

## DESCRIPTION

### TITLE OF THE INVENTION:

SYNTHETIC RESIN CAP AND MOLD AND PRODUCTION METHOD THEREFOR

### TECHNICAL FIELD

[0001]

The present invention relates to a synthetic resin cap and a mold and production method therefor.

### BACKGROUND ART

[0002]

Conventionally, there has been a synthetic resin cap, which has an inside plug having an opening section. In order to secure airtightness of a container until its cap is opened, the opening section of the synthetic resin cap is closed by a detachable piece connected to the opening section through a weakened section (refer to Patent Documents 1 and 2).

### PRIOR ART LITERATURE

#### PATENT LITERATURE

[0003]

Patent Document 1: Japanese patent application

unexamined publication No. 2012-254816.

Patent Document 2: Japanese patent application

unexamined publication No. 2009-196696.

## SUMMARY OF THE INVENTION

[0004]

Usually, the above-described synthetic resin cap is molded by injection molding or the like method using a mold. Because a section of the mold designed to form the weakened section is narrow, the flow of molten resin does not necessarily go through it smoothly. Also, such a cap is formed so that the weakened section annularly surrounds a resin inlet mark which corresponds to the place where a resin inlet of the mold is placed at. (For example, refer to Patent Document 1). By virtue of the formation of such a weakened section, the molten resin flows through a weakened-section-forming section of the mold from inside to outward at high pressure and high fluidity. Accordingly, the flow of the molten resin will fill in the entire mold, including the weakened section.

[0005]

However, even though the weakened section is formed in the above described manner, it is still possible that the weakened section may have pores formed therein if the flow of resin is insufficient. Then, if the weakened section has such pores formed therein, the sealing properties of a container, to which the cap is attached, will deteriorate.

[0006]

This problem prominently emerges in a synthetic resin cap which has a relatively small opening area for pouring out the contents of a container by small amounts (refer to, for

example, Patent Document 2). In such a synthetic resin cap, a resin inlet is located externally of the annular weakened section.

[0007]

Thus, in molding the synthetic resin cap, molten resin charged into the mold from the resin inlet flows in the direction whichever is easier to proceed, while avoiding flowing through the weakened-section-forming section. As a result, in the thus-molded synthetic resin cap, the weakened-section-forming section is insufficiently charged with resin and therefore, the weakened section is prone to have pores formed therein. Notably, if the thickness of the weakened section is increased, the formation of pores can be prevented to a certain extent. However, in this case, the removal of the detachable piece becomes difficult, and thus openability deteriorates.

[0008]

An object of the present invention is to provide a synthetic resin cap that makes it possible to maintain sealing properties without sacrificing opening properties even when the size of an opening area is reduced.

[0009]

The present invention provides a synthetic resin cap molded by use of a mold having a resin inlet, the synthetic resin cap comprising: an opening section and a thin wall section, wherein the opening section and the thin wall section are provided such that a resin inlet mark is

positioned therebetween; the opening section is configured such that a detachable piece is connected to the opening section through a weakened section; and the thin wall section is formed so as to intersect with a radial direction of a virtual circle whose center is located at the resin inlet mark.

[0010]

The thin wall section in the present invention may be formed so as to surround the resin inlet mark. Also, the thin wall section in the present invention may be formed so as to surround the opening section. Also, the thin wall section in the present invention may have a primary thin wall section formed so as to surround the resin inlet mark, and secondary thin wall sections formed such that the opening section is located therebetween. Also, the thin wall section in the present invention may be continuous to the weakened section, and an end portion of the thin wall section may be formed thicker than the weakened section. Also, the opening section in the present invention may have a shape resembling the letter C and may be formed in such a manner so as to surround the resin inlet mark. Also, the thin wall section in the present invention may have an annular shape, a shape resembling the letter C, or a rectilinear shape.

[0011]

The present invention also provides a mold for molding a synthetic resin cap having an opening section to which a detachable piece is connected through a weakened section, the

mold comprising: a resin inlet for charging molten resin into the mold; an opening-section-molding section for molding the opening section at a position located apart from the resin inlet; and a flow-limiting section located opposite the opening-section-molding section with respect to the resin inlet and adapted to limit the flow of the resin, wherein the opening-section-molding section has a weakened-section-forming section.

[0012]

The flow-limiting section in the present invention may be formed so as to surround the resin inlet. Also, the flow-limiting section may be formed so as to surround the opening-section-molding section. Also, the flow-limiting section in the present invention may be continuous to the weakened-section-forming section, and an end portion of the flow-limiting section may be thinner than the weakened-section-forming section. Also, the flow-limiting section may have an annular shape, a shape resembling the letter C, or a rectilinear shape.

