first groove portions 12a and the second groove portions 12b overlap each other, the overlapping region is included in the length of each of the groove portions 12.

[0018]

In a case where shape of the storage portion 2 seen in plan view from the rear surface of the sheet 1 is a substantially rectangular shape, the size of the storage portion 2 in the carrier tapes 10 and 20 described above is determined based on the length and the width of the outer peripheral edge 11. From the viewpoint of further exhibiting the effects of the present invention, the storage portion 2 preferably has a size as described below.

The length of the outer peripheral edge 11 along the longitudinal direction of the sheet 1 (that is, the longitudinal direction of the carrier tape 20) preferably ranges from

0.20 mm to 2.00 mm.

The length of the outer peripheral edge 11 along the width direction of the sheet 1 (that is, the width direction of the carrier tape 20) preferably ranges from 0.50 mm to 3.00 mm.

5 The length of the outer peripheral edge 11 along the longitudinal direction of the sheet 1 is preferably shorter than the length of the outer peripheral edge 11 along the width direction of the sheet 1.

Examples of a specific size of the storage portion 2 include a size in which the length of the outer peripheral edge 11 along the width direction of the sheet 1 ranges
10 from 0.30 mm to 0.60 mm and the length of the outer peripheral edge 11 along the longitudinal direction of the sheet 1 ranges from 0.15 mm to smaller than 0.45 mm.

[0019]

The thickness of the sheet of the flat portion of the carrier tape of the present invention is the average value of the thicknesses of the sheet of the flat portion measured
15 at five places using a micro-gauge.

Hereinafter, a cross section of the carrier tape observed by using a microscope and a cross section of the carrier tape including a part measured by using an optical microscope measuring instrument are considered to be a cross section including a part in the vicinity of the center of the opening portion of the storage portion.

20 The thickness of the sheet in the part forming the bottom surface of the storage portion is the average value obtained by measuring the thickness in the vicinity of the center on the bottom surface of the storage portion on the cross section observed by using a microscope, in any selected five storage portions. The thickness of the sheet in the part forming the side portion of the storage portion is the average value obtained by
25 measuring the thickness in the vicinity of the center of any selected side portion of the

storage portion on the cross section observed by using a microscope, in any selected five storage portions.

[0020]

The width (refer to W1 in FIG. 1B) of the outer bottom surface of the storage
5 portion of the carrier tape of the present invention is the average value obtained by using
an optical microscope measuring instrument set to have a magnification of 100, and
measuring the length (the length along the longitudinal direction of the carrier tape) of
the flat portion (excluding a curved portion leading to the outer surface 7) at the center on
the outer bottom surface, in any selected five storage portions. Similarly, the length
10 (refer to L1 in FIG. 1C) of the outer bottom surface is the average value obtained by
measuring the length (the length along the width direction of the carrier tape) of the flat
portion at the center on the outer bottom surface, in any selected five storage portions.

[0021]

As the width (refer to W2 in FIG. 1B) of the open surface in the storage portion
15 of the carrier tape of the present invention, the average value obtained by using an optical
microscope measuring instrument set to have a magnification of 100, and measuring the
length at the center on the open surface (the diameter length between 5a to 5a in FIG. 1B)
in the longitudinal direction of the carrier tape, in any selected five storage portions is
considered to be the width of the open surface. Here, 5a in FIG. 1B is on the border
20 between the inner surface 9 and the curved opening peripheral edge portion 5.

Similarly, as the length (refer to L2 in FIG. 1C) of the open surface in the storage
portion, the average value obtained by using an optical microscope measuring instrument
set to have a magnification of 100, and measuring the length at the center on the open
surface (the diameter length between 5a to 5a in FIG. 1C) in the width direction of the
25 carrier tape, in any selected five storage portions is considered to be the length of the

open surface. Here, 5a in FIG. 1C is on the border between the inner surface 9 and the curved opening peripheral edge portion 5.

