

DESCRIPTION

TITLE OF THE INVENTION: SAFETY CAP

TECHNICAL FIELD

[0001]

The present invention relates to a safety cap with a child-resistant function which has a devised cap structure that makes it difficult for infants etc. to carelessly open the cap.

BACKGROUND ART

[0002]

There is known a safety cap with a child-resistant function which includes an inner cap with a female screw to be mounted on a mouth of a container, an outer cap that is movable in an axial direction relative to the inner cap, and which incorporates a ratchet mechanism between the inner cap and the outer cap (see, for example, Patent Document 1).

[0003]

The safety cap of Patent Document 1 has a plurality of upward ratchet teeth formed on an outer circumference of an upper part of the inner cap and a plurality of downward ratchet pawls formed on a ceiling surface of the outer cap. The ratchet pawls on the outer cap side have a simple flat plate shape. The ratchet teeth on the inner cap side are formed such that their surfaces that make contact with the ratchet pawls on the outer cap side when the safety cap is rotated in a direction in which the safety cap is tightened on the container are perpendicular to main surfaces of the ratchet

pawls and such that their surfaces that make contact with the ratchet pawls on the outer cap side when the safety cap is rotated in a direction in which the safety cap is taken off from the container are inclined.

[0004]

When the outer cap is rotated in the direction in which the safety cap is tightened on the container, the ratchet pawls having a flat plate shape are engaged with the perpendicular surfaces of the ratchet teeth so as to rotate the inner cap together. This allows the female screw of the inner cap to be tightened on a male screw of the container. Meanwhile, when the outer cap is just rotated in the direction in which the safety cap is taken off from the container, the outer cap just spins as the ratchet pawls slip on the inclined surfaces of the ratchet teeth. It is therefore possible to prevent the safety cap from being carelessly taken off. It is necessary to rotate the outer cap while pressing down the outer cap in order to take off the safety cap from the container. Patent Document 1 describes that infants are incapable of executing such an operation correctly, and therefore a child-resistant function can be realized (paragraph 0004).

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0005]

Patent Document 1: JP 4844807 B1

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006]

The conventional safety cap of Patent Document 1 has a following problem. Specifically, a corner of each of the ratchet pawls having a flat plate shape is engaged with one point of an inclined surface of a corresponding ratchet tooth. Accordingly, when a pressing force is accidentally applied to the outer cap, there are cases where a surprisingly large rotational force in an opening direction is applied to the inner cap. In this case, there is a risk of mistakenly opening the cap.

[0007]

The present invention was accomplished in view of the above problems of the conventional safety cap, and an object of the present invention is to provide a safety cap whereby a child-resistant function can be improved.

SOLUTIONS TO THE PROBLEMS

[0008]

The configuration of the present invention is a safety cap comprising: a screw-type inner cap detachably mounted on a mouth of a container; and an outer cap that is combined with the inner cap so as to be rotatable relative to the inner cap, each of the inner cap and the outer cap having a plurality of engaging protuberances, the engaging protuberances of the inner cap and the engaging protuberances of the outer cap being engaged with each other and rotating the inner cap when the outer cap is rotated while being pressed toward the inner cap, each of the engaging protuberances having a vertical part that is engaged when the outer cap is rotated in a closing direction and

an inclined part that is engaged when the outer cap is rotated in an opening direction, and the inclined part having a steeply inclined part that has a steep inclination and a gently inclined part that has a gentler inclination than the steeply inclined part, the steeply inclined part and the gently inclined part being continuous with each other.

[0009]

The inclined part has a convex inclined part that is formed into a convex shape by the steeply inclined part and the gently inclined part in one of the engaging protuberance of the inner cap and the engaging protuberance of the outer cap and a concave inclined part that is formed into a concave shape by the steeply inclined part and the gently inclined part in the other of the engaging protuberance of the inner cap and the engaging protuberance of the outer cap; and the convex inclined part and the concave inclined part may be engageable in close contact with each other. It is preferable that the steeply inclined part has a longer length in a circumferential direction than the gently inclined part.

