

DESCRIPTION

SIMPLE-STRUCTURED REEL, HALF BODY OF REEL, AND MANUFACTURING METHOD OF HALF BODY

Technical Field

[0001]

The present invention relates to a simple-structured reel molded from a thin-plastic sheet for a chip carrier tape of electronic components, a half body of the reel, and a technique related to reinforcing a periphery of an axial hole of the reel.

Background Art

[0002]

The carrier tape reel for conveying electronic components are injection molded of aluminum or plastic. Such materials are typically costly, and manufacturing costs of the reels is also high. Although the use of cardboard as a material for the reel has been contemplated to restrict costs, there is a worry that dust of cardboard may adversely affect the electronic components. Such known reels are carried as a completed product into a plant, and are typically too bulky in transportation and storage.

[0003]

A simple-structured reel sheet-formed of thin plastic

sheet as disclosed in Patent Document 1 is widely used. In accordance with this disclosed technique, semi-finished products of a reel are first produced through sheet forming. The semi-finished product includes a flange having a half-shaft projection at the center thereof. The half-shaft projection is projected as high as about half the width of a tape using vacuum forming. Such semi-finished products are manufactured at low costs. When the semi-finished products are transported or stored, stack height of the products is limited if the products are stacked on top of each other in the same alignment, namely, with one half-shaft projection received in another half-shaft hole. When the reel is produced from the sheet formed products (semi-finished products), a pair of half reel bodies are simply put together with one half-shaft projection bonded to the other half-shaft projection. The reel has thus a reel core between left and right flanges having a length matching the tape width.

[0004]

Strength requirement of the flange of the reel is not so high, but a peripheral portion of the shaft hole where a strong rotary torque acts during tape winding needs to be reinforced by additional plastic to prevent deformation and damage. Such a technique is known (Patent Document 2). Such a reinforced reel is not only more durable than the

reel disclosed in the Patent Document 1, but also low in manufacturing costs in comparison with a reel that is molded of a relatively thick plastic sheet only for reinforcement around the shaft hole.

[0005]

[Patent Document 1] Japanese Unexamined Utility Model Registration Application Publication No. 60-85557

[Patent Document 2] Japanese Unexamined Utility Model Registration Application Publication No. 6-61876

Disclosure of Invention

Problems To Be Solved by the Invention

[0006]

When the half body and reinforcement plate of the reel disclosed in the Patent Document 2 are molded individually, the shaft hole of the same shape is arranged in each of the half body and the reinforcement plate. When the reinforcement plate is rigidly secured to the half body, the shaft holes thereof need to be aligned. The shaft hole of this type of reel is not merely round but in star-shaped or gear-shaped with radially extending notches from round hole to be engaged with rotary shaft keys. When the reinforcement plate is rigidly secured, not only the center axis but also the direction of each notch needs to be aligned. In the manufacturing process of the reel disclosed

in the Patent Document 2, the axes of the shaft holes of the shaft body and the reinforcement plate need to be aligned accurately. Yield of the reel may be lowered by alignment failure of the axes of the shaft holes. To improve the yield, a mechanism for introducing a reinforcement plate into a production line with precision is additionally required and it is difficult to manufacture the reel at low costs. A magazine accommodating a stack of plurality of reinforcement plates may be required as the mechanism to introduce the reinforcement plates. If the reinforcement plate is slightly rotated during the introduction of the reinforcement plate onto the half body, the axes of the shaft holes are misaligned and the rotary shaft cannot be inserted. A plurality of notches are formed around the outer circumference of each reinforcement plate in the known art so that the reinforcement plate may not be rotated easily during the introduction thereof. The magazine includes vertically extending guide bars having the number equal to the number of notches and the shape matching the shape of the notches. When the guide bar engaged with the notch, the reinforcement plate restrains the rotation of the reinforcement plate while the reinforcement plates are introduced one by one.

[0007]

The present invention has been developed in view of the

above-described problem, and it is an object of the present invention to provide a simple-structured reel having a reinforced shaft hole periphery and a half body.

Means for Solving the Problems

[0008]

To achieve the object, the present invention relates to a half body of a simple-structured reel. The half body comprises a flange made of a plastic sheet and having an axial hole and a half shaft projecting in the direction of an axis of the reel around the axial hole by sheet forming. The reel is made of a pair of the half bodies, formed by bonding the half shafts of the half bodies in a face to face fashion and comprises left and right flanges and a reel core between the left and right flanges. The half shaft of the half body comprises a recess in the center thereof, a circular projection surrounding the recess, and a reinforcement plate made of a plastic sheet rigidly secured to the recess. The axial hole is formed by stamping the center of the recess out through the reinforcement plate and the flange at a time subsequent to the securing of the reinforcement plate to the recess. Preferably, the half shaft may include a radially extending recess portion continuously extending from the recess.