[0022]

The radius of curvature (refer to R in FIG. 1B) of the opening peripheral edge
5 portion in the storage portion of the carrier tape of the present invention is obtained as follows. First, the opening peripheral edge portion in a cross section in the longitudinal direction of the carrier tape is observed by using a microscope which can measure an image having resolution of 1 μm or smaller and is set to have a magnification of 300. Next, the radius of curvature is calculated from any selected three coordinates on the
10 contour (on the line R) of the opening peripheral edge portion. In the present invention, the radius of curvature of the opening peripheral edge portion is the average value of the radii of curvature in any selected five storage portions.

[0023]

The length of the groove portion of the carrier tape of the present invention is
15 the average value obtained by using an optical microscope measuring instrument set to have a magnification of 100, observing the groove portion from the rear surface of the carrier tape in plan view, and measuring any selected five groove portions of the groove portions. The length of each side of the storage portion formed in the carrier tape of the present invention is the average value obtained by using an optical microscope measuring
20 instrument set to have a magnification of 100, observing the outer peripheral edge from the rear surface of the carrier tape, and measuring the length of any selected five sides of the sides.

[0024]

(Manufacturing method of carrier tape)

25 The carrier tape of the present invention can be manufactured by pinch-pressing

a sheet using a first die and a second die and forming storage portions.

As an example of the manufacturing method for the carrier tape of the first embodiment of the present invention, a case of manufacturing a carrier tape using a manufacturing apparatus 100 in FIGS. 3A to 3B will be described.

5 In FIGS. 3A to 3B, the manufacturing apparatus 100 has a first die 110 and a second die 120. First, the first die 110 and the second die 120 are disposed in a state where a pinch-pressing surface 111 of the first die 110 and a pinch-pressing surface 121 of the second die 120 face each other such that they are separated from each other, as illustrated in FIG. 3A. The sheet 1 which had been heated to any selected temperature
10 and had been softened was fed to a position between the pinch-pressing surface 111 and the pinch-pressing surface 121.

Next, a drawing punch 112 was caused to protrude through a punch hole 113 such that the drawing punch 112 was inserted into a punch-receiving hole 122. The protruding drawing punch 112 pressed the sheet 1 into the punch-receiving hole 122 in a
15 state where its punch end surface 114 abutted the sheet 1. The pressed sheet 1 was stretched inside the punch-receiving hole 122, and thus the storage portion 2 was formed.

In the obtained sheet 1, the thickness of the bottom portion and the thickness of the flat portion of the storage portion 2 are substantially the same as each other, as in FIG. 4A. Here, if a part of the sheet forming the bottom portion of the storage portion 2 is
20 pressed upward, the rear surface of the storage portion 2 is widened as in FIG. 4B, and thus a carrier tape having the rear bottom surface area corresponding to 90% or larger of the opening area is obtained. In addition, at this time, a carrier tape having a thickness of the bottom portion smaller than the thickness of the flat portion is obtained. In
25 addition, a carrier tape in which (thickness of bottom portion-thickness of side portion) is smaller than 0.05 mm is obtained. As a result, the radius R of curvature of the opening

peripheral edge portion 5 of the storage portion 2 is reduced.

[0025]

Examples of a method of pressing the outer bottom surface 6 of the sheet 1 in FIG. 4A upward inside the punch-receiving hole 122 include the following method,
5 which is a method of pushing the bottom surface of the punch-receiving hole 122 upward to the outer bottom surface 6 of the sheet 1, in a state where the drawing punch 112 is present inside the formed storage portion 2 and the drawing punch 112 is pushing the inner bottom surface 8 of the storage portion 2. In this manner, the thickness of the bottom portion, the thickness of the side portion, and the radius of curvature of the
10 opening peripheral edge portion can be adjusted by pinching the bottom surface of the storage portion 2 of the sheet 1 between the drawing punch 112 and the bottom surface of the punch-receiving hole 122, and flattening the bottom surface of the storage portion 2.