EFFECT OF THE INVENTION

[0010]

According to a safety cap of the present invention, engaging protuberances of an inner cap and engaging protuberances of an outer cap are engaged with each other via their vertical parts when the outer cap is rotated in a closing direction. Meanwhile, when the outer cap is rotated in an opening direction, the engaging protuberances of the inner cap and the engaging protuberances of the outer cap are engaged with each other via

their inclined parts. This forms a ratchet mechanism that rotates the inner cap in the opening direction. Here, when the outer cap is rotated in the opening direction, the inclined parts of the engaging protuberances slip, and the outer cap receives a force in a direction away from the inner cap and tends to float up from the inner cap. When the outer cap floats up even a little, the gently inclined parts are separated away from each other at once. This extremely reduces a contact area between the inclined parts that are engaged with each other, thereby reducing frictional resistance. Accordingly, the outer cap more easily floats up and it is possible to extremely lower a risk of rotating the inner cap in the opening direction. That is, even in a case where tightening torque at closing is small, the inner cap is not rotated in the opening direction in such a case that an infant etc. rotates the outer cap in the opening direction. It is therefore possible to improve a child-resistant function.

[0011]

Furthermore, according to the safety cap, an inclination of a steeply inclined part and an inclination of a gently inclined part of each of the engaging protuberances of the inner cap are set to the same as an inclination of a steeply inclined part and an inclination of a gently inclined part of each of the engaging protuberances of the outer cap, and a convex inclined part formed into a convex shape on one of the engaging protuberances and a concave inclined part formed into a concave shape on the other of the engaging protuberances can be engaged in close contact with each other.

Furthermore, in the safety cap, the steeply inclined part has a longer length in a circumferential direction than the gently inclined part. This

makes it possible to obtain a sufficient rotational force in a direction in which the inner cap is opened at opening.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1(A) is a longitudinal cross-sectional view of a safety cap according to an embodiment of the present invention. Fig. 1(B) is a cross-sectional view of the safety cap taken along line X-X of Fig. 1(A).

Fig. 2(A) is a front view of the inner cap 10. Fig. 2(B) is a top view of the inner cap 10.

Fig. 3(A) is a longitudinal cross-sectional view of the outer cap. Fig. 3(B) is a bottom view of the outer cap.

Fig. 4 is an enlarged view taken along line Y-Y of Fig. 1(B).

Fig. 5(A) and (B) are an operation explaining view taken along line Y-Y of Fig. 1(B).

Fig. 6 is a view that corresponds to Fig. 1(A) showing another embodiment.

Fig. 7 is a view that corresponds to Fig. 1(A) showing a further another embodiment.

Fig. 8(A) is a top view of the inner cap. Fig. 8(B) is a bottom view of the outer cap.

MODE FOR CARRYING OUT THE INVENTION

[0013]

An embodiment of the present invention is described below with reference to the drawings.

[0014]

A safety cap includes a screw-type inner cap 10 that is detachably mounted on a mouth of a container, and an outer cap 20 that is combined with the inner cap 10 so as to be rotatable relative to the inner cap 10 (see Figs. 1(A) and 1(B)). Fig. 1(A) is a longitudinal cross-sectional view of the safety cap, taken along a central axis C (the one-dot chain line in Fig. 1(A)) common to the inner cap 10 and the outer cap 20. Fig. 1(B) is a cross-sectional view of the safety cap taken along line X-X of Fig. 1(A). It should be noted that the left half of Fig. 1(A) is a cross-sectional view, taken along a position corresponding to an engaging protuberant part 13 of the inner cap 10 in Fig. 1(B), and the right half of Fig. 1(A) is a cross-sectional view, taken along a position corresponding to an engaging protuberant part 23 of the outer cap 20 in Fig. 1(B).