[0013]

The present invention also provides a production method for a synthetic resin cap having an opening section to which a detachable piece is connected through a weakened section, comprising: a step of charging molten resin into a mold from a resin inlet; a step of forming the opening section; and a step of limiting the flow of the resin in a direction opposite the opening section with respect to the resin inlet.

The production method can be performed by utilizing the above described mold.

[0014]

According to the present invention, since the thin wall section is configured so as to intersect with a radial direction of a virtual circle, whose center is located at the resin inlet mark, the resin inlet mark is positioned between the thin wall section and the opening section. Therefore, it becomes possible that the molten resin extends well through the weakened section in molding the synthetic resin cap. Thus, according to the present invention, the formation of pores in the weakened section can be prevented without necessitating the increase of the thickness of the weakened section. Thus, the present invention makes it possible to maintain sealing properties of the cap without sacrificing opening properties.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

[FIG. 1] Bottom view showing a first embodiment of the present invention.

[FIG. 2] Plan view showing the first embodiment of the present invention.

[FIG. 3] Sectional view taken along line III—III of FIG. 2.

[FIG. 4] Longitudinal sectional view showing a mold for molding the first embodiment of the present invention.

[FIG. 5] Bottom view showing a second embodiment of the

present invention.

[FIG. 6] Plan view showing the second embodiment of the present invention.

[FIG. 7] Bottom view showing a third embodiment of the present invention.

[FIG. 8] Plan view showing the third embodiment of the present invention.

[FIG. 9] Bottom view showing a fourth embodiment of the present invention.

[FIG. 10] Plan view showing the fourth embodiment of the present invention.

[FIG. 11] Bottom view showing a fifth embodiment of the present invention.

[FIG. 12] Plan view showing the fifth embodiment of the present invention.

[FIG. 13] Bottom view showing a sixth embodiment of the present invention.

[FIG. 14] Plan view showing the sixth embodiment of the present invention.

[FIG. 15] Sectional view taken along line XV—XV of FIG. 14.

#### MODES FOR CARRYING OUT THE INVENTION

[0016]

A first embodiment of the present invention will be described with reference to FIGS. 1 to 4. Embodiments of the present invention are described below while referring to a hinge cap, in which a cap body and an inside plug are

connected by a hinge. However, the present invention is not limited to a hinge cap, but is also applicable to a screw cap, in which a cap body is screwed to an inside plug.

[0017]

First, the constitution of the present embodiment is described. A synthetic resin cap 1 (hereinafter may also be called the cap 1) includes an inside plug 2 and a cap body 4 connected to the inside plug 2 by a hinge 3.

[0018]

The cap body 4 has a top wall 5 and a circumferential wall 6 extending downward from the circumferential edge of the top wall 5. The top wall 5 has, on its inner surface, an inner ring 7 and an outer ring 8 formed concentrically with each other. The circumferential wall 6 is connected to the hinge 3 at a diametrical one end and has a brim 9 formed at the other diametrical end. The circumferential wall 6 has an annular protrusion 10 formed on its inner surface at a lower end where the brim 9 is present.

[0019]

The inside plug 2 has a ceiling wall 11 and an outer tube 12 extending downward from the circumferential edge of the ceiling wall 11. The ceiling wall 11 has an inner tube 13 formed on its bottom surface. A space between the outer tube 12 and the inner tube 13 allows the mouth of a container (not shown) to be fitted therein when the cap 1 is fitted to the container. The ceiling wall 11 has, on its top surface, a tubular wall 14 and a pouring tube 15. The tubular wall 14

is engaged with the annular protrusion 10 when the cap body 4 is closed, and holds the cap 1 while the cap body 4 is closed.

[0020]

The ceiling wall 11 has an opening section 16 formed therein at an eccentric position located radially inward of the pouring tube 15. The ceiling wall 11 has a thin wall section 17A formed therein at an eccentric position located radially inward of the pouring tube 15 and opposite the opening section 16. The opening section 16 and the thin wall section 17A are provided such that a resin inlet mark 27A is positioned therebetween.

[0021]

The opening section 16 is an opening serving as a flow path through which a substance contained in the container is poured out. Initially (before opening), a detachable piece 18 is connected to the edge of the closed opening section 16 of the cap 1 by a weakened section 19 having an approximately pentagonal shape as viewed from bottom. An opening means 20 such as a pull ring is connected to the detachable piece 18 for fracturing the weakened section 19 to thereby detach the detachable piece 18. The weakened section 19 is provided in the form of a score 21 formed in the bottom surface of the ceiling wall 11.