[0026]

As an example of the manufacturing method for the carrier tape of the second
15 embodiment of the present invention, a case of manufacturing a carrier tape using a manufacturing apparatus 200 in FIGS. 5A to 5D will be described.

In FIG. 5A, the manufacturing apparatus 200 has the first die 110 and a second die 220. The manufacturing method for the carrier tape of the second embodiment of the present invention is similar to the manufacturing method for the carrier tape of the
20 first embodiment except for using the second die 220 having a projection portion (which will also be referred to as a rib), in place of the second die 120 in FIG. 3.

The second die 120 has a first rib 223 and a second rib 224. The drawing punch 112 is caused to protrude, so that when the sheet 1 is pressed into a punch-receiving hole 222, the first rib 223 formed on a pinch-pressing surface 221
25 compresses the sheet 1 to form the first groove portions 12a, and the second rib 224

compresses the sheet 1 to form the second groove portions 12b. At this time, the sheet 1 is firmly clamped by the first rib 223 and the second rib 224. Therefore, the sheet 1 is not misaligned toward the punch-receiving hole 222 and is sufficiently stretched. As a result, the radius R of curvature of the opening peripheral edge portion 5 of the storage portion 2 is reduced.

[0027]

As a high-molecular-weight polymer material constituting the sheet 1 which can be applied to the manufacturing method described above, a high-molecular-weight polymer material of a resin sheet used for press working in the related art can be used. Examples thereof include polyethylene terephthalate, polystyrene, polypropylene, polycarbonate, polyimide, and polyetherimide. Among these, it is preferable to use a polystyrene-based resin in which the amount of a styrene monomer unit with respect to the whole monomer constituent unit of the high-molecular-weight polymer ranges from 50 mol% to 100 mol%. As a monomer other than a styrene monomer, a known monomer which can be copolymerized with styrene can be applied.

Examples

[0028]

Hereinafter, the present invention will be described in detail based on Examples. However, the present invention is not limited to the following disclosures.

(Evaluation of deformation of storage portion)

Whether or not the storage portions of the carrier tape were unlikely to be fitted to each other and deformation of the storage portions was minimized when being wound around a reel was evaluated while having the following deformation rate of the storage portion as an index.

A carrier tape was wound around a reel, and the deformation rate of the storage

portion was calculated by the following expression based on the opening area B before being wound and an opening area B' after being wound. The opening area B' after being wound was measured by feeding the wound carrier tape from the reel and using the method described above.

- 5 Deformation rate of storage portion (%)=[(opening area B'-opening area B)/opening area B]×100

The calculated deformation rate of the storage portion indicates that if the absolute value was closer to 0%, the storage portions were less likely to be fitted to each other and less deformation was likely to be caused.

- 10 [0029]

- Dies similar to those of the manufacturing apparatus 100 in FIGS. 3A to 3B were used, and storage portions were provided in a polystyrene-based resin sheet having a thickness of 0.2 mm. The bottom portions of the storage portions were pressed to obtain a carrier tape similar to the carrier tape 10 illustrated in FIGS. 1A to 1C. Table 1
15 shows details of the shape of the formed storage portion 2.

A second die similar to that illustrated in FIGS. 3A to 3B was used with the following specification.

Punch end surface of drawing punch: 0.4 mm for long side, and 0.2 mm for short side

- 20 Receiving hole opening portion: 0.5 mm for long side, and 0.3 mm for short side
Extrusion depth: 0.3 mm

The obtained carrier tape was wound around a reel, and deformation of the storage portions before and after being wound was evaluated. Table 1 shows the results.