[0015]

As illustrated in Fig. 1(A), the safety cap is used by being mounting detachably on a mouth B1 of a container B that is virtually illustrated (the two-dot chain line in Fig. 1(A)). A male screw B2 is formed on an outer circumference of the mouth B1 of the container B. A nozzle N having a nozzle hole N1 on the central axis C is pressed into the mouth B1.

[0016]

The inner cap 10 has a skirt part 11 that forms a lower part of the inner cap 10, a small-diameter part 12 that forms an upper part of the inner cap 10, and a ceiling part 12a that closes an upper end of the small-diameter

part 12, and the inner cap 10 is formed into a cylindrical shape having a step (an oblique step 11c) (see Figs. 1(A), 1(B), 2(A) and 2(B)).

Fig. 2(A) is a front view of the inner cap 10, and Fig. 2(B) is a top view of the inner cap 10.

[0017]

As illustrated in Fig. 1(A), a female screw 11a that is fitted to the male screw B2 on the container B side is formed on an inner surface of the skirt part 11. An annular rib 11b is formed on a lower part of an outer circumference of the skirt part 11. An upper end of the skirt part 11 is continuous with the small-diameter part 12 via the oblique step 11c. A step 11d that is engaged with an outer flange N2 formed on the middle of the nozzle N is formed on an inner side of the oblique step 11c. The engagement of the step 11d with the outer flange N2 defines a tightening limit at closing.

As illustrated in Fig. 1(A), a downward stopper 12b that closes the nozzle hole N1 of the nozzle N is formed on a central part of an inner surface of the ceiling part 12a of the small-diameter part 12. A central part of an upper surface of the ceiling part 12a is smoothly recessed.

[0018]

As illustrated in Figs. 1(A) and 2(A), a plurality of engaging protuberant parts 13 that protrude upward are formed on the oblique step 11c at regular intervals in a circumferential direction. Each of the engaging protuberant parts 13 has a thickness that is almost equal to the width of the oblique step 11c and each of the engaging protuberant parts 13 is integrated with an outer circumferential surface of the small-diameter part 12 so that

strength is increased. An upper end surface of each of the engaging protuberant part 13 has a horizontal part 13a, a gently inclined part 13b1, and a steeply inclined part 13b that are formed in this order from the forward side toward the backward side of an opening direction of the inner cap 10 (the direction indicated by arrow K in Figs. 2(A) and 2(B)). Front and rear side surfaces of each of the engaging protuberant part 13 are a vertical part 13c and a vertical part 13d, respectively. The horizontal part 13a is a surface that is perpendicular to the central axis C. The steeply inclined part 13b and the gently inclined part 13b1 are different in the degree of inclination. The steeply inclined part 13b, which has a steeper inclination than the gently inclined part 13b1, and the gently inclined part 13b1, which has a gentler inclination than the steeply inclined part 13b, are continuous with each other so as to form an inclined part. The vertical part 13c and the vertical part 13d are surfaces that are perpendicular to the horizontal part 13a.

[0019]

The outer cap 20 has a skirt part 21 that has a tapered shape slightly reducing the diameter from the bottom side to the top side, a ceiling part 22 that closes an upper end of the skirt part 21, and a plurality of engaging protuberant parts 23 that are suspended from a lower surface of the ceiling part 22 (see Figs. 1(A), 1(B), 3(A), and 3(B)). Fig. 3(A) is a longitudinal cross-sectional view, taken along the central axis C (the one-dot chain line in Fig. 3(A)) of the outer cap 20. Fig. 3(B) is a bottom view of the outer cap 20.

[0020]

As illustrated in Figs. 1(A) and 3(A), an annular rib 21a is formed on a lower end part of an inner circumferential surface of the skirt part 21. A wide annular recess 21b in which the annular rib 11b of the inner cap 10 is contained so as to be movable upward and downward is formed above the annular rib 21a. A plurality of anti-slip knurlings 21c are formed over the whole circumference of an outer circumferential surface of an upper part of the skirt part 21.

