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TITLE OF THE INVENTION

METHOD FOR MANUFACTURING TUBE CONTAINER

BACKGROUND OF THE INVENTION

This invention relates to a method for manufacturing a tube container, and more particularly to a method for forming of resin such as polyethylene terephthalate (hereinafter referred to as "PET"), polyolefin or the like into a tube container.

In general, it is considered that a synthetic resin tube container for packing cosmetics or the like therein desirably exhibits the following characteristics:

(1) Clearness

The tube container which exhibits satisfactory clearness permits contents thereof to be viewed therethrough, so that selling of the goods may be promoted and residues of the contents in the container may be observed.

(2) Barrier characteristics

Permeation of air and/or water vapor through the tube container promotes a deterioration in quality of the contents, thus, it is desired that the container substantially prevents gas from permeating gas therethrough.

(3) Squeezing characteristics

The tube container is generally constructed so as to return to its original configuration by elasticity thereof when it is released from user's fingers after it is securely held between the fingers to squeeze the contents therefrom. However, excessive restoring force of the container causes ambient air to suckedly enter the tube container before it is capped, resulting in the contents being deteriorated.

(4) Recycling characteristics

Disposal of a container, a package or the like has recently caused serious environmental pollution, therefore, the manufacturer is highly requested to develop a tube container which is constructed into a single-layer structure, to thereby be recycled or reused.

Irrespective of the fact that the tube container is extensively asked to exhibit such characteristics as described above, an increase in barrier characteristics requires to employ a laminate structure, to thereby cause clearness of the tube

container to be deteriorated. Also, the tube container is preferably made of PET for the purpose of promoting recycling or reusing thereof. Formation of PET into a container of a bottle-like shape is generally carried out by blow molding. Unfortunately, the blow molding fails to provide the PET container with satisfactory squeezing characteristics. Also, the PET container is hard to permit viscous fluid or contents to be smoothly charged therein through a mouth thereof.

SUMMARY OF THE INVENTION

The present invention has been made in view of the foregoing disadvantage of the prior art.

Accordingly, it is an object of the present invention to provide a method for manufacturing a tube container which is capable of satisfactorily providing a tube container with the above-described characteristics.

It is another object of the present invention to provide a method for manufacturing a tube container which is capable of providing a tube container exhibiting increased squeezing characteristics.

In accordance with the present invention, a method for manufacturing a tube container is provided. The method comprises the steps of subjecting a resin material selected from a group consisting of polyethylene terephthalate, polyolefin and the like to injection molding to form a parison including a mouth and a body, transferring the parison to blow mold and biaxial orientation blowing, to thereby prepare a molded material including the mouth and body, removing the molded material from the blow mold, cutting a bottom of the body of the molded material to charge contents in the molded material, and sealing the bottom of the body of the molded material by welding; wherein the biaxial orientation blowing is carried out in such a manner that the parison is stretched in an axial direction thereof and expanded in a direction perpendicular to said axial direction.

In a preferred embodiment of the present invention, the biaxial orientation blowing is carried out by drawing the parison in an axial direction of a drawing rod by means of the drawing rod and blowing air into the parison to expand the parison in a direction perpendicular to said axial direction.

The biaxial orientation blowing may be executed in such a manner that drawing of the parison in the axial direction of the drawing rod is first carried out, followed by blowing of air into

the parison.

Alternatively, the biaxial orientation blowing may be carried out by blowing air into the parison concurrently with advancing of the drawing rod into the body of the parison.

In a preferred embodiment of the present invention, sealing of the bottom of the body of the molded material is executed by ultrasonic welding. Alternatively, it may be executed by high-frequency welding.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and many of the attendant advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings; wherein

Fig. 1 is a sectional view showing a parison injection-molded;

Fig. 2 is a sectional view showing the parison transferred to a blow mold;

Fig. 3 is a sectional view showing the parison into which a drawing rod is inserted;

Fig. 4 is a sectional view showing the parison into which air is blown;

Figs. 5A and 5B are a side elevation view and a front elevation view each showing sites of measurement in an experiment, respectively;

Fig. 6 is a graphical representation showing results of measurement during successive blowing of air into a parison through a mouth of the parison;

Fig. 7 is a graphical representation showing results of measurement during blowing of air into a parison through a bottom of the parison; and

Figs. 8A to 8D are schematic views showing cutting of a bottom of a tube container after molding, charging of contents into the tube container, sealing of the tube container and the tube container finished, respectively.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Now, a method for manufacturing a tube container according to the present invention will be describe hereinafter

with reference to the accompanying drawings.