[0022]

The score 21 is provided in such a manner as to be continuous to one end of the opening means for facilitating fracture of the weakened section 19, and a shape thereof is

selected as appropriate. In the present embodiment, the score 21 is in the form of a groove having an approximately V-shaped section.

[0023]

The thin wall section 17A is provided in the form of a groove section 22A. The groove section 22A is formed so as to intersect with a radial direction R of a virtual circle C whose center is located at the resin inlet mark 27A. In the present embodiment, the groove section 22A has a shape resembling the letter C and is composed of an arcuate section 22a formed so as to substantially semicircularly surround the resin inlet mark 27A, and rectilinear sections 22b, 22b extending from respective opposite ends of the arcuate section 22a toward the opening section 16. Preferably, the groove section 22A has a shape having a U-shaped section or an arcuate section, but can have other shapes as appropriate and as needed.

[0024]

The resin inlet mark 27A is where a resin inlet 27 (also called a gate) was positioned when the cap 1 was molded. The resin inlet mark 27A is positioned usually in a central region 2a of the inside plug 2. Notably, in the present invention, the term "mark" is intended to mean "a place where something existed," and it does not matter whether the mark is visibly traceable or not.

[0025]

Next, a mold and a method for molding the present

embodiment will be described. A mold 23 includes a first mold 24 (the first mold 24 is hereinafter called the upper mold 24 for the sake of convenience) and a second mold 25 (the second mold 25 is hereinafter called the lower mold 25 for the sake of convenience). The upper mold 24 and the lower mold 25 are composed of a plurality of cores 26 whose shapes correspond to the shapes of the above-mentioned components. The mold 23 has an inside-plug-molding section 28 for molding the inside plug 2. The inside-plug-molding section 28 has an opening-section-molding section 28a for molding the opening section 16.

[0026]

The lower mold 25 has a core 26a for forming the bottom surface of the ceiling wall 11. The core 26a has a weakened-section-forming section 29 having a protrusion corresponding to the score 21. The upper mold 24 has the resin inlet 27 for charging molten resin into the mold 23. In the present embodiment, the resin inlet 27 is formed in a central region of the inside-plug-molding section 28.

[0027]

A flow-limiting section 30 having a shape corresponding to the groove section 22A is provided opposite the opening-section-molding section 28a (weakened-section-forming section 29) with respect to the resin inlet 27. The flow-limiting section 30 limits the flow of molten resin charged into the mold 23 from the resin inlet 27, by means of narrowing a flow path of the molten resin.

[0028]

Molten resin charged into the mold 23 from the resin inlet 27 flows in such a manner as to radially spread in a radial direction R of the virtual circle C. At this time, since the flow-limiting section 30 is provided so as to intersect with the radial direction R, that is to say, a flowing direction of the molten resin, the flow-limiting section 30 limits the flow of the molten resin in a direction opposite the weakened-section-forming section 29.

[0029]

Therefore, the flow of molten resin is limited substantially in all directions around the resin inlet 17, including a direction toward the weakened-section-forming section 29. Thus, when the molten resin is charged into the mold from the resin inlet 27, the molten resin extends well through the entire space of the mold 23 through the weakened-section-forming section 29 and through the flow-limiting section 30. Thus, the molten resin is reliably charged to the weakened-section-forming section 29. Accordingly, the formation of pores in the weakened section 19 is prevented.

[0030]

Since molten resin is also reliably charged to the flow-limiting section 30, the formation of pores in the groove section 22A is also prevented. Particularly, in the case where the groove section 22A has a U-shaped section or an arcuate section, the formation of pores in the groove section 22A is prevented.

[0031]

A second embodiment of the present invention will be described with reference to FIGS. 5 and 6. The second embodiment differs from the first embodiment in that a groove section 22B is formed annularly so as to surround the resin inlet mark 27A. Structural features similar to those of the first embodiment are denoted by the same reference numerals, and repeated description thereof is omitted.

[0032]

According to the present embodiment, an annular thin wall section 17B (groove section 22B) is formed so as to surround the resin inlet mark 27A. The opening section 16 is provided in the ceiling wall 11 at a position located internally of the groove section 22B. Thus, when the molten resin is charged into the mold 23, the flow of the resin is limited in all directions around the resin inlet 17. Accordingly, similar to the first embodiment, the molten resin is reliably charged to the weakened-section-forming section 29.

[0033]

A third embodiment of the present invention will be described with reference to FIGS. 7 and 8. The third embodiment differs from the first embodiment in that an approximately C-shaped groove section 22C is formed to be continuous to the score 21 so that the weakened section 19 and a thin wall section 17C are provided in such a manner as to surround the resin inlet mark 27A. Structural features

similar to those of the first embodiment are denoted by the same reference numerals, and repeated description thereof is omitted.