[0021]

A plurality of engaging protuberant parts 23 that protrude downward are formed on an inner surface of the upper part of the skirt part 21 at regular intervals in the circumferential direction. Each of the engaging protuberant parts 23 is formed into a vertically-long curved block shape so as to be integral with the inner surface of the skirt part 21 and the inner surface of the ceiling part 22. A lower end surface of each of the engaging protuberant parts 23 has a gently inclined part 23b1, a steeply inclined part 23b, and a horizontal part 23a that are formed in this order from the forward side to the backward side of an opening direction of the outer cap 20 (the direction indicated by arrow K in Figs. 3(A) and 3(B)). Front and rear side surfaces of each of the engaging protuberant parts 23 are a vertical part 23d and a vertical part 23c, respectively. The gently inclined part 23b1, which is gently inclined, and the steeply inclined part 23b, which has a steeper inclination than the gently inclined part 23b1, are continuous with each other so as to form an inclined part. The horizontal part 23a is a surface that is perpendicular to the central axis C. The vertical part 23d

and the vertical part 23c are surfaces that are perpendicular to the horizontal part 23a.

[0022]

The engaging protuberant parts 13 on the inner cap 10 side and the engaging protuberant parts 23 on the outer cap 20 side correspond to each other, up and down (see Figs. 1(A), 1(B), and 4). Meanwhile, the outer cap 20 is relatively movable in the axial direction to the inner cap 10. When the outer cap 20 is pressed down to its descending limit toward the inner cap 10, each pair of upper parts of the engaging protuberant parts 13 and lower parts of the engaging protuberant parts 23 are engaged with each other (see Fig. 1(A)). When the outer cap 20 is at an ascending limit, each pair of engaging protuberant part 13 and engaging protuberant part 23 are separated from each other in a top-bottom direction and are not engaged (see Fig. 4). The descending limit of the outer cap 20 is regulated by contact of the inner surface of the ceiling part 22 of the outer cap 20 with the upper end of the inner cap 10 (see Fig. 1(A)). Meanwhile, the ascending limit of the outer cap 20 is regulated by contact of the annular rib 21a formed on the lower end part of the inner circumference of the outer cap 20 with a lower part of the annular rib 11b formed on the outer circumference of the inner cap 10. Accordingly, the outer cap 20 is undetachably combined with the inner cap 10.

[0023]

Assume that an inclination of the gently inclined part 13b1 formed on the upper end surface of the engaging protuberant part 13 of the inner cap 10 with respect to a horizontal plane is $\theta 1$, the length of the gently inclined

part 13b1 in the circumferential direction is a_1 , an inclination of the steeply inclined part 13b formed on the upper end surface of the engaging protuberant part 13 of the inner cap 10 with respect to a horizontal plane is θ_2 , and the length of the steeply inclined part 13b in the circumferential direction is a_2 , as illustrated in Fig. 4. Assume that an inclination of the gently inclined part 23b1 formed on the lower end surface of the engaging protuberant part 23 of the outer cap 20 with respect to a horizontal plane is ϕ_1 , the length of the gently inclined part 23b1 in the circumferential direction is b_1 , an inclination of the steeply inclined part 23b formed on the lower end surface of the engaging protuberant part 23 of the outer cap 20 with respect to a horizontal plane is ϕ_2 , and the length of the steeply inclined part 23b is b_2 . It is assumed here that $\theta_1 = \phi_1 \approx 30^\circ$, $\theta_2 = \phi_2 \approx 45^\circ$, $a_1 \geq b_1$, $a_2 \geq b_2$, $a_2/a_1 = 1$ to 4, and $b_2/b_1 = 1$ to 4. In this way, the steeply inclined part 13b and the gently inclined part 13b1 of the engaging protuberant part 13 are formed into a convex shape (hereinafter referred to as "convex inclined part") as a whole, and the steeply inclined part 13b has a longer length in the circumferential direction than the gently inclined part 13b1. The steeply inclined part 23b and the gently inclined part 23b1 of the engaging protuberant part 23 are formed into a concave shape (hereinafter referred to as "concave inclined part") as a whole, and the steeply inclined part 23b has a longer length in the circumferential direction than the gently inclined part 23b1. The convex inclined part and the concave inclined part are engageable in close contact with each other. Although, in the present embodiment, the steeply inclined part 13b and the gently inclined part 13b1 of the engaging protuberant part 13 form the convex inclined part, and the