Referring first to Figs. 1 to 4, a fore part of a method for manufacturing a tube container according to the present invention is illustrated. The fore part basically employs biaxial orientation blowing. First, a parison 1 is formed by injection molding of PET. This results in the parison 1 being provided with a mouth 1a and a body 1b for a container. The mouth 1a is formed with a predetermined size or the same dimensions as that of the tube container to be finished, whereas the body 1b is formed with a shrunk or constricted size.

In the illustrated embodiment, the tube container is made of PET, because it satisfactorily exhibits not only sufficient clearness while being kept reduced in thickness but the above-described characteristics including increased recycling characteristics as seen in a PET bottle. For the same reasons, polyolefin may be effectively substituted for PET for this purpose.

Then, the parison 1 is transferred to a blow mold 3, so that the body 1b is subjected to drawing by means of a drawing rod 4 and blowing air thereinto. More specifically, first the drawing rod 4 is deeply inserted into the body 1b of the parison 1 to sufficiently draw the body 1b in an axial direction of the drawing rod 4 as shown in Fig. 3. Then, air is blown into the body 1b, leading to expansion of the body 1b in a width direction thereof as shown in Fig. 4, resulting in providing a molded material 5.

Thus, first the drawing rod 4 is deeply inserted at a distal end thereof into the body 1b of the parison 1 in the blow mold 3 to draw the parison 1 to a deep position of the blow mold 3 in the axial direction of the drawing rod 4 as shown in Fig. 3 and then air is blown through the distal end of the drawing rod 4 into the body 1b of the parison 1 to expand the parison 1 in a direction perpendicular to the axial direction of the drawing rod 4. Such molding of the body 1b of the parison 1 permits a degree of drawing of the body 1b by the biaxial orientation blowing of the illustrated embodiment to be substantially increased as compared with that by the prior art. Also, it permits the body 1b of the parison 1 to be first drawn to a position in proximity to a distal end or bottom end of the mold 3 to sufficiently

elongate the body 1b in a longitudinal direction thereof and then expanded on a bottom side thereof as indicated at dotted lines in Fig. 4. It was found that such molding of the parison 1 permits a thickness of the body 1b to be increased on a side of the distal end thereof and reduced on a side of the mouth 1a.

The conventional biaxial orientation blowing is adapted to blow air into the parison while advancing the drawing rod 4 into the body 1b of the parison 1. It is known in the art that the prior art or conventional blowing causes the body 1b of the parison 1 to be successively expanded from a side of the mouth 1a, wherein a degree of drawing of the body 1b is limited to a level as low as about 2.5 times. On the contrary, it was found that the biaxial orientation blowing constructed as described above permits it to be substantially increased to a level as high as about 3.2 to 3.8.

Also, the inventor made an experiment in order to determine a difference in thickness of the body 1b between the conventional biaxial orientation blowing and the biaxial orientation blowing of the illustrated embodiment. For this purpose, four samples of each of a first molded material produced by successively blowing air through the mouth 1a into the body 1b as in the prior art and a second molded material obtained by blowing air into the body 1b through a bottom thereof were prepared. The samples each were subjected to measurement of a thickness of portions A, B, C and D thereof shown in Fig. 5B which are defined apart by distances shown in Fig. 5A from the mouth 1a. In Fig. 5B, reference character E indicates a parting line of the blow mold. Results of the measurement on the samples of the first molded material into which air was blown through the mouth 1a were as shown in Fig. 6 and those of the second molded material into which it was blown through the bottom were as shown in Fig. 7. Figs. 6 and 7 clearly reveal that a thickness of the second molded material into which air was blown through the bottom is increased on a side of the bottom and decreased on a side of the mouth 1a as compared with that of the first molded material into which was blown through the mouth 1a.

It is not necessarily required that feed of air to be blown into the body 1b of the parison 1 is carried out through

the distal end of the drawing rod 4. Air may be blown into the body 1b concurrently with advancing of the drawing rod 4 into the body 1 as in the conventional biaxial orientation blowing.

Thereafter, the molded material 5 is removed from the blow mold 3 and then, as shown in Fig. 8A, a bottom end 6 of the molded material 5 is cut by means of a cutter 7, to thereby be open and the mouth 1a is mounted thereon with a cap 8. Then, contents 9 are charged in the body 1b through the open end 6 as shown in Fig. 8B, followed by sealing of the bottom 6 by means of an ultrasonic welding unit 10 as shown in Fig. 8C, resulting in a finished tube container 11 being provided as shown in Fig. 8D. PET generally has a melting point increased to a degree sufficient to be kept from being welded by conventional heat sealing techniques. However, the present invention permits the PET body to be significantly reduced in thickness, to thereby be sufficiently sealed by ultrasonic welding. Also, the present invention permits a thickness of the body 1b to be increased on a side of the bottom as compared with that of the mouth 1a, to thereby prevent a failure in sealing of the bottom by melting of the bottom due to excessive reduction in thickness thereof. Such sealing results in the tube container 11 filled with the contents 9 being finished.