[0030]

[Table 1]

	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Example 9	Example 10	Example 11	Example 12
Rear bottom surface area A (mm ²)	0.126	0.128	0.126	0.127	0.127	0.127	0.126	0.128	0.128	0.128	0.127	0.126
Opening area B (mm ²)	0.139	0.139	0.137	0.135	0.134	0.140	0.135	0.133	0.133	0.126	0.127	0.129
Rear bottom surface area A/opening area B	90.6%	92.1%	92.3%	93.7%	94.9%	90.4%	93.1%	95.9%	95.9%	102.1%	99.9%	97.5%
Thickness of bottom portion (mm)	0.150	0.100	0.200	0.150	0.100	0.250	0.200	0.150	0.100	0.150	0.100	0.200
Thickness of flat portion (mm)	0.200	0.200	0.250	0.250	0.250	0.300	0.300	0.300	0.300	0.200	0.200	0.250
Thickness of side portion (mm)	0.107	0.124	0.167	0.154	0.175	0.227	0.248	0.275	0.306	0.113	0.147	0.182
Thickness of flat portion-thickness of bottom portion (mm)	0.050	0.100	0.050	0.100	0.150	0.050	0.100	0.150	0.200	0.050	0.100	0.050
Thickness of bottom portion-thickness of side portion (mm)	0.043	-0.024	0.033	-0.004	-0.075	0.023	-0.048	-0.125	-0.206	0.037	-0.047	0.018
Radius of curvature of opening peripheral edge portion (R μ m)	88	78	112	101	84	136	124	109	91	45	28	76
Deformation rate (%)	10.4%	8.6%	8.3%	6.7%	5.4%	10.6%	7.4%	4.3%	4.3%	-2.1%	0.1%	2.5%

[0031]

[Examples 2 to 9 and Comparative Examples 1 to 3]

The carrier tapes shown in Table 1 were obtained in a manner similar to that of Example 1 except for changing the thickness of the sheet and/or the thickness of the bottom portion to be used. Tables 1 and 2 show the details of the shape of the storage
 5 portion and the calculated results of the deformation rate of the storage portion.

[0032]

[Example 10]

Dies similar to those of the manufacturing apparatus 200 in FIGS. 5A to 5D
 10 were used, and storage portions were provided in a polystyrene-based resin sheet having a thickness of 0.2 mm. The bottom portions of the storage portions were pressed to obtain a carrier tape similar to the carrier tape 20 illustrated in FIGS. 2A to 2C. Table 2 shows details of the shape of the storage portion.

A second die similar to that illustrated in FIGS. 5A to 5D was used with the
 15 following specification.

Punch end surface of the drawing punch: 0.4 mm for long side, and 0.2 mm for short side

Receiving hole opening portion: 0.5 mm for long side, and 0.3 mm for short side

Extrusion depth: 0.3 mm

20 Length l1 of first rib: 0.27 mm

Width w1 of first rib: 0.1 mm

Height h1 of first rib: 0.1 mm

Length l2 of second rib: 0.13 mm

Width w2 of second rib: 0.1 mm

25 Height h2 of second rib: 0.1 mm

The obtained carrier tape was wound around a reel, and deformation of the storage portions before and after being wound was evaluated. Table 1 shows the results.

[0033]

[Table 2]

	Example 13	Example 14	Example 15	Example 16	Example 17	Example 18	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4	Comparative Example 5	Comparative Example 6
Rear bottom surface area A (mm ²)	0.128	0.127	0.127	0.126	0.128	0.128	0.126	0.128	0.127	0.126	0.127	0.126
Opening area B (mm ²)	0.127	0.128	0.128	0.128	0.128	0.128	0.159	0.154	0.148	0.151	0.148	0.143
Rear bottom surface area A/opening area B	100.1%	99.4%	99.4%	98.8%	99.7%	100.4%	79.1%	82.9%	85.9%	83.8%	85.9%	87.9%
Thickness of bottom portion (mm)	0.150	0.100	0.250	0.200	0.150	0.100	0.200	0.250	0.300	0.200	0.250	0.300
Thickness of flat portion (mm)	0.250	0.250	0.300	0.300	0.300	0.300	0.200	0.250	0.300	0.200	0.250	0.300
Thickness of side portion (mm)	0.205	0.227	0.316	0.337	0.351	0.392	0.064	0.136	0.189	0.089	0.143	0.193
Thickness of flat portion-thickness of bottom portion (mm)	0.100	0.150	0.050	0.100	0.150	0.200	0.000	0.000	0.000	0.000	0.000	0.000
Thickness of bottom portion-thickness of side portion (mm)	-0.055	-0.127	-0.066	-0.137	-0.201	-0.292	0.136	0.114	0.111	0.111	0.107	0.107
Radius of curvature of opening peripheral edge portion (R _{μm})	45	32	108	84	61	40	150	193	223	111	135	167
Deformation rate (%)	-0.1%	0.6%	0.6%	1.2%	0.3%	-0.4%	26.5%	20.7%	16.4%	19.4%	16.4%	13.8%