steeply inclined part 23b and the gently inclined part 23b1 of the engaging protuberant part 23 form the concave inclined part, the shape of the steeply inclined part 13b and the gently inclined part 13b1 and the shape of the steeply inclined part 23b and the gently inclined part 23b1 may be exchanged with each other. That is, it is only necessary that one of the engaging protuberant part 13 and the engaging protuberant part 23 be a convex inclined part and the other one of the engaging protuberant part 13 and the engaging protuberant part 23 be a concave inclined part.

[0024]

In this safety cap, when the outer cap 20 is rotated in a closing direction (the direction opposite to the direction indicated by arrow K in Fig. 4) while being pressed down in the axial direction, the vertical part 23c of each of the engaging protuberant part 23 that is on the forward side in the closing direction is engaged with the vertical part 13c of each of the engaging protuberant parts 13 on the inner cap 10 side that is on the backward side in the closing direction and this rotate the inner cap 10 in the closing direction. In this way, it is possible to surely close the mouth B1 of the container B.

[0025]

Meanwhile, when the mouth B1 of the container B is opened, the outer cap 20 is rotated in the opening direction (the direction indicated by arrow K in Fig. 4) while being pressed in the axial direction. In this case, the engaging protuberant parts 23 on the outer cap 20 side are engaged with the corresponding engaging protuberant parts 13 on the inner cap 10 side so that the steeply inclined part 23b and the gently inclined part 23b1 are in close contact with the steeply inclined part 13b and the gently inclined part

13b1, respectively (see Fig. 5(A)). This transmits a rotational force in the opening direction to the inner cap 10, thereby rotating the inner cap 10 to be able to open the mouth B1. If the pressing force in the axial direction applied to the outer cap 20 is small, the steeply inclined part 23b on the outer cap 20 side slips on the steeply inclined part 13b on the inner cap 10 side, and as a result, the outer cap 20 floats up (see Fig. 5(B)). This extremely reduces a contact area between the engaging protuberant parts 23 and the engaging protuberant parts 13. As a result, the outer cap 20 more easily floats up to reduce frictional resistance between the engaging protuberant parts 23 and the engaging protuberant parts 13, and the rotational force for rotating the inner cap 10 in the opening direction also extremely decreases. Consequently, it is possible to minimize a risk of mistakenly opening the mouth B1 of the container B.

(Modification)

[0026]

The container B of Fig. 1 may have a wide mouth B1 in which the nozzle N is not used (see Fig. 6). In this case, a tightening limit at capping is defined by closing the mouth B1 by a stopper 12b that has a short skirt shape and is suspended from a lower surface of a ceiling part 12a of an inner cap 10, and contact of an upper end of the mouth B1 with the lower surface of the ceiling part 12a.

[0027]

The inner cap 10 may be formed without the oblique step 11c in the middle part of the outer circumference of the inner cap 10, so that the skirt part 11 that forms a lower half of the inner cap 10 and the small-diameter

part 12 that forms an upper half of the inner cap 10 have an identical diameter (see Figs. 7, 8(A), and 8(B)). Fig. 8(A) is a top view of the inner cap 10, and Fig. 8(B) is a bottom view of the outer cap 20.

