



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
28.05.2008 Bulletin 2008/22

(51) Int Cl.:
B65D 41/04 (2006.01)

(21) Application number: **06798112.6**

(86) International application number:
PCT/JP2006/318551

(22) Date of filing: **13.09.2006**

(87) International publication number:
WO 2007/032539 (22.03.2007 Gazette 2007/12)

(84) Designated Contracting States:
DE FR GB

(30) Priority: **13.09.2005 JP 2005265100**
13.09.2005 JP 2005265099

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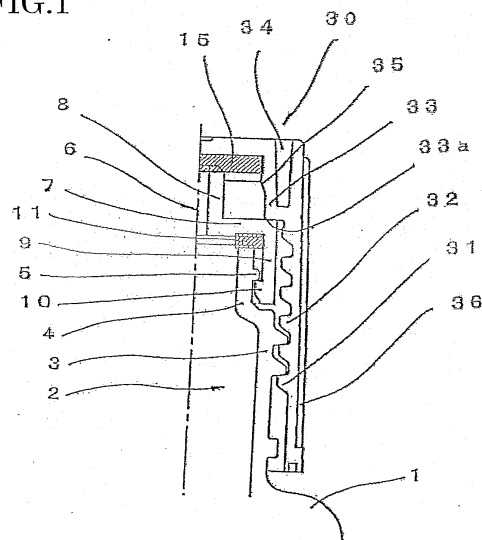
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(54) **SCREW CAP AND SAFETY CAP**

(57) There are provided a screw-type cap which can secure necessary fastening torque (opening torque) even in a case of a container having a plug having a foremost end portion of a small diameter and also a safety cap which cannot be opened by only rotation and therefore has a child resistance effect. A safety cap 20 consists of a screw-type inner cap 21 and an outer cap 22 which is mounted in such a manner that it covers the inner cap 21 and can be rotated and can displace axially within a limited distance. The outer cap 22 can rotate integrally with the inner cap 21 by pushing down the outer cap 22 and rotate it while the outer cap 22 rotates idly by rotation only. A plug portion 8 is formed by projecting a plug 6 from a disk portion 7 which is in abutting engagement with a tip end portion of a mouth portion 2 of the container. The inner cap 21 has a small diameter portion 21c formed in the inner middle portion thereof. The small diameter portion 21c is in abutting engagement with the disk portion 7 and controls interference by screwing. By causing the small diameter portion 21c of the inner cap 21 against the disk portion 7 of the plug 6, interference can be controlled to prevent excessive fastening and necessary fastening torque (opening torque) can be secured even in a case where the cap has the plug portion having a small diameter while idle rotation can be secured to achieve a child resistance effect.

FIG.1



Description

Technical Field

[0001] This invention relates to a screw-type cap and a safety cap which are capable of securing a necessary fastening torque (i.e., plug opening torque) even in a case where a plug member of a small diameter is used and, in the safety cap, cannot be opened easily by, for example, a child when he wishes to open it. More particularly, the invention relates to a cap which is suitable for use as a cap of a cartridge container of methanol for a methanol fuel cell.

Background Art

[0002] In containers which receive contents, there is one which needs to be sealed after starting use. As such container, there is used a container in which a screw-type cap is provided so as to open and close the cap and, for facilitating take-out of contents from the container, the shape of the mouth portion of the container matches the state of the contents or conditions required by a demander of the contents. As a container for receiving liquid, for example, there is a container in which a plug member having a narrowed foremost end portion is provided in the mouth portion of the container so that the liquid can be taken out accurately by narrowing flow of the liquid or dripping the liquid.

[0003] As such container, for example, Fig. 7 shows a container 101 which is formed with a screw portion 103 on an outer periphery of a foremost end portion of its mouth portion 102. In a tip end portion thereof, there is formed a stepped portion 104 of a small diameter and an engaging projecting flange 105 is formed on the outer periphery of the stepped portion 104. On the other hand, a plug 106 which is attached to the mouth portion 102 of this container has a disk portion 107 which is in abutting engagement against the foremost end surface of the mouth portion 102. In the central portion of the disk portion 107, there is formed a plug portion 108 of a cylindrical configuration having a small diameter for taking liquid out of the container in a manner to project outwardly (upward in the drawing). A cylindrical portion 109 projects from the outer periphery of the disk portion 107 toward inwardly (downward in the drawing) and an engaging flange 110 is provided on the inner periphery of the end portion of the cylindrical portion 109.

[0004] The plug 106 is attached to the container 101 by fitting the plug 106 on the outside of the stepped portion 104 in a manner to bring the disk portion 107 of the plug 106 into abutting engagement with the foremost end surface of the mouth portion 102 of the container 101 via a packing 111 and causing the upper surface of the engaging flange 110 of the plug 106 to engage with the lower surface of the engaging flange 105 of the mouth portion 102 of the container.

[0005] A cap 120 screwed on the mouth portion 102

of the container having such plug 106 for sealing the container is formed in the form of a cylinder having a bottom. Screw portions 121 and 122 are formed on the inner periphery of the cylindrical portion of the cap 120 and vertical projections 126 for preventing slipping are formed on the outer periphery of the cylindrical portion of the cap 120. In the inside of the top portion of the cap 120 is mounted a separate packing 115 for sealing.

[0006] Such screw-type cap which has been commonly adopted in the past has the problem, depending upon the type of contents of the container, that, if contents can be taken out easily by opening the container, waste of the contents may occur by leakage of the contents or a child may drink the contents by mistake. Therefore, for maintaining a sealed state accurately, there has been adopted a safety cap (a child resistant cap) which cannot be opened unless an extra operation, e.g., a pushing down operation, is applied in addition to rotation of the cap for opening. For this purpose, various types of safety caps have been proposed including Japanese Patent Publication No. Sho 59-12541.

[0007] The child resistant closing device of this Japanese Patent Publication No. Sho 59-12541 has an inner cap member and an outer cap member. A driving projection in the form of a pulse is provided on the outer periphery of the inner cap member and a ratchet groove is provided in the top portion of the inner cap member. A driving projection is provided on the outer periphery of the outer cap member and a leaf spring which engages with the ratchet groove in ratchet-meshing is provided in the inside of the top portion of the outer cap member.

[0008] In the above described container 101 with the screw-type cap having the plug 106 of the narrowed foremost end portion, fastening force for fastening the cap 120 is determined by clamping of the container with frictional force produced by contact of the screw portion 103 of the container 101 with the screw portions 121 and 122 of the cap 120 in a state in which the foremost end surface of the plug portion 108 of the plug 106 is in abutting engagement with the top portion of the cap 120. Since, however, the foremost end portion of the plug portion 108 of the plug 106 is narrow, the area of contact with the top portion of the cap 120 is small and, therefore, the cap 120 tends to be tightened excessively and, as a result, the top portion of the cap 120 tends to be deformed with the packing 115 in such a manner that it swells outwardly (upwardly in the drawing). Further, since the mouth portion 102 of the container is of a small diameter, diameters of the screw portions 103, 121 and 122 for fastening the cap 120 are small and frictional force produced by the screw portions 103, 121 and 122 is also small with the result that sufficient fastening force (plug opening torque) cannot be secured.

[0009] In the meanwhile, the device for preventing easy opening disclosed by, e.g., Japanese Patent Publication No. Sho 59-12541 is used for a mouth portion of a container having a relatively large diameter and a ratchet mechanism is provided between the top portion of the

inner cap and the top portion of the outer cap. This device cannot be applied directly to the container with the screw-type cap of a small diameter having the plug of a narrow foremost end portion in the mouth portion thereof because it is difficult to secure a space for disposing the device and secure precision in forming of the container.

[0010] In view of the above described problems of the prior art technique, it is an object of the invention to provide a screw-type cap capable of securing necessary fastening torque (plug opening torque) even in a case of a container having a plug of a narrowed foremost end portion.

[0011] It is another object of the invention to provide a safety cap having a child resistant effect which cannot be opened by a rotating operation only.

Disclosure of the Invention

[0012] For overcoming the problems of the prior art technique, a screw-type cap as defined in claim 1 comprises a plug member attached to a mouth portion of a container and having a narrowed foremost end portion, and a cap covering the plug member and screwed onto a screw portion of the mouth portion of the container and sealed with the foremost end portion of the plug member, said plug member having a disk portion which is in abutting engagement with a tip end portion of the mouth portion of the container and a plug portion projecting from the disk portion, and said cap having a small diameter portion formed in the inner middle portion thereof, said small diameter portion being in abutting engagement with the disk portion of the plug member and controlling interference by screwing.

[0013] According to the screw-type cap, since the cap comprises a plug member attached to a mouth portion of a container and having a narrowed foremost end portion, and a cap covering the plug member and screwed onto a screw portion of the mouth portion of the container and sealed with the foremost end portion of the plug member, said plug member having a disk portion which is in abutting engagement with a tip end portion of the mouth portion of the container and a plug portion projecting from the disk portion, and said cap having a small diameter portion formed in the inner middle portion thereof, said small diameter portion being in abutting engagement with the disk portion of the plug member and controlling interference by screwing, the interference by screwing of the cap is controlled by abutting engagement of the small diameter portion of the cap with the disk portion of the plug member and excessive fastening of the cap thereby can be prevented and necessary fastening torque (plug opening torque) can be secured even in a case of a plug member of a small diameter.