[0034]

[Examples 11 to 18 and Comparative Examples 4 to 6]

The carrier tapes shown in Tables 1 and 2 were obtained in a manner similar to that of Example 10 except for changing the thickness of the sheet and/or the thickness of the bottom portion to be used. Tables 1 and 2 show the details of the shape of the storage portion and the calculated results of the deformation rate of the storage portion.

[0035]

As confirmed through Examples 1 to 18, in a case where the rear bottom surface area A had a size of 90% or larger of the opening area B, the deformation rate of the storage portion was reduced. As confirmed through Examples 1 to 18, in a case where the radius of curvature of the opening peripheral edge portion was half or smaller of the thickness of the sheet of the flat portion, the deformation rate of the storage portion was reduced. In addition, as confirmed through Examples 1 to 18, in a case where the thickness of the bottom portion was smaller than the thickness of the flat portion, the deformation rate of the storage portion was reduced. As confirmed through Examples 1 to 18, in a case where the difference obtained by subtracting the thickness of the side portion from the thickness of the bottom portion became a value smaller than 0.05 mm, the deformation rate of the storage portion was reduced.

Industrial Applicability

[0036]

A carrier tape of the present invention is a carrier tape in which storage portions of the carrier tape wound around a reel are unlikely to be fitted to each other and deformation of the storage portions is minimized. Therefore, in the carrier tape of the present invention, electronic components can be suitably loaded, unloaded, and stored so that the carrier tape can be favorably utilized.

Reference Signs List

		[0037]
	10	carrier tape
	20	carrier tape
5	1	sheet
	2	storage portion
	3	flat portion
	4	sprocket hole
	5	opening peripheral edge portion
10	5a	border line
	6	outer bottom surface
	7	outer surface
	8	inner bottom surface
	9	inner surface
15	11	outer peripheral edge
	12	groove portion
	12a	first groove portion
	12b	second groove portion
	100	manufacturing apparatus
20	110	first die
	111	pinch-pressing surface
	112	drawing punch
	113	punch hole
	114	punch end surface
25	120	second die

	121	pinch-pressing surface
	122	punch-receiving hole
	200	manufacturing apparatus
	220	second die
5	221	pinch-pressing surface
	222	punch-receiving hole
	223	first rib
	224	second rib

CLAIMS

1. A carrier tape which is a sheet, comprising:
a flat portion; and
5 a recessed storage portion that is formed in the flat portion,
wherein an area of a rear surface of the storage portion corresponds to a size of
90% or larger of an area of an opening portion of the storage portion.
2. The carrier tape according to Claim 1,
10 wherein a radius of curvature of an opening peripheral edge portion of the
storage portion is half or smaller of a thickness of the sheet of the flat portion.
3. The carrier tape according to Claim 1 or 2,
wherein a thickness of the sheet in a part forming a bottom surface of the storage
15 portion is smaller than a thickness of the sheet of the flat portion.
4. The carrier tape according to any one of Claims 1 to 3,
wherein a difference obtained by subtracting a thickness of the sheet in a part
forming a side portion of the storage portion from a thickness of the sheet in the part
20 forming the bottom surface of the storage portion is a value smaller than 0.05 mm.
5. The carrier tape according to any one of Claims 1 to 4, further comprising:
a groove portion that is provided between a side portion of the storage portion
and the flat portion, on a rear side of the sheet.