As described above, the illustrated embodiment provides the tube container by forming of PET into the parison 1, subjecting the parison 1 to biaxial orientation blowing to form the molded material 5, cutting the bottom 6 of the body 1b of the molded material 5 to charge contents 9 therein and then sealing the molded material 5, to thereby finish the tube container 11. Such construction of the illustrated embodiment permits the tube container to exhibit not only satisfactory clearness but increased squeezing characteristics, because restoring force thereof is reduced when it is released from user's hands after the contents are squeezed out of the container, resulting in keeping ambient air from entering the container before it is capped. Also, the illustrated embodiment minimizes whitening of the tube container.

Further, biaxial orientation of the parison and therefore the tube container by the illustrated embodiment permits

molecules of the container to be orientated in two directions, to thereby minimize permeation of gas such as oxygen, carbon dioxide or the like through the container, so that the tube container may exhibit increased barrier characteristics irrespective of being constructed into a single-layer structure.

In addition, the illustrated embodiment uses PET of a single layer for manufacturing the tube container, so that the tube container thus obtained may exhibit enhanced recycling characteristics.

In the illustrated embodiment, the biaxial orientation blowing may be so executed that first the parison 1 is oriented in the axial direction of the drawing rod 4 and then air is blown into the parison 1 to expand it in a direction perpendicular to the axial direction. This results in a degree of drawing of the parison 1 being further increased, to thereby reduce a thickness of the parison as compared with direct blowing.

Such a decrease in thickness of the parison due to an increase in degree of drawing of the parison permits ultrasonic welding to be employed for the illustrated embodiment. Also, the biaxial orientation blowing in the illustrated embodiment minimizes or substantially reduces non-uniformity in thickness of the parison thus molded, so that the ultrasonic welding may lead to satisfactory sealing of the parison substantially free of unevenness, as compared with the direct blowing. Furthermore, the body 1b is increased in thickness on a side of the bottom as compared with on a side of the mouth 1a, to thereby keep the bottom of the body 1b from being holed by melting thereof due to an excessive decrease in thickness thereof during sealing, to thereby prevent leakage of the contents from the body.

Thus, it will be noted that the method of the present invention provides an ideal tube container exhibiting the above-described characteristics. Substitution of polyolefin for PET permits the present invention to likewise exhibit substantially the same advantages as described above. Also, sealing of the tube container may be carried out by high-frequency welding.

While a preferred embodiment of the invention has been described with a certain degree of particularity with reference to the drawings, obvious modifications and variations are

possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

Claims

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1. A method for manufacturing a tube container, comprising the steps of:
 - subjecting a resin material selected from a group consisting of polyethylene terephthalate, polyolefin and the like to injection molding to form a parison (1) including a mouth (1a) and a body (1b);
 - transferring the parison (1) to a blow mold (3) and biaxial orientation blowing, to thereby prepare a molded material (5) including said mouth (1a) and body (1b);
 - removing the molded material (5) from the blow mold (3);
 - cutting a bottom (6) of the body (1b) of the molded material (5) to charge contents (9) in the molded material (5); and
 - sealing the bottom of the body (1b) of the molded material (5) by welding;wherein the biaxial orientation blowing is carried out in such a manner that the parison is stretched in an axial direction thereof and expanded in a direction perpendicular to said axial direction.
2. A method as defined in claim 1, wherein the biaxial orientation blowing is carried out by drawing the parison (1) in an axial direction of a drawing rod (4) by means of the drawing rod (4) and blowing air in to the parison (1) to expand the parison (1) in a direction perpendicular to said axial direction.
3. A method as defined in claim 2, wherein drawing of the parison (1) in the axial direction of the drawing rod (4) is first carried out, followed by blowing of air into the parison (1).
4. A method as defined in claim 2, wherein said biaxial orientation blowing is carried out by blowing air into the parison (1) concurrently with advancing of the drawing rod (4) into the body (1b) of the parison (1).
5. A method as defined in any one of claims 1 to 4, wherein sealing of the bottom of the body (1b) of the molded material (5) is executed by ultrasonic welding.
6. A method as defined in any one of claims 1 to 4, wherein sealing of the bottom of the body (1b) of the molded material (5) is executed by high-frequency welding.