[0014] In a screw-type cap as defined in claim 2, in addition to the structure defined in claim 1, the small diameter portion of the cap is formed by providing a recess in a top portion of a large diameter portion of the cap and the outer configuration of the cap is formed in a cylinder.

[0015] According to this screw-type cap, since the small diameter portion of the cap is formed by providing a recess in a top portion of a large diameter portion of the cap and the outer configuration of the cap is formed in a cylinder, the small diameter portion can be formed while the outer configuration of the cap is made cylindrical and forming of the cap is facilitated by making thickness of the respective portions substantially uniform.

[0016] In a safety cap as defined in claim 3, in addition to the structure defined in claim 1 or 2, a safety cap is formed with said cap which constitutes an inner cap and an outer cap which covers the inner cap and is mounted on the inner cap rotatably about the inner cap and also axially slidably within a limited range in such a manner that the outer cap can move integrally with the inner cap by pushing down the outer cap and rotating the outer cap while the outer cap can rotate idly by rotating the outer cap without pushing it down, said inner cap having a small diameter portion formed in the inner middle portion thereof, said small diameter portion being in abutting engagement with the disk portion of the plug member and controlling interference by screwing.

[0017] According to this safety cap, the safety cap is formed with a screw-type inner cap having a plug member having a narrowed foremost end portion in the mouth portion of the container and an outer cap which covers the inner cap and is mounted on the inner cap rotatably about the inner cap and also axially slidably within a limited range in such a manner that the outer cap can move integrally with the inner cap by pushing down the outer cap and rotating the outer cap while the outer cap can rotate idly by rotating the outer cap without pushing it down, the plug portion of the plug member being formed by projecting from the disk portion abutting against the foremost end portion of the mouth portion of the container, and the inner cap having a small diameter portion formed in the inner middle portion thereof, said small diameter portion being in abutting engagement with the disk portion of the plug member and controlling interference by screwing. Therefore, interference by screwing of the inner cap can be controlled to prevent excessive fastening and necessary fastening torque (plug opening torque) can be secured even in a case of a plug member of a small diameter. By this arrangement, the child resistant effect can be achieved by securing the idle rotation accurately.

[0018] In a safety cap as defined in claim 4, in addition to the structure defined in claim 3, the small diameter portion of the inner cap has a stepped portion on the outside thereof and either one of a ratchet wheel and a ratchet pawl of a ratchet mechanism which can be brought to meshing engagement with each other by pushing down and rotation of the outer cap and can be rotated idly relative to each other by rotation only is provided on either one of the stepped portion and a top portion of the outer cap and the other of the ratchet wheel and the ratchet pawl of the ratchet mechanism is provided on the other of the stepped portion and the top portion

of the outer cap.

[0019] According to this safety cap, the small diameter portion of the inner cap has a stepped portion on the outside thereof and either one of a ratchet wheel and a ratchet pawl of a ratchet mechanism which can be brought to meshing engagement with each other by pushing down and rotation of the outer cap and can be rotated idly relative to each other by rotation only is provided on either one of the stepped portion and a top portion of the outer cap and the other of the ratchet wheel and the ratchet pawl of the ratchet mechanism is provided on the other of the stepped portion and the top portion of the outer cap. Since the stepped portion is provided on the outside of the small diameter portion of the inner cap, a space can be secured and either the ratchet wheel or the ratchet pawl constituting the ratchet mechanism can be provided in this space whereby the child resistant effect can be achieved without significantly enlarging the screw-type cap.

[0020] A safety cap as defined in claim 5 comprises, in addition to the structure defined in claim 3 or 4, energizing means for enabling maintaining of the idle rotation which is provided between the inner cap and the outer cap.

[0021] According to this safety cap, there is provided energizing means for enabling maintaining of the idle rotation which is provided between the inner cap and the outer cap. Thus, energizing means such as a spring can be provided separately from the ratchet mechanism in a space in which the energizing means can move in axial direction of the inner and outer cap whereby the idle rotation of the outer cap can be secured and the child resistant effect can be achieved more accurately.

[0022] In a safety cap as defined in claim 6, in addition to the structure defined in claim 4 or 5, the ratchet wheel constituting the ratchet mechanism is formed in a lightened structure.

[0023] According to this safety cap, since the ratchet wheel constituting the ratchet mechanism is formed in a lightened structure and therefore is formed with a necessary outer frame only, a thick portion can be eliminated and the forming cycle using resin can be shortened while functions of the ratchet is maintained.

[0024] In a cap as defined in claim 7, in addition to the structure defined in any of claims 1 - 6, the seal between the foremost end portion of the plug member and the cap or the inner cap is substituted by, or added with, a valve mechanism for preventing leakage of contents of the container which is provided on the plug member.

[0025] According to this cap, since the seal between the foremost end portion of the plug member and the cap or the inner cap is substituted by, or added with, a valve mechanism for preventing leakage of contents of the container which is provided on the plug member, leakage of contents immediately after removal of the cap can be prevented and handling can thereby be further facilitated and leakage during storage etc. can be more perfectly prevented.

[0026] A cap as defined in claim 8, in addition to the structure defined in any of claims 1 - 7, further comprises a coupler consisting of a socket having a valve and energizing means for energizing the valve in closing direction and a plug having a valve and energizing means for energizing the valve in closing direction and being detachably fitted to the socket, said plug, in the state of being fitted to the socket, opening the both valves to communicate the socket with the plug, either one of the socket and the plug of the coupler being provided on either one of the plug member and a member on a demander side which receives contents of the container, and the other of the socket and the plug of the coupler being provided on the other of the plug member and the member on a demander side which receives contents of the container.

[0027] According to this cap, the cap further comprises a coupler consisting of a socket having a valve and energizing means for energizing the valve in closing direction and a plug having a valve and energizing means for energizing the valve in closing direction and being detachably fitted to the socket, said plug, in the state of being fitted to the socket, opening the both valves to communicate the socket with the plug, either one of the socket and the plug of the coupler being provided on either one of the plug member and a member on a demander side which receives contents of the container, and the other of the socket and the plug of the coupler being provided on the other of the plug member and the member on a demander side which receives contents of the container and, therefore, by fitting and communication between the container and the member of a demander side via the socket and the plug, contents of the container can be shifted accurately without causing leakage.

[0028] In a cap as defined in claim 9, in addition to the structure defined in any of claims 1 - 8, the container is a container for liquid fuel.

[0029] According to this cap, the container is a container for liquid fuel and, therefore, liquid fuel can be securely sealed and can be taken out accurately when it is necessary.

[0030] In a cap as defined in claim 10, in addition to the structure defined in any of claim 1 - 9, the container is a container for methanol.

[0031] According to this cap, the container is a container for methanol and, therefore, the cap satisfies necessary conditions as a container for methanol used for a methanol fuel cell.

Brief Description of the Drawings

[0032]

Fig. 1 is a partial vertical sectional view showing an embodiment of the screw-type cap of the present invention in an assembled state.

Fig. 2 is a plan view, a front view, a bottom view and a vertical sectional view showing the embodiment of

the screw-type cap of the invention.

Fig. 3 shows an embodiment of a safety cap of the present invention in which Fig. 3A is a partial vertical sectional view showing an outer cap in an idle rotation state and Fig. 3B is a partial vertical sectional view showing the outer cap in an integral rotation state.

Fig. 4 is a plan view, a front view, a bottom view and a vertical sectional view showing an inner cap of the embodiment of the safety cap.

Fig. 5 is a plan view, a front view, a bottom view and a vertical sectional view showing an outer cap of the embodiment of the safety cap.

Fig. 6 is a view for illustrating the operation of the safety cap of the embodiment of the invention in which Fig. 6A shows the idle rotation state and Fig. 6B shows the integral rotation state.

Fig. 7 is a partial vertical sectional view showing a container having a plug member for which the safety cap of the present invention is applied and also showing a prior art cap.

Description of Preferred Embodiments of the Invention

[0033] Embodiments of the invention will now be described in detail with reference to the drawings.

[0034] Figs. 1 and 2 show an embodiment of the screw-type cap of the present invention in which Fig. 1 is a partial vertical sectional view in an assembled state and Fig. 2 is a plan view, a front view, a bottom view and a vertical sectional view of the cap.

[0035] As the container which is sealed with this screw-type cap 30, the container 1 made of a synthetic resin illustrated by Fig. 7 is used. A screw portion 3 is formed in a mouth portion 2 of the container and a plug 6 made of a synthetic resin constituting a plug member is fitted and connected with the tip end portion of the container via a packing 11. In the plug 6, a plug portion 8 of a small diameter projects in the central portion of a disk portion 7 and the fitted connection between the plug 6 and the container 1 can be maintained by engagement between an engaging flange 5 of the container 1 and an engaging flange 10 of the plug 6.

[0036] The screw-type cap 30 provided for this container 1 is made of a synthetic resin and is formed in the form of a cylinder having a bottom as shown in Figs. 1 and 2 with the bottom portion constituting a top portion. A cylindrical portion 31 of a large diameter which constitutes a base portion (the lower portion in the drawings) is formed in its inner periphery with a screw portion 32 which is screwed onto the screw portion 3 of the container 1.