[0009]

The simple-structured reel is manufactured by using a

pair of the above half bodies and putting together half bodies with the half shafts bonded to each other in a face to face to fashion.

[0010]

A method of manufacturing the half body of the simple-structured reel, includes a step of projecting from the plastic sheet a circular half shaft with a recess arranged in the center thereof, a reinforcement step of fitting and rigidly securing a reinforcement plate made of a plastic sheet into the recess, a step of punching the flange in the plastic sheet in alignment with the axis of the half shaft, and a step of stamping an axial hole out through the reinforcement plate and the plastic sheet in the center of the recess at a time.

[0011]

In accordance with the method of manufacturing the half body of the reel, the steps of punching and stamping are concurrently performed.

Advantages of the Invention

[0012]

In accordance with the present invention, the axial hole is stamped out in the flange and the reinforcement plate subsequent to the rigid securing of the reinforcement plate on the recess of the half shaft. In each of the half

body and the simple-structure reel, the half shaft and the reinforcement plate are always aligned in axial hole. The half shaft including a radially extending recess portion continuously extending from the recess is divided into a plurality of arc portions. Without reducing mechanical strength, the half shaft is easily sheet formed. Since the recess portion functions as an air passage, the reinforcement plate is smoothly fitted into and rigidly secured to the recess.

[0013]

In the manufacturing method of the half body, the axial hole stamping step is performed subsequent to the reinforcement step of the reinforcement plate to the recess. A production line is thus simplified. Since a production line of the reinforcement plate includes only the punching process of the plastic sheet, the reinforcement plate itself is manufactured at low costs. The punching step of the flange and the axial hole stamping step are integrated into the same punching step. The production line of the half body is even further simplified. As a result, the simple-structure reel is provided at low costs.

Best Mode for Carrying Out the Invention

[0014]

The preferred embodiments of the present invention are

described below with reference to the drawings. Fig. 1 is a perspective view of a half body of a reel in accordance with one embodiment of the present invention. The half body is manufactured of a plastic sheet thinner than 1 mm using a manufacturing method to be described later. The half body includes a projected circular half shaft 3 surrounding a circular recess 2 in the center of a flange 1. A circular reinforcement plate 4 having a diameter matching the diameter of the recess 2 is rigidly secured to the recess 2. An axial hole 5 is stamped out in the center of the recess 2 reinforced by the reinforcement plate 4, namely, stamped out through together the reinforcement plate 4 and the flange 1 in the center of the flange 1 at a time.

[0015]

The elements of the half body of this embodiment are described below. The flange 1 is produced by cutting (punching) a circle from a plastic sheet. A rib 1a having an appropriate shape is formed in the flange 1 to withstand twisting force. Also, a fan-shaped cutout 1b is formed in the flange 1. The cutout 1b serves as a window through which the residual amount of a carrier tape is visibly monitored.

[0016]

The half shaft 3 is projected by sheet forming the plastic sheet in the direction of axis of the reel, for

example, using one of vacuum forming, pneumatic forming, vacuum and pneumatic forming. As described above, the half shaft 3 is formed in a circular shape with surrounding the circular recess 2. The height of the projected half shaft 3 is set to be about half the width of the tape to be wound. In accordance with the present embodiment, the half shaft 3 comprises a group of four circular arc projections 3b defined by four radial recess portions 3a continuously extending from the recess 2. First, the half shaft 3 having such a segment structure is advantageous because the recess portion 3a functioning as a reinforcement rib results in the half shaft 3 mechanically stronger than a mere continuous ring-shaped projection. Second, the half shaft 3 provides an edge in the molding process in comparison with the mere continuous ring-shaped projection. Third, when the reinforcement plate 4 is fitted into the recess 2, the recess portion 3a serves as an air passage, thereby easily and reliably engaging the reinforcement plate 4 tightly with the recess 2.

[0017]

Since the reinforcement plate 4 is manufactured by cutting another plastic sheet taking into consideration the diameter and the shape of the recess 2, the reinforcement plate 4 is rigidly secured to the recess 2 through an appropriate bonding process, for example gluing or welding.