[0034]

According to the present embodiment, the weakened section 19 and the substantially C-shaped thin wall section 17C are formed in such a manner as to surround the resin inlet mark 27A. Thus, when the molten resin is charged into the mold 23, the flow of the resin is limited in all directions around the resin inlet 17. Accordingly, similar to the first embodiment, the molten resin is more reliably charged to the weakened-section-forming section 29. In the present embodiment, preferably, at least end portions 17a, 17a of the thin wall section 17C are formed thicker than the weakened section 19. Through employment of such a thickness relation, the fracture of the thin wall section 17C can be prevented, and only the weakened section 19 can be reliably fractured.

[0035]

A fourth embodiment of the present invention will be described with reference to FIGS. 9 and 10. The fourth embodiment differs from the first embodiment in that an approximately C-shaped thin wall section 17D is formed greater than the thin wall section 17A so that the weakened section 19 is positioned internally of the thin wall section 17D. Structural features similar to those of the first embodiment are denoted by the same reference numerals, and

repeated description thereof is omitted.

[0036]

According to the present embodiment, the substantially C-shaped thin wall section 17D (groove section 22D) is formed so as to surround the resin inlet mark 27A and the opening section 16. That is to say, the opening section 16 (weakened section 19) is provided in the ceiling wall 11 at a position located internally of the groove section 22D. Thus, when the molten resin is charged into the mold 23, the flow of the resin is limited substantially in all directions around the resin inlet 17. Accordingly, similar to the first embodiment, the molten resin is reliably charged to the weakened-section-forming section 29.

[0037]

A fifth embodiment of the present invention will be described with reference to FIGS. 11 and 12. The fifth embodiment differs from the first embodiment in that the opening section 16 has a shape resembling the letter C (hereinafter the opening section 16 of the present embodiment is called the opening section 16E, and the weakened section 19 of the opening section 16E is called the weakened section 19E) and that a rectilinear thin wall section 17E is provided.

[0038]

According to the present embodiment, the weakened section 19E is formed in such a manner as to substantially semicircularly surround the resin inlet mark 27A. Also, the substantially rectilinear thin wall section 17E is formed in

the ceiling wall 11 at a position opposite the weakened section 19E. Thus, when molten resin is charged into the mold 23, the flow of the molten resin is limited substantially in all directions around the resin inlet 17. Accordingly, similar to the first embodiment, the molten resin is reliably charged to the weakened-section-forming section 29. In contrast to the other embodiments, a groove section 22E in the present embodiment is provided in the top surface of the ceiling wall 11.

[0039]

A sixth embodiment of the present invention will be described with reference to FIGS. 13 to 15. The sixth embodiment differs from the first embodiment in that a thin wall section 17F is composed of an approximately C-shaped groove section 22F (hereinafter the groove section 22F is called the primary groove section 22F) and secondary groove sections 31, 31 continuous to the respective rectilinear sections 22b, 22b of the primary groove section 22F. Structural features similar to those of the first embodiment are denoted by the same reference numerals, and repeated description thereof is omitted.

[0040]

The thin wall section 17F of the present embodiment has a primary thin wall section 17b formed of the primary groove section 22F, and secondary thin wall sections 17c, 17c formed of the secondary groove sections 31, 31. The secondary groove sections 31, 31 are formed in such a manner as to

extend from respective one ends of the rectilinear sections 22b, 22b of the primary groove section 22F and such that an opening section 16F formed of an approximately pot-like score 21F is located therebetween. In contrast to the other embodiments, the primary groove section 22F and the secondary groove sections 31, 31 have an approximately V-shaped section. The shape of the primary groove section 22F and the secondary groove sections 31, 31 may be modified as appropriate; for example, an approximately U-shaped section may be employed as in the case of the other embodiments. In the present embodiment, the secondary groove sections 31, 31 are formed rectilinearly in parallel with each other; however, the secondary groove sections 31, 31 can be formed in nonparallel with each other.

[0041]

According to the present embodiment, the primary thin wall section 17b is formed in such a manner as to surround the resin inlet mark 27A; additionally, the secondary thin wall sections 17c, 17c continuous to the primary thin wall section 17b are formed such that the opening section 16F is located therebetween. Accordingly, the thin wall section 17F is formed so as to surround the opening section 16F and the resin inlet mark 27A. Thus, when molten resin is charged into the mold 23, the flow of the molten resin is limited in all directions around the resin inlet 17. Accordingly, similar to the first embodiment, the molten resin is more reliably charged to the weakened-section-forming section 29.