[0028]

In Figs. 7, 8(A), and 8(B), engaging protuberant parts 13, 13 ... on the inner cap 10 side are provided at regular intervals in a circular form along a peripheral part of the upper surface of the ceiling part 12a of the inner cap 10, and engaging protuberant parts 13, 13 ... are formed into a fan-like flat block that is longer in the radial direction of the inner cap 10. A horizontal part 13a, a gently inclined part 13b1, and a steeply inclined part 13b are formed on an upper surface of each of the engaging protuberant parts 13 in this order from the forward side to the backward side of an opening direction of the inner cap 10 (the direction indicated by arrow K in Fig. 8(A)). Front and rear side surfaces of each of the engaging protuberant parts 13 are a vertical part 13c and a vertical part 13d, respectively.

[0029]

Meanwhile, engaging protuberant parts 23, 23 ... on the outer cap 20 side are provided at regular intervals in a circular form along a peripheral part of the lower surface of the ceiling part 22 of the outer cap 20, and engaging protuberant parts 23, 23 ... are formed into a fan-like flat block that is longer in the radial direction of the outer cap 20. A gently inclined part 23b1, a steeply inclined part 23b, and a horizontal part 23a are formed on a lower surface of each of the engaging protuberant parts 23 in this order from the forward side to the backward side of an opening direction of the outer cap 20 (the direction indicated by arrow K in Fig. 8(B)). Front and rear side

surfaces of each of the engaging protuberant parts 23 are vertical parts 23d and 23c, respectively. The pairs of engaging protuberant parts 13 and engaging protuberant parts 23 of Figs. 7 and 8 work in an identical manner to the pairs of engaging protuberant parts 13 and engaging protuberant parts 23 of Figs. 1 to 5, and exert a child-resistant function. One of or both of the vertical part 13d of Fig. 8(A) and the vertical part 23d of Fig. 8(B) may be eliminated. In this case, the lower end of the steeply inclined part 13b may be fitted to the upper surface of the ceiling part 12a or the upper end of the gently inclined part 23b1 may be fitted to the lower surface of the ceiling part 22.

In the above description, each of the inner cap 10 and the outer cap 20 can be integrally formed from a proper rigid plastic material.

[0030]

The present application claims the benefit of the priority date of Japanese patent application No. 2012-129510 filed on June 7, 2012. All of the contents of the Japanese patent application No. 2012-129510 filed on June 7, 2012, are incorporated by reference.

INDUSTRIAL APPLICABILITY

[0031]

The safety cap of the present invention is suitably widely applicable as a safety cap of a container for any purposes that require a child-resistant function.

DESCRIPTION OF THE NUMERALS

[0032]

10	inner cap
20	outer cap
13, 23	engaging protuberant part
13b, 23b	steeply inclined part
13b1, 23b1	gently inclined part
13c, 23c	vertical part

CLAIMS

1. A safety cap comprising:

a screw-type inner cap detachably mounted on a mouth of a container; and

an outer cap that is combined with the inner cap so as to be rotatable relative to the inner cap,

each of the inner cap and the outer cap having a plurality of engaging protuberances,

the engaging protuberances of the inner cap and the engaging protuberances of the outer cap being engaged with each other and rotating the inner cap when the outer cap is rotated while being pressed toward the inner cap,

each of the engaging protuberances having a vertical part that is engaged when the outer cap is rotated in a closing direction and an inclined part that is engaged when the outer cap is rotated in an opening direction, and

the inclined part having a steeply inclined part that has a steep inclination and a gently inclined part that has a gentler inclination than the steeply inclined part, the steeply inclined part and the gently inclined part being continuous with each other.

2. The safety cap according to claim 1, wherein:

the inclined part has a convex inclined part that is formed into a convex shape by the steeply inclined part and the gently inclined part in one

of the engaging protuberance of the inner cap and the engaging protuberance of the outer cap and a concave inclined part that is formed into a concave shape by the steeply inclined part and the gently inclined part in the other of the engaging protuberance of the inner cap and the engaging protuberance of the outer cap; and

the convex inclined part and the concave inclined part are engageable in close contact with each other.

3. The safety cap according to claim 1 or 2, wherein the steeply inclined part has a longer length in a circumferential direction than the gently inclined part.