[0037] In this screw-type cap 30, a small diameter por-

tion 33 having a cylindrical shape of a small diameter is formed on the large diameter cylindrical portion 31 concentrically with the large diameter cylindrical portion 31 at a position at which a bottom surface 33a of the small diameter portion 33 abuts against the upper surface of the disk portion 7 of the plug 6 constituting the plug member when the screw portion 32 is fastened to the screw portion 3 of the container 1.

[0038] By this arrangement, the screw-type cap 30 has the large diameter cylindrical portion 31 which has a large diameter over the entire length thereof and the small diameter portion 33 is formed in the upper portion of the large diameter cylindrical portion 31 integrally and concentrically with the large diameter cylindrical portion 31 thereby forming a partially dual cylinder configuration with a recess 34 opening in the top portion being formed between the large diameter cylindrical portion 31 and the small diameter portion 33.

[0039] By forming the upper end portion of the screw-type cap 30 not as a portion of the small diameter of the small diameter portion 33 but as a portion of the large diameter of the large diameter cylindrical portion 31, rotation of the screw-type cap 30 can be made with a small force. By forming the small diameter portion 33 by providing the recess 34 in the inside of the large diameter cylindrical portion 31, thickness of each portion of the screw-type cap 30 is made substantially uniform whereby forming of the cap with a synthetic resin is facilitated.

[0040] In this screw-type cap 30, a packing holding portion 35 in the form of a horizontal flange is formed in a manner to project inwardly from the inside of the top portion of the large diameter cylindrical portion 31 for mounting and holding a packing 15 which seals the plug portion 8 of a small diameter of the plug 6. A slipping prevention portion 36 consisting of vertical projections is formed over the entire outer periphery of the large diameter cylindrical portion 31.

[0041] In the screw-type cap 30 constructed in the above described manner, when the screw portion 32 of the large diameter cylindrical portion 31 is screwed onto the screw portion 3 of the container 1, the plug portion 8 having a small diameter of the plug 6 is brought into abutting engagement with the top portion of the screw-cap 30 via the packing 15 and, in addition, the upper surface of the disk portion 7 of the plug 6 constituting the plug member is brought into engagement with the bottom surface 33a of the small diameter portion 33 of the screw-type cap 30. Thus, in comparison with the case of the prior art cap in which excessive fastening of the cap is prevented by abutting engagement only between the top portion of the cap and the plug portion 8 having a small diameter, excessive fastening can be prevented more effectively by abutting engagement with a significantly enlarged area of contact.

[0042] Accordingly, the screw-type cap 30 can be fastened securely to the screw portion 3 of the container 1 and plug-opening torque (i.e., torque necessary for opening the screw-type cap 30) can be increased and the cap

can be fastened to the container in such a manner that the cap cannot be opened or closed too easily.

[0043] Although no particular explanation has been made about contents to be received in the container in the above embodiment, no particular restriction is made about the container and contents so long as the contents are those which must be received in the container and kept in a sealed state, or those which are kept in a sealed state and, after the container is opened, are kept in a sealed state again. Particularly, if the cap is used as a screw-type cap of a container for fuel of a fuel cell, particularly as a screw-type cap of a container for methanol which is a fuel of a methanol fuel cell, the container can be sealed accurately, and can be sealed accurately again after the container is opened.

[0044] Sealing between the foremost end portion of the plug 6 as the plug member and the screw-type cap 30 has been realized by mounting the packing 15. Instead of the packing, other seal means may be employed such, for example, as providing the screw-type cap with a projection which contacts the foremost end portion of the plug member for sealing, or as forming the foremost end portion of the plug member with a tapered surface reducing its diameter upwardly and providing the screw-type cap with a tapered ring integrally with the screw-type cap so as to contact the tapered surface of the plug member. In a case where a valve mechanism is provided in the plug 6 as the plug member, sealing between the plug 6 and the screw-type cap 30 may be omitted, or storing and use of the contents can be made more safely by the both sealing functions.

[0045] As described in detail in the foregoing, this screw-type cap 30 is a screw-type cap for the container 1 comprising the plug 6 as the plug member having the narrowed foremost end portion in the mouth portion 2 of the container, the plug portion 8 of the plug 6 projects from the disk portion 7 which abuts against the foremost end portion of the mouth portion 2 of the container, and the small diameter portion 33 is formed in the inner side of the middle portion of the large diameter cylindrical portion 31 which small diameter portion is in abutting engagement with the disk portion and controlling interference by screwing. Therefore, interference by screwing of the screw-type cap 30 can be controlled so as to prevent excessive fastening and necessary torque (plug-opening torque) can be secured even in the case that the container comprises the plug portion 7 of a small diameter.

[0046] According to this screw-type cap 30, the small diameter portion 33 of the screw-type cap 30 is formed by providing the recess 34 in the top portion of the large diameter portion 31 and the outer configuration of the screw-type cap 30 is formed in a cylinder of a large diameter and, therefore, the small portion 33 can be formed while the screw-type cap 30 is formed in a cylindrical shape whereby easiness of operation can be secured by maintaining an ordinary outer configuration of a general cap and thickness of each part of the screw-type cap 30

can be made substantially uniform so that forming of the cap can be facilitated.

[0047] Further, according to this screw-type cap 30, it can satisfy necessary conditions as a cap of a container when the container is one for a liquid fuel or one for methanol used as a fuel of a methanol fuel cell and contents can be sealed safely and securely and also can be taken out of the container safely and securely when the contents are needed.

[0048] In the screw-type cap 30, if a check valve is provided on the plug portion 8 of the plug 6 as a valve mechanism for preventing leakage of contents, immediate leakage of contents can be prevented when the screw-type cap 30 is removed and safety and easiness for operation thereby can be further improved. In case a valve mechanism is provided on the plug 6, seal between the plug 6 and the screw-type cap 30 can be omitted to simplify the structure and, in case the valve mechanism is provided together with the seal, keeping and use of the contents can be made more safely by the two seal functions.

[0049] In the screw-type cap 30, in case there is provided a coupler consisting of a socket having a valve and energizing means for energizing the valve in closing direction and a plug having a valve and energizing means for energizing the valve in closing direction and being detachably fitted to the socket, the plug, in the state of being fitted to the socket, opening the both valves to communicate the socket with the plug, and either one of the socket and the plug of the coupler is provided on either one of the plug portion 8 of the plug 6 and a member on a demander side which receives contents of the container 1, and the other of the socket and the plug of the coupler is provided on the other of the plug 6 and the member on a demander side which receives contents of the container 1, the contents can be shifted accurately from the container 1 to the member of a demander side without danger of leakage. Particularly, in a case where the coupler is made of a socket having a valve and a coil spring made of metal which constitutes energizing means for energizing the valve in closing direction and a plug having a valve and a coil spring made of metal which constitutes energizing means for energizing the valve in closing direction and being detachably fitted to the socket, the plug, in the state of being fitted to the socket, opening the both valves to communicate the socket with the plug, and there is provided a housing in the base portions of these valves which can allow reciprocal movements of these valves and can seal these valves, the energizing means for energizing the valves are housed in this housing and a flow path is formed in a space outside of this housing, the coil springs made of metal can be housed in this housing and contact of the coils springs with liquid thereby can be prevented.

[0050] By this arrangement, in a case where it is necessary to prevent contact of methanol in the container 1 with a metal as in the case of a methanol fuel cell, liquid can be supplied to or taken out of the container 1 from

which the screw-type cap 30 is removed without contacting a metal by simple attachment or detachment of the coupler.

[0051] Another embodiment of the invention will now be described with reference to the drawings.

Fig. 3 to Fig. 6 show another embodiment of the safety cap of the present invention. Fig. 3A is a partial vertical sectional view showing an outer cap in an idle rotation state and Fig. 3B is a partial vertical sectional view showing the outer cap in an integral rotation state. Fig. 4 is a plan view, a front view, a bottom view and a vertical sectional view showing an inner cap. Fig. 5 is a plan view, a front view, a bottom view and a vertical sectional view showing an outer cap. Fig. 6 is a view for illustrating the operation of the safety cap of the embodiment of the invention in which Fig. 6A shows the idle rotation state and Fig. 6B shows the integral rotation state.

[0052] As the container which is sealed with this screw-type cap 20, the container 1 made of a synthetic resin illustrated by Fig. 7 is used. A screw portion 3 is formed in a mouth portion 2 of the container and a plug 6 made of a synthetic resin constituting a plug member is fitted and connected with the tip end portion of the container via a packing 11. In the plug 6, a plug portion 8 of a small diameter projects in the central portion of a disk portion 7 and the fitted connection between the plug 6 and the container 1 can be maintained by engagement between an engaging flange 5 of the container 1 and an engaging flange 10 of the plug 6.

[0053] The safety cap 20 provided in the container 1 comprises an inner cap 21 and an outer cap 22 respectively made of a synthetic resin. The plug 6 is covered by the inner cap 21 and the inner cap 21 is screwed on the screw portion 3 of the base portion of the mouth portion 2 of the container 1 to bring about a sealed state. The outer cap 22 which covers the inner cap 21 is mounted on the inner cap 21 rotatably and also slidably within a limited distance. By pushing down the outer cap 22 and rotating it, it can be rotated integrally with the inner cap 21 while the outer cap is rotated idly by only the rotating operation whereby it can function as a safety cap having a child resistance effect.

[0054] The inner cap 21 of this safety cap 20 is formed, as shown in Figs. 3 and 4, in the form of a two-stage cylinder having a bottom with the bottom portion constituting a top portion. A large diameter cylindrical portion 21a of the base portion of the inner cap 21 has in its inner periphery a screw portion 21b which is screwed onto the screw portion 3 of the container 1. A small diameter portion 21c having a cylindrical shape is provided at a position at which a bottom surface 21c' of the small diameter portion 21c abuts against the upper surface of the disk portion 7 of the plug 6 constituting the plug member when the inner cap 21 is fastened to the screw portion 3 of the container 1.

[0055] By this arrangement, when the inner cap 21 is fastened to the container 1, the top portion of the inner cap 21 abuts against a plug portion 8 having a foremost

end portion of a small diameter of the plug 6 via a packing 15 and, in addition, the upper surface of a disk portion 7 of the plug 6 constituting the plug member abuts against a bottom surface 21c' of a small diameter portion 21c of the inner cap 21. Thus, in comparison with the conventional device in which excessive screwing of the inner cap 21 is prevented by only abutment of the top portion of the inner cap 21 with the plug portion 8 having a foremost end portion of a small diameter of the plug 6, abutment is made with a significantly enlarged area of contact and excessive screwing thereby can be prevented effectively.

[0056] Accordingly, the inner cap 21 can be fastened tightly to the screw portion 3 of the container 1 whereby the plug opening torque is increased so that the inner cap 21 will not be opened or loosened easily.

[0057] The inner cap 21 is formed, on the inner surface of the top portion thereof, with a packing holding portion 21d in the form of an inwardly projecting horizontal projection which holds the mounted packing 15 for sealing the plug portion 8 having a foremost end portion of a small diameter of the plug 6. The inner cap 21 is also formed, on the outer surface of the lower end portion of a large diameter cylindrical portion 21a, with an axial displacement restricting portion 21e in the form of a horizontally projecting linear projection which restricts axial displacement of the outer cap 22. The inner cap 21 is formed, downwardly of the restriction portion 21e, with a skirt portion 21f consisting of alternately formed vertical projections and recesses around the entire periphery of the inner cap 21.

[0058] In the inner cap 21, there is formed a stepped portion 21g on the outside of the large diameter cylindrical portion 21a and the small diameter portion 21c of the two stage cylindrical portions. The stepped portion 21g has a conical surface.

[0059] In the stepped portion 21g having a conical surface of the inner cap 21, there are formed plural (eight in this embodiment) ratchet wheels 24 of a ratchet mechanism 23 at an equal interval in the circumferential direction. The ratchet mechanism 23 enables the outer cap 22 to be made integral with the inner cap 21 by pushing down and rotation of the outer cap 22 and enables the outer cap to rotate idly by rotation only.

[0060] The ratchet wheels 24 of the ratchet mechanism 23 are formed, as shown in Fig. 4, at an equal interval in the circumferential direction of the stepped portion 21g. The front side of each ratchet wheel as viewed in the clockwise direction (i.e., left side in the drawing) constitutes a low vertical surface 24a rising from the surface of the stepped portion 21g and the rear side of each ratchet wheel as viewed in the clockwise direction (i.e., right side in the drawing) constitutes a high vertical surface 24b rising from the surface of the stepped portion 21g. These low vertical surface 24a and the high vertical surface 24b are connected to each other by an inclining surface 24c and a small horizontal surface 24d. In this embodiment, the inclining surface 24c above the low vertical

surface 24a, the horizontal surface 24d, and the high vertical surface 24b function effectively as the ratchet wheel 24.

[0061] This ratchet wheel 24 is not of a solid synthetic resin structure but is of a lightened structure consisting substantially of an outer frame only. The low vertical surface 24a and the high vertical surface 24b are respectively formed as vertical plates, the upper portion of the low vertical surface is used as the inclining surface 24c and the upper portion of the high vertical surface 24b is used as a part of the horizontal surface 24d. A portion between these surfaces constitutes other part of the horizontal surface 24d which is provided on the inner peripheral side only as viewed from above.

[0062] By constructing the ratchet wheel 24 as a lightened structure, there is no thick portion in the inner cap 21 and, therefore, the thickness can be made substantially uniform all over. Accordingly, it is not necessary to match the forming cycle in forming of the resin to a thick portion and the forming can be made efficiently in a short period of time.

[0063] Further, by forming the ratchet wheel 24 by utilizing the stepped portion 21g of the inner cap 21, it is not necessary to increase the height of the inner cap 21 but the inner cap 21 can be made compact.

[0064] The outer cap 22 which is fitted on the outside of the inner cap 21 is formed, as shown in Figs. 3 and 5, in such a manner that the bottom portion of a cylinder having a bottom constitutes a top portion 22a. In the inner periphery of the lower portion of the cylindrical portion 22b, there is formed a displacement restricting portion 22c in the form of an inwardly projecting horizontal projection for restricting axial displacement within a certain distance, i.e., a distance in which the outer cap can rotate integrally with the inner cap 21 or rotate idly. The outer cap 22 thereby is restricted in its upward displacement. On the other hand, downward displacement of the outer cap is restricted by abutting engagement of the top portion 22a of the outer cap 22 with the top portion of the inner cap 21. Thus, the outer cap 22 can displace vertically between them (see the uppermost end position in Fig. 3A and the lowermost end position in Fig. 3B).

[0065] In the outer cap 22, a slipping prevention portion 22d in the form of vertical projections and recesses is formed on the outer periphery of the cylindrical portion 22a.

[0066] In the outer cap 22, there are formed, at an equal interval in the circumferential direction, plural (eight in the illustrated example) ratchet pawls 25 of the ratchet mechanism for enabling the outer cap 22 to become integral with the inner cap 21 by pushing down and rotation of the outer cap 22 and enabling the outer cap 22 to rotate idly by rotation only of the outer cap 22.

[0067] The ratchet pawls 25 are formed in the form of a plate projecting downwardly from the top portion 22a and are disposed radially at an equal interval in the circumferential direction in positions opposite to the ratchet wheels 24 of the ratchet mechanism 23 of the inner cap

21. In the state in which the outer cap 22 is pushed down, the ratchet pawl 25 is located at a position above the upper end of the low vertical surface 24a of each ratchet wheel 24 and, by rotating the outer cap 22 with the ratchet pawl being pushed against the inclining surface 24c or the high vertical surface 24b of the ratchet wheel 24, the inner cap 21 can be opened or closed.

[0068] In the state in which the outer cap 22 is not pushed down, the ratchet pawl 25 is located on the upper surface of the inclining surface 24c of each ratchet wheel 24 and, when the outer cap 22 is rotated in this state, the outer cap 22 slides over the inclining surface 24 and therefore rotates idly without being coupled to the inner cap 21.

[0069] In the container 1 which is sealed with such safety cap 20, the packing 11 is previously mounted in a manner to abut against the disk portion 7 provided inside of the cylindrical portion 9 of the plug 6 and the safety cap 20 is fitted on the container 1 in a manner to cover the foremost end portion of the mouth portion 2 of the container 1 so that the safety cap 20 is fitted and connected to the container 1 with the engaging flange 5 of the container 1 being engaged with the engaging flange 10 of the plug 6.

[0070] Then the packing 15 is mounted on the top portion of the small diameter portion 21c of the inner cap 21 of the safety cap 20 and then the inner cap 21 is mounted on the container 1 by lightly screwing onto the screw portion 3 of the container 1.

[0071] Further, the outer cap 22 is mounted to cover the inner cap 21 and is pushed down to the extent that the displacement restricting portion 22c of the outer cap 22 overrides the axial displacement restricting portion 21e of the inner cap 21 so that the outer cap 22 can displace vertically (in the axial direction) within a limited distance relative to the inner cap 21 and can rotate concentrically with the inner cap 21.

[0072] In a case where the container 1 is to be sealed by fastening the inner cap 21, the outer cap 22 is pushed down and rotated in the clockwise direction. In this case, as shown in Fig. 6B, by pushing down of the outer cap 22, the ratchet pawl 25 abuts against the high vertical surface 24b by rotation of the outer cap 22 from the state in which the ratchet pawl 25 is located on the upper surface of the inclining surface 24c of the ratchet wheel 24 of the ratchet mechanism 23 whereby rotation of the outer cap 22 is transmitted to the inner cap 21 to rotate the inner cap 21 integrally and thereby cause the inner cap 21 to be fastened to the container 1.

[0073] When the outer cap 22 is rotated in the counterclockwise direction while it is pushed down, the ratchet pawl 25 abuts against the inclining surface 24c of the ratchet wheel 24 so strongly that rotation of the outer cap 22 is transmitted to the inner cap 21 with the force for pushing down the outer cap 22 being continuously applied and the ratchet pawl 25 maintaining its height without being elevated along the inclining surface 24c. The inner cap 21 is thereby rotated integrally with the outer

cap 22 and is disengaged from the container 1 and can be removed from the container 1.

[0074] On the other hand, if an attempt is made to remove the safety cap 20 by rotating the outer cap 22 in the counterclockwise direction without pushing down the outer cap 22, the ratchet pawl 25 is elevated, as shown in Fig. 6A, by sliding along the inclining surface 24c of the ratchet wheel 24 of the ratchet mechanism 23 whereby the outer cap 22 rotates idly and rotation of the outer cap 22 cannot be transmitted to the inner cap 21 and, therefore, the safety cap 20 cannot be removed by rotation. By this arrangement, the child resistance effect can be performed and an erroneous removal of the safety cap 20 can be prevented.

[0075] Accordingly, by using this safety cap 20, leakage of contents of the container 1 by mistake or take-out of the contents by a child by mistake can be prevented.

[0076] According to this ratchet mechanism 23, in the case of rotation in the direction of idle rotation, the ratchet pawl 25 only displaces along the ratchet wheel 24 and therefore idling torque can be reduced almost to zero. Even if the plug opening torque is in the order of $30\text{cN} \cdot \text{m}$ to $40\text{cN} \cdot \text{m}$, by reducing the idling torque substantially to zero, the child resistance effect can be made clear.

[0077] In the above described embodiment, the ratchet wheel 24 of the ratchet mechanism 23 is provided on the inner cap 21 and the ratchet pawl 25 is provided on the outer cap 22. The ratchet mechanism may be constructed by reversely providing the ratchet wheel and the ratchet pawl.

[0078] Although no particular explanation has been made about contents to be received in the container in the above embodiment, no particular restriction is made about the container and contents so long as the contents are those which must be received in the container and kept in a sealed state, or those which are kept in a sealed state and, after the container is opened, are kept in a sealed state again. If the safety cap is used, for example, as a cap of a container of a fuel for a fuel cell, leakage of the fuel by mistake or taking out of the fuel by a child by mistake can be prevented. Particularly, if the safety cap is used as a cap of a container of methanol which is a fuel for a methanol fuel cell, it can be used for sealing the container safely.

[0079] Seal between the foremost end portion of the plug 6 as the plug member and the inner cap 21 is made by providing the packing 15. Alternative seal means may be provided such that, instead of the packing, the inner cap may be provided with a projection which contacts the foremost end portion of the plug member for sealing or the foremost end portion of the plug member may be formed in a shape having a tapering surface reducing the diameter upwardly while the inner cap is integrally formed with a tapering ring which contacts this tapering surface and these tapering surface and the tapering ring contact each other for sealing. In a case where a valve mechanism is provided on the plug 6 which is the plug member, seal between the plug 6 and the inner cap 21

may be omitted. Alternatively, keeping or using of contents can be made further safely by using the two sealing functions.

[0080] As described in detail in the foregoing description, according to this safety cap 20, the safety cap 20 is formed with the screw-type inner cap 21 having the plug 6 as the plug member having a narrowed foremost end portion in the mouth portion 2 of the container and the outer cap 22 which covers the inner cap 21 and is mounted on the inner cap 21 rotatably about the inner cap 21 and also axially slidably within a limited range in such a manner that the outer cap 22 can move integrally with the inner cap 21 by pushing down the outer cap 22 and rotating the outer cap 22 while the outer cap 22 can rotate idly by rotating the outer cap 22 without pushing it down, the plug portion 8 of the plug 6 being formed by projecting from the disk portion 7 abutting against the foremost end portion of the mouth portion 2 of the container, and the inner cap 21 having the small diameter portion 21c formed in the inner middle portion thereof, the small diameter portion 21c being in abutting engagement with the disk portion 7 of the plug 6 and controlling interference by screwing. Therefore, interference by screwing of the inner cap 21 can be controlled to prevent excessive fastening and necessary fastening torque (plug opening torque) can be secured even in a case of a plug member of a small diameter.

[0081] According to this safety cap 20, since the stepped portion 21g is provided on the outside of the small diameter portion 21c of the inner cap 21, a space can be secured and either the ratchet wheel 24 or the ratchet pawl 25 constituting the ratchet mechanism 23 can be provided in this space whereby the child resistant effect can be achieved without significantly enlarging the screw-type cap 20.

[0082] According to this safety cap 20, since the ratchet wheel 24 constituting the ratchet mechanism 23 is formed in a lightened structure and therefore is formed with a necessary outer frame portions 24a to 24d only, a thick portion can be eliminated and the forming cycle using resin can be shortened while functions of the ratchet is maintained.

[0083] Further, according to this safety cap 20, in case the container 1 is a container of a liquid fuel or a container of methanol which is a fuel for a methanol fuel cell, the safety cap 20 satisfies necessary conditions and can be used as a cap of such container, enabling the container to be sealed safely and accurately and enabling contents to be taken out safely and accurately when the contents are needed.

[0084] If, in this safety cap 20, energizing means such as a spring portion is provided integrally between the inner cap 21 and the outer cap 22, e.g., on either the top portion of the inner cap 21 or the top portion of the outer cap 22 by utilizing a space in which the outer cap can displace axially, the outer cap 22 can be separated from the inner cap 21 by means of the spring portion whereby the idle rotation of the outer cap 22 can be secured ac-

curately while restraining the height of the safety cap 20 and the child resistance effect can thereby be achieved more securely.

[0085] If, in this safety cap 20, a check valve is provided on the plug 6 which is the plug member as a valve mechanism for preventing leakage of contents, immediate leakage of the contents can be prevented when the safety cap 20 is removed. Thus, in addition to the child resistance effect, safety and easiness for use can be improved further.

[0086] In a case where a valve mechanism is provided on the plug 6 as the plug member, seal between the plug 6 and the inner cap 21 may be omitted to simplify the mechanism. If the valve mechanism is provided together with the seal, storage and use of contents can be made further safely by the two seal functions.

[0087] In the safety cap 20, in case there is provided a coupler consisting of a socket having a valve and energizing means for energizing the valve in closing direction and a plug having a valve and energizing means for energizing the valve in closing direction and being detachably fitted to the socket, the plug, in the state of being fitted to the socket, opening the both valves to communicate the socket with the plug, and either one of the socket and the plug of the coupler is provided on either one of the plug portion 8 of the plug 6 and a member on a demander side which receives contents of the container 1, and the other of the socket and the plug of the coupler is provided on the other of the plug 6 and the member on a demander side which receives contents of the container 1, the contents can be shifted accurately from the container 1 to the member of a demander side without danger of leakage. Particularly, in a case where the coupler is made of a socket having a valve and a coil spring made of metal which constitutes energizing means for energizing the valve in closing direction and a plug having a valve and a coil spring made of metal which constitutes energizing means for energizing the valve in closing direction and being detachably fitted to the socket, the plug, in the state of being fitted to the socket, opening the both valves to communicate the socket with the plug, and there is provided a housing in the base portions of these valves which can allow reciprocal movements of these valves and can seal these valves, the energizing means for energizing the valves are housed in this housing and a flow path is formed in a space outside of this housing, the coil springs made of metal can be housed in this housing and contact of the coils springs with liquid thereby can be prevented.

[0088] By this arrangement, in a case where it is necessary to prevent contact of methanol in the container 1 with a metal as in the case of a methanol fuel cell, liquid can be supplied to or taken out of the container 1 from which the safety cap 20 is removed without contacting a metal by simple attachment or detachment of the coupler.

[0089] As described in the foregoing, according to the screw-type cap of claim 1 of the present invention, since the cap comprises a plug member attached to a mouth

portion of a container and having a narrowed foremost end portion, and a cap covering the plug member and screwed onto a screw portion of the mouth portion of the container and sealed with the foremost end portion of the plug member, said plug member having a disk portion which is in abutting engagement with a tip end portion of the mouth portion of the container and a plug portion projecting from the disk portion, and said cap having a small diameter portion formed in the inner middle portion thereof, said small diameter portion being in abutting engagement with the disk portion of the plug member and controlling interference by screwing, the interference by screwing of the cap is controlled by abutting engagement of the small diameter portion of the cap with the disk portion of the plug member and excessive fastening of the cap thereby can be prevented and necessary fastening torque (plug opening torque) can be secured even in a case of a plug member of a small diameter.

[0090] According to the screw-type cap of claim 2 of the present invention, since the small diameter portion of the cap is formed by providing a recess in a top portion of a large diameter portion of the cap and the outer configuration of the cap is formed in a cylinder, the small diameter portion can be formed while the outer configuration of the cap is made cylindrical and forming of the cap is facilitated by making thickness of the respective portions substantially uniform.

[0091] According to the safety cap of claim 3 of the present invention, the safety cap is formed with a screw-type inner cap having a plug member having a narrowed foremost end portion in the mouth portion of the container and an outer cap which covers the inner cap and is mounted on the inner cap rotatably about the inner cap and also axially slidably within a limited range in such a manner that the outer cap can move integrally with the inner cap by pushing down the outer cap and rotating the outer cap while the outer cap can rotate idly by rotating the outer cap without pushing it down, the plug portion of the plug member being formed by projecting from the disk portion abutting against the foremost end portion of the mouth portion of the container, and the inner cap having a small diameter portion formed in the inner middle portion thereof, said small diameter portion being in abutting engagement with the disk portion of the plug member and controlling interference by screwing. Therefore, interference by screwing of the inner cap can be controlled to prevent excessive fastening and necessary fastening torque (plug opening torque) can be secured even in a case of a plug member of a small diameter. By this arrangement, the child resistant effect can be achieved by securing the idle rotation accurately.

[0092] According to the safety cap of claim 4 of the present invention, the small diameter portion of the inner cap has a stepped portion on the outside thereof and either one of a ratchet wheel and a ratchet pawl of a ratchet mechanism which can be brought to meshing engagement with each other by pushing down and rotation of the outer cap and can be rotated idly relative to each

other by rotation only is provided on either one of the stepped portion and a top portion of the outer cap and the other of the ratchet wheel and the ratchet pawl of the ratchet mechanism is provided on the other of the stepped portion and the top portion of the outer cap. Since the stepped portion is provided on the outside of the small diameter portion of the inner cap, a space can be secured and either the ratchet wheel or the ratchet pawl constituting the ratchet mechanism can be provided in this space whereby the child resistant effect can be achieved without significantly enlarging the screw-type cap.

[0093] According to the safety cap of claim 5 of the present invention, there is provided energizing means for enabling maintaining of the idle rotation which is provided between the inner cap and the outer cap. Thus, energizing means such as a spring can be provided separately from the ratchet mechanism in a space in which the energizing means can move in axial direction of the inner and outer cap whereby the idle rotation of the outer cap can be secured and the child resistant effect can be achieved more accurately.

[0094] According to the safety cap of claim 6 of the present invention, since the ratchet wheel constituting the ratchet mechanism is formed in a lightened structure and therefore is formed with a necessary outer frame only, a thick portion can be eliminated and the forming cycle using resin can be shortened while functions of the ratchet is maintained.

[0095] According to the cap of claim 7 of the present invention, since the seal between the foremost end portion of the plug member and the cap or the inner cap is substituted by, or added with, a valve mechanism for preventing leakage of contents of the container which is provided on the plug member, leakage of contents immediately after removal of the cap can be prevented and handling can thereby be further facilitated and leakage during storage etc. can be more perfectly prevented.

[0096] According to the cap of claim 8 of the present invention, the cap further comprises a coupler consisting of a socket having a valve and energizing means for energizing the valve in closing direction and a plug having a valve and energizing means for energizing the valve in closing direction and being detachably fitted to the socket, said plug, in the state of being fitted to the socket, opening the both valves to communicate the socket with the plug, either one of the socket and the plug of the coupler being provided on either one of the plug member and a member on a demander side which receives contents of the container, and the other of the socket and the plug of the coupler being provided on the other of the plug member and the member on a demander side which receives contents of the container and, therefore, by fitting and communication between the container and the member of a demander side via the socket and the plug, contents of the container can be shifted accurately without causing leakage.

[0097] According to the cap of claim 9, the container is a container for liquid fuel and, therefore, liquid fuel can

be securely sealed and can be taken out accurately when it is necessary.

[0098] According to the cap of claim 10 of the present invention, the container is a container for methanol and, therefore, the cap satisfies necessary conditions as a container for methanol used for a methanol fuel cell.

Industrial Utility

[0099] As described above, the screw-type cap and the safety cap of the present invention can secure necessary fastening torque (opening torque) even in a case where the cap has a plug portion of a small diameter. In the case of the safety cap, it cannot be opened easily even if a child tries to open it. The cap is useful as a cap of a container and is particularly suitable for a cap of a cartridge container of methanol for a methanol fuel cell.

Claims

1. A screw-type cap comprising a plug member attached to a mouth portion of a container and having a narrowed foremost end portion, and a cap covering the plug member and screwed onto a screw portion of the mouth portion of the container and sealed with the foremost end portion of the plug member, said plug member having a disk portion which is in abutting engagement with a tip end portion of the mouth portion of the container and a plug portion projecting from the disk portion, and said cap having a small diameter portion formed in the inner middle portion thereof, said small diameter portion being in abutting engagement with the disk portion of the plug member and controlling interference by screwing.
2. A screw-type cap as defined in claim 1 wherein the small diameter portion of the cap is formed by providing a recess in a top portion of a large diameter portion of the cap and the outer configuration of the cap is formed in a cylinder.
3. A safety cap as defined in claim 1 or 2 wherein a safety cap is formed with said cap which constitutes an inner cap and an outer cap which covers the inner cap and is mounted on the inner cap rotatably about the inner cap and also axially slidably within a limited range in such a manner that the outer cap can move integrally with the inner cap by pushing down the outer cap and rotating the outer cap while the outer cap can rotate idly by rotating the outer cap without pushing it down, said inner cap having a small diameter portion formed in the inner middle portion thereof, said small diameter portion being in abutting engagement with the disk portion of the plug member and controlling interference by screwing.
4. A safety cap as defined in claim 3 wherein the small

diameter portion of the inner cap has a stepped portion on the outside thereof and either one of a ratchet wheel and a ratchet pawl of a ratchet mechanism which can be brought to meshing engagement with each other by pushing down and rotation of the outer cap and can be rotated idly relative to each other by rotation only is provided on either one of the stepped portion and a top portion of the outer cap and the other of the ratchet wheel and the ratchet pawl of the ratchet mechanism is provided on the other of the stepped portion and the top portion of the outer cap.

5. A safety cap as defined in claim 3 or 4 further comprising energizing means for enabling maintaining of the idle rotation which is provided between the inner cap and the outer cap. 5
6. A safety cap as defined in claim 4 or 5 wherein the ratchet wheel constituting the ratchet mechanism is formed in a lightened structure. 10
7. A cap as defined in any of claims 1 - 6 wherein the seal between the foremost end portion of the plug member and the cap or the inner cap is substituted by, or added with, a valve mechanism for preventing leakage of contents of the container which is provided on the plug member. 15
8. A cap as defined in any of claims 1 - 7 further comprising a coupler consisting of a socket having a valve and energizing means for energizing the valve in closing direction and a plug having a valve and energizing means for energizing the valve in closing direction and being detachably fitted to the socket, said plug, in the state of being fitted to the socket, opening the both valves to communicate the socket with the plug, either one of the socket and the plug of the coupler being provided on either one of the plug member and a member on a demander side which receives contents of the container, and the other of the socket and the plug of the coupler being provided on the other of the plug member and the member on a demander side which receives contents of the container. 20
9. A cap as defined in any of claims 1 - 8 wherein the container is a container for liquid fuel. 25
10. A cap as defined in any of claims 1 - 9 wherein the container is a container for methanol. 30

55

FIG.1

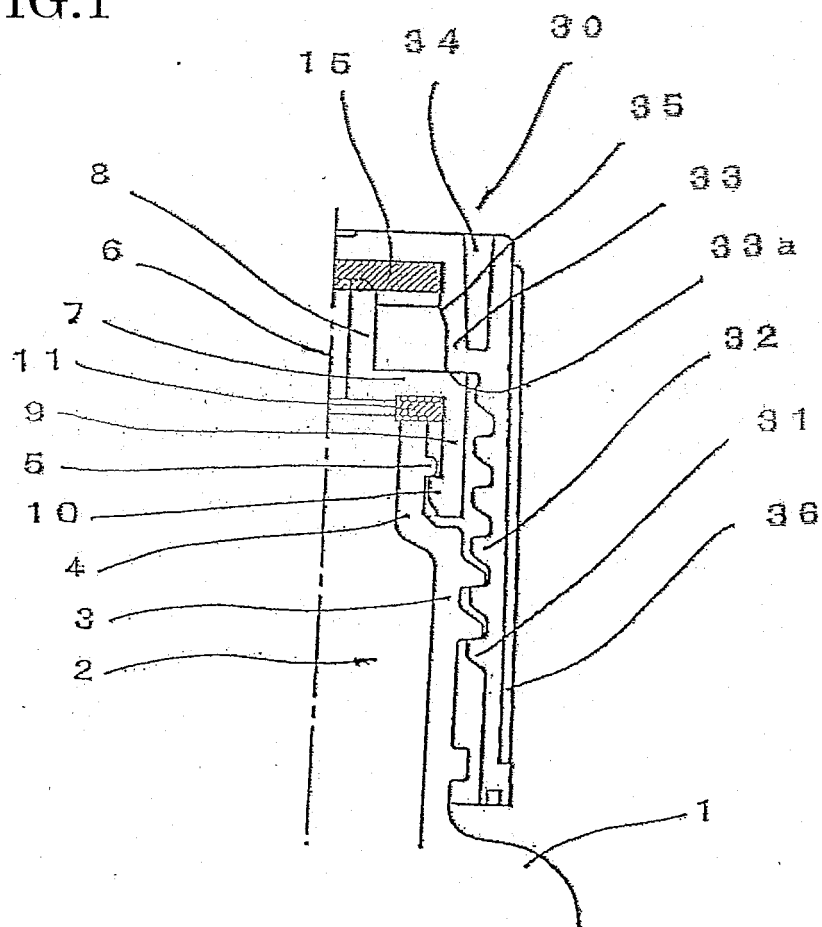


FIG.2

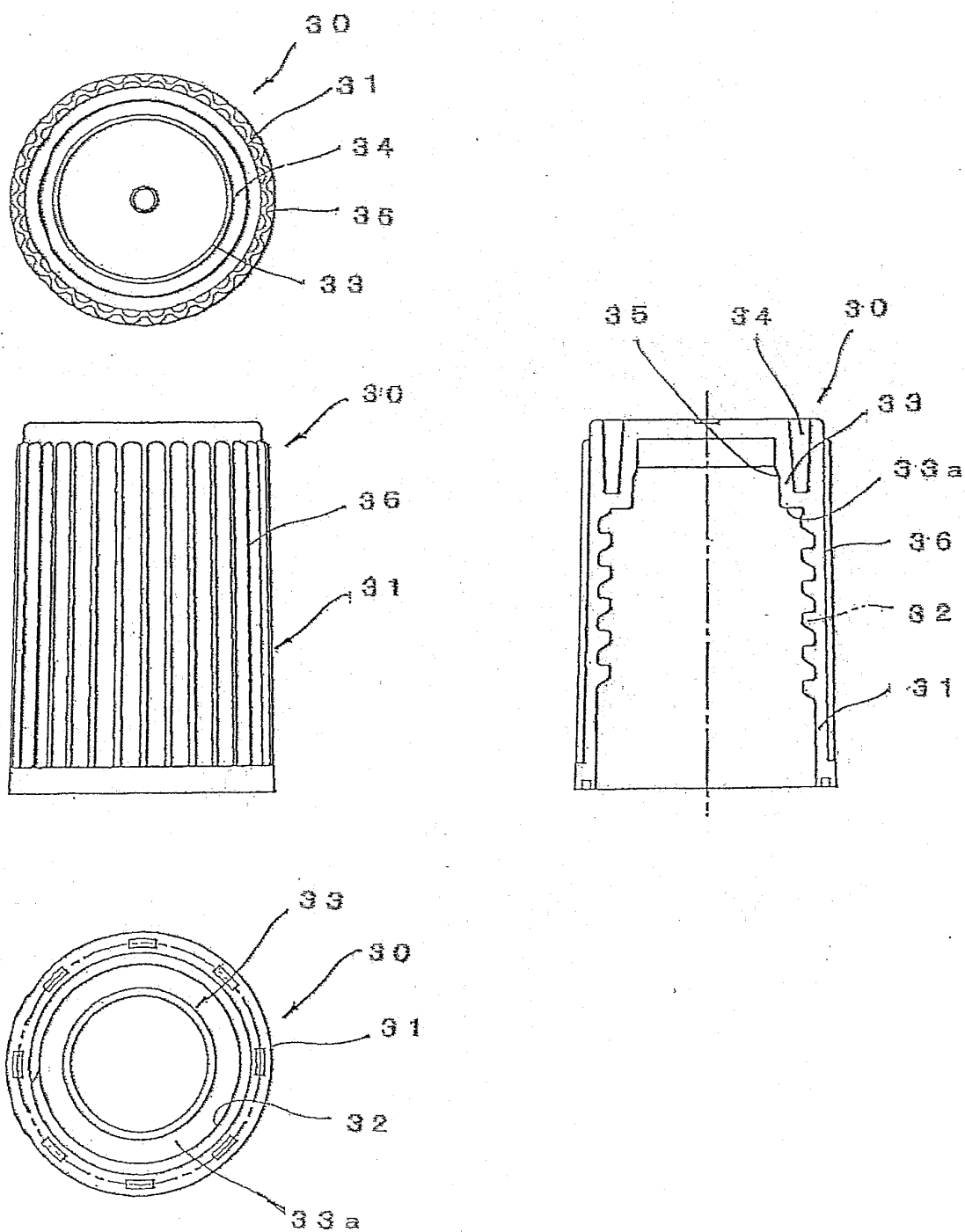


FIG.3A

FIG.3B

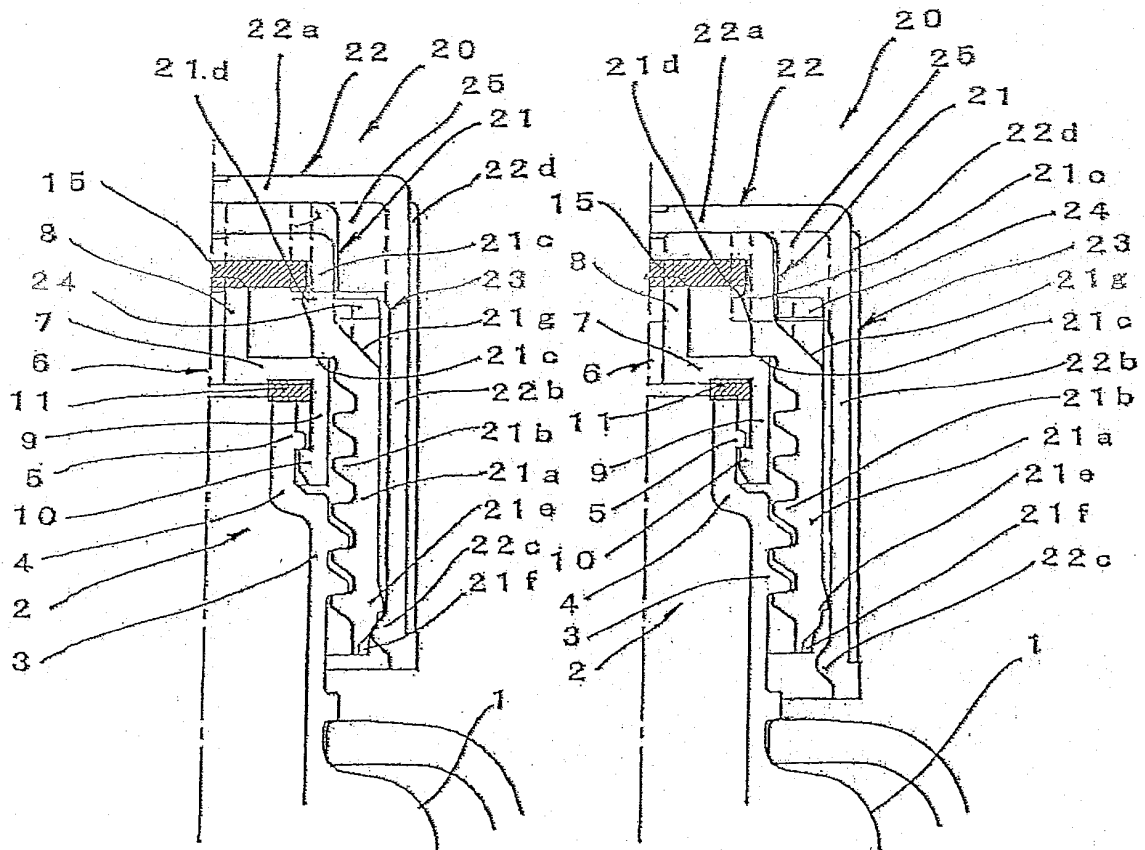


FIG.4

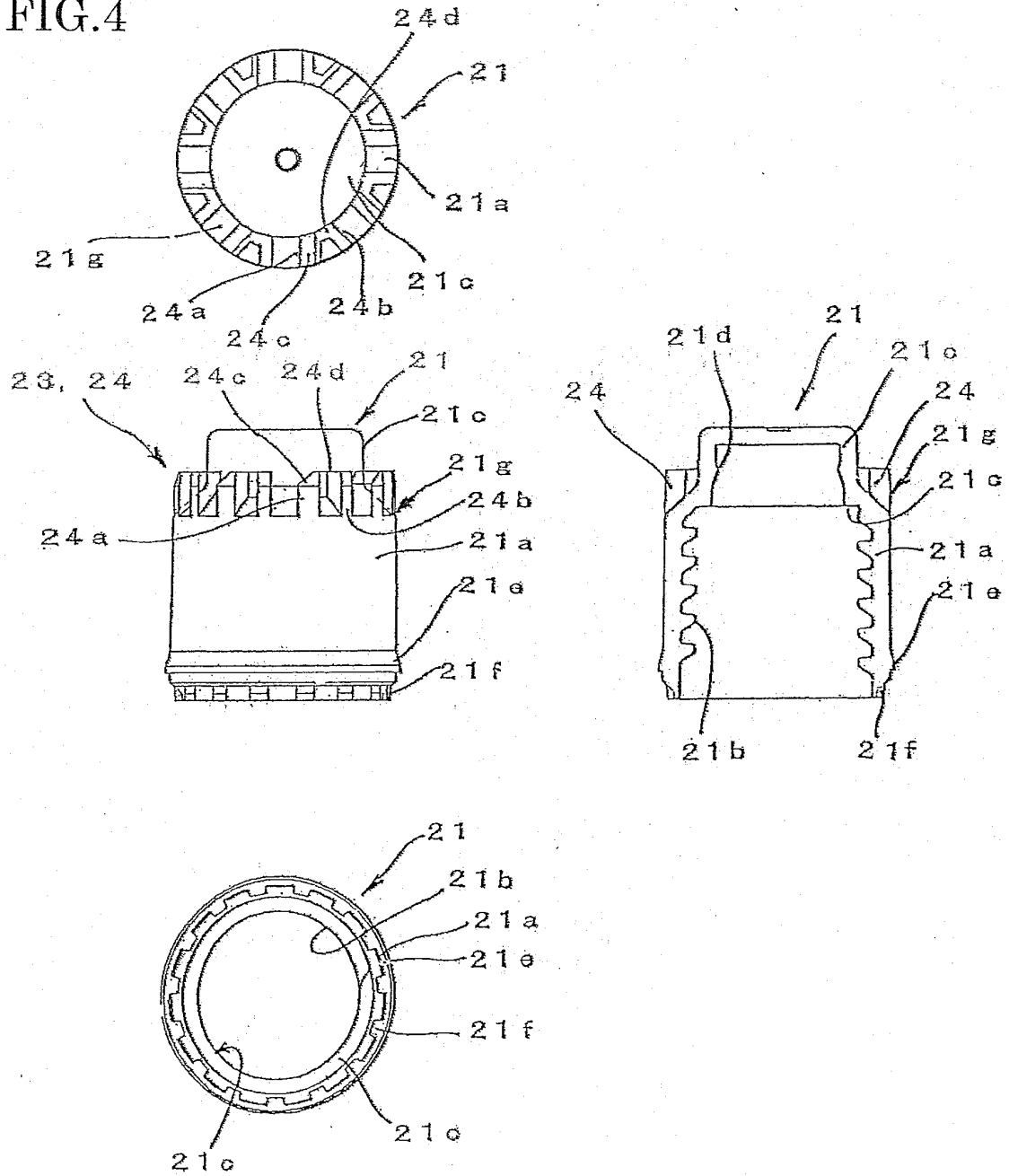
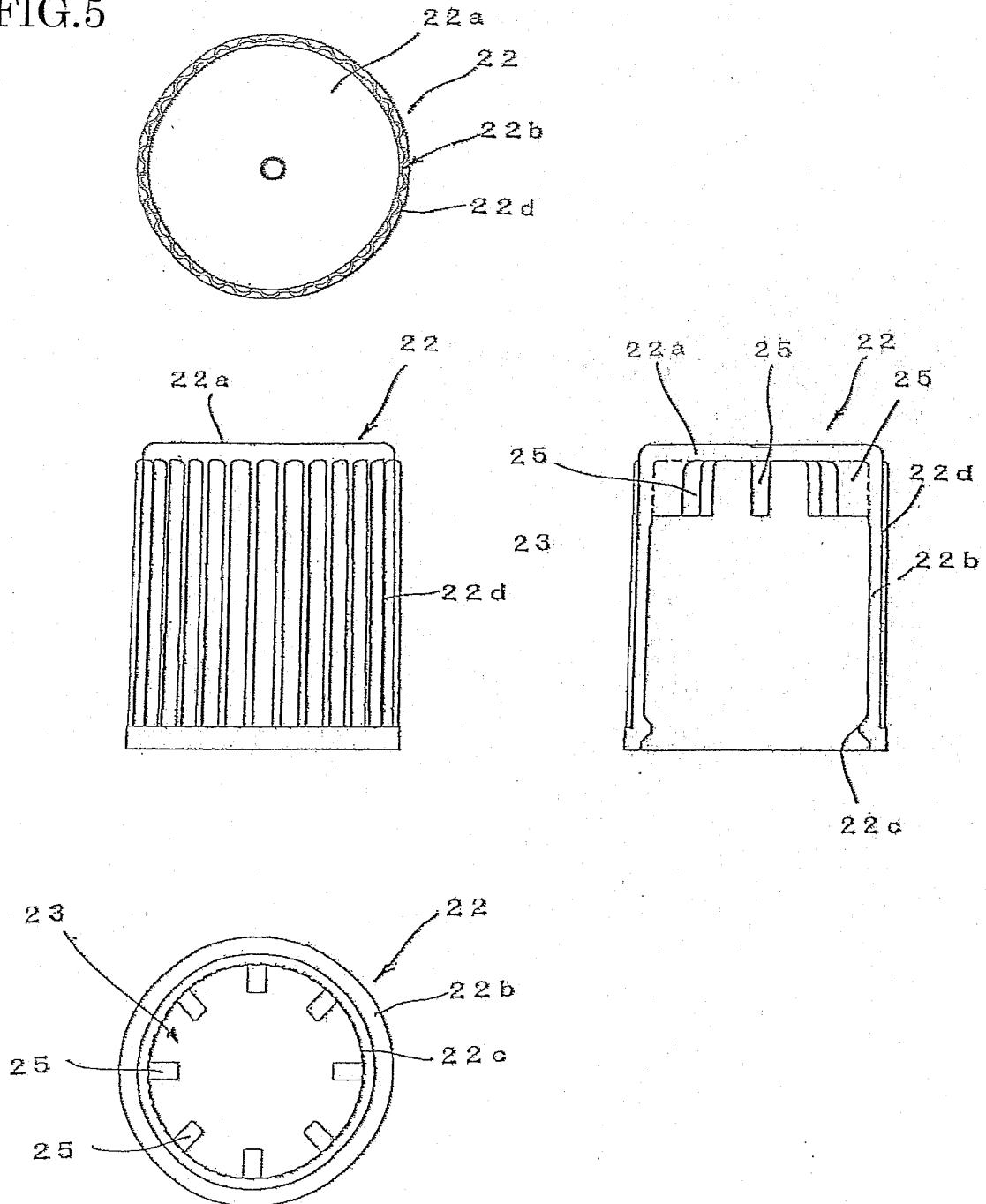


FIG.5



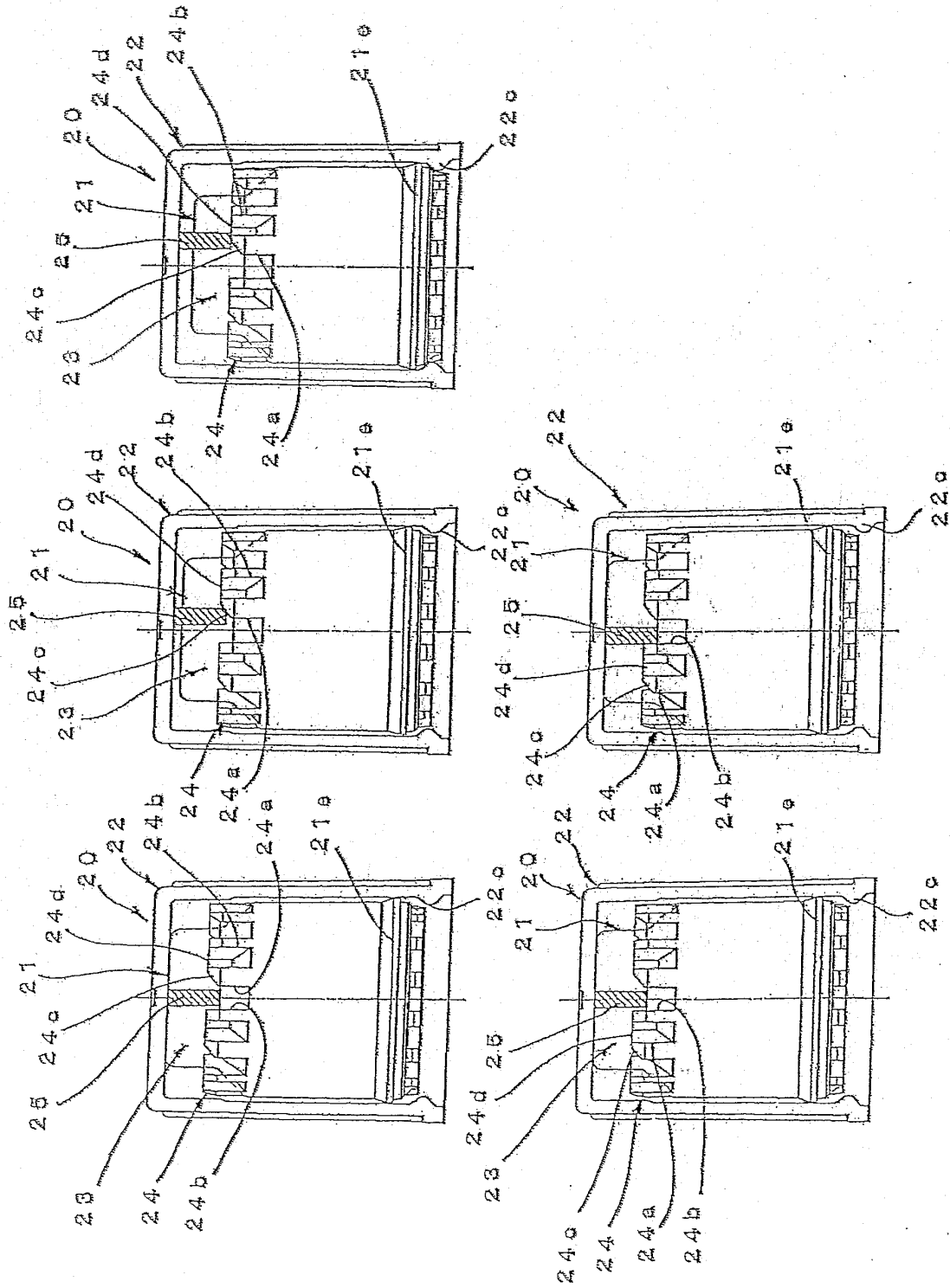