The reinforcement plate 4 has no axial hole prior to the securing, and is a mere circular disk. Even if a mere circular disk as the reinforcement plate 4 may be fitted into the recess 2, such a reinforcement plate can still be fitted into the recess 2. If there is no air passage such as the recess portion 3a in the half shaft 3, a notch is preferably formed on the outer circumference of the circular disk to allow air to pass therethrough during the fitting of the reinforcement plate 4.

[0018]

An axial hole 5 is identical in shape to known ones. In accordance with the present invention, the axial hole 5 is stamped out through the recess 2 and the reinforcement plate 4 at a time, and thus there is no need for a hole alignment procedure which may be required during the fitting of the reinforcement plate in the known art.

[0019]

The half body having the above-referenced structure is handled in the same way as the known half body. By stacking the half bodies with the half shafts 3 aligned in the same direction for transportation or storage, the overall stack height is controlled to be low even if a large number of half bodies is stacked. The half body is a semi-finished product for the reel, and the known method may be used to complete the production of each reel. More specifically, as

shown in Fig. 2, two half bodies are paired, and the half shafts 3 are bonded in a face-to-face fashion. The simple-structure reel having the reel core between the left and right flanges, the reel core having a length matching the width of the tape, is easily produced.

[0020]

Fig. 3 illustrates a procedure of a manufacturing method of the half body of the present invention. In a projection step (a) of projecting the half shaft 3, a thin plastic sheet S is transferred to a sheet forming machine, and softened at a predetermined temperature. The half shaft 3 is then formed into three-dimensional shape in accordance with a mold using one of vacuum forming, pneumatic forming, vacuum and pneumatic forming. The mold is shaped to form the recess 2 in the center of the half shaft 3.

[0021]

A reinforcement step (b) to be performed next includes a fitting step for fitting the separately prepared reinforcement plate 4 into the recess 2 in the half shaft 3 and a securing step for rigidly securing the fitted reinforcement plate 4 to the recess 2. The fitting step includes discharging the reinforcement plates 4 one by one from a magazine M accommodating a large number of reinforcement plates 4. In this fitting step, the reinforcement plate 4 is simply discharged to the recess 2

in a straight direction. In other words, a known mechanism for restricting the rotation of the reinforcement plate 4 is not required. The securing step includes pressing the fitted reinforcement plate 4 on the recess 2 and bonding the pressed reinforcement plate 4 to the recess 2. The reinforcement plate 4 may be rigidly secured to the recess 2 by adhesion or welding. Any other method may be used as long as the reinforcement plate 4 remains fixed to the recess 2.

[0022]

In a punching step (c), the axial hole 5 is stamped at the center of recess 2 through the reinforcement plate 4 and the recess 2 in the flange 1 at a time, and the circular sheet S is cut (punched) into round shape with the axial hole 5 being center position to produce the flange 1. As a result, the half body of the reel is finished. A stamping step of stamping the axial hole 5 and a punching step of the flange 1 are performed at the same time in the single punching step (c). The production line is thus simplified. Optionally, these steps may be performed separately.

Brief Description of the Drawings

[0023]

Fig. 1 is a perspective view of a half body in accordance with one embodiment of the present invention.

Fig. 2 is a front view of a simple-structure reel made of a pair of half bodies.

Fig. 3 illustrates a production procedure of the half body in accordance with one embodiment of the present invention.

Reference Numerals

[0024]

- 1 Flange
- 2 Recess
- 3 Half shaft
- 4 Reinforcement plate
- 5 Axial hole

CLAIMS:

1. A method of manufacturing a half body of a simple-structured reel, said half body comprising:

a flange made of a plastic sheet and having an axial hole; and

a half shaft projecting in the direction of an axis of said reel around said axial hole by sheet forming,

wherein said reel is made of a pair of said half bodies, formed by bonding said half shafts of said half bodies in a face to face fashion and comprises left and right flanges and a reel core between said left and right flanges, and

wherein said method comprises:

a step of projecting from the plastic sheet a circular half shaft with a recess arranged in the center thereof;

a reinforcement step of fitting and rigidly securing a reinforcement plate made of a plastic sheet into said recess;

a step of punching said flange in the plastic sheet in alignment with the axis of said half shaft; and

a step of stamping an axial hole out through said

reinforcement plate and the plastic sheet in the center of said recess at a time.

2. The method of manufacturing the half body according to claim 1, wherein said steps of punching and stamping are concurrently performed.