[0042]

While the present invention has been described with reference to the embodiments described above, the present invention is not limited thereto, but may be modified as appropriate without departing from the gist of the invention. For example, the shape, size, etc., of the opening section 16 can be modified appropriately as needed. Whether the groove section 22 is formed in the bottom surface of the ceiling wall 11 as in the case of the above first to fourth embodiments or in the top surface of the ceiling wall 11 as in the case of the above fifth embodiment can be selected as appropriate. Also, the shape, size, etc., of the groove section 22 can be modified as appropriate so long as the effect of the present invention is yielded.

#### DESCRIPTION OF REFERENCE NUMERALS

[0043]

- 1: synthetic resin cap
- 2: inside plug
- 2a: central region
- 3: hinge
- 4: cap body
- 5: top wall
- 6: circumferential wall
- 7: inner ring
- 8: outer ring
- 9: brim

10: annular protrusion  
11: ceiling wall  
12: outer tube  
13: inner tube  
14: tubular wall  
15: pouring tube  
16: opening section  
17: thin wall section  
17a: end portion  
17b: primary thin wall section  
17c: secondary thin wall section  
18: detachable piece  
19: weakened section  
20: opening means  
21: score  
22: groove section  
22a: arcuate section  
22b: rectilinear section  
23: mold  
24: upper mold  
25: lower mold  
26: core  
26a: core  
27: resin inlet  
27A: resin inlet mark  
28: inside-plug-molding section  
28a: opening-section-molding section

29: weakened-section-forming section

30: flow-limiting section

31: secondary groove section

C: virtual circle

R: radial direction

## CLAIMS

[Claim 1] A synthetic resin cap molded by use of a mold having a resin inlet, comprising:

an opening section and a thin wall section,

wherein the opening section and the thin wall section are provided such that a resin inlet mark is positioned therebetween;

the opening section is configured such that a detachable piece is connected to the opening section through a weakened section; and

the thin wall section is provided so as to intersect with a radial direction of a virtual circle whose center is located at the resin inlet mark.

[Claim 2] A synthetic resin cap according to claim 1, wherein the thin wall section is formed so as to surround the resin inlet mark.

[Claim 3] A synthetic resin cap according to claim 2, wherein the thin wall section is formed so as to surround the opening section.

[Claim 4] A synthetic resin cap according to claim 3, wherein the thin wall section has a primary thin wall section formed so as to surround the resin inlet mark, and secondary thin wall sections formed such that the opening section is located therebetween.

[Claim 5] A synthetic resin cap according to claim 2, wherein

the thin wall section is continuous to the weakened section, and

an end portion of the thin wall section is formed thicker than the weakened section.

[Claim 6] A synthetic resin cap according to claim 1, wherein the opening section has a shape resembling the letter C and is formed so as to surround the resin inlet mark.

[Claim 7] A synthetic resin cap according to any one of claims 1 to 6, wherein the thin wall section has an annular shape, a shape resembling the letter C, or a rectilinear shape.

[Claim 8] A mold for molding a synthetic resin cap having an opening section to which a detachable piece is connected through a weakened section, comprising:

a resin inlet for charging molten resin into the mold;  
an opening-section-molding section for molding the opening section at a position located apart from the resin inlet; and

a flow-limiting section located opposite the opening-section-molding section with respect to the resin inlet and adapted to limit the flow of the molten resin,

wherein the opening-section-molding section has a weakened-section-forming section.

[Claim 9] A mold according to claim 8, wherein the flow-limiting section is formed so as to surround the resin inlet.

[Claim 10] A mold according to claim 9, wherein the flow-limiting section is formed so as to surround the opening-

section-molding section.

[Claim 11] A mold according to claim 8, wherein

the flow-limiting section is continuous to the weakened-section-forming section, and

an end portion of the flow-limiting section is thinner than the weakened-section-forming section.

[Claim 12] A mold according to any one of claims 8 to 11, wherein the flow-limiting section has an annular shape, a shape resembling the letter C, or a rectilinear shape.

[Claim 13] A production method for a synthetic resin cap having an opening section to which a detachable piece is connected through a weakened section, comprising:

a step of charging molten resin into a mold from a resin inlet;

a step of forming the opening section; and

a step of limiting flow of the molten resin in a direction opposite the opening section with respect to the resin inlet.

[Claim 14] A production method for a synthetic resin cap molded by use of a mold according to claim 8, comprising:

a step of charging molten resin into the mold from the resin inlet;

a step of forming the opening section; and

a step of limiting the flow of the molten resin in a direction opposite the opening section with respect to the resin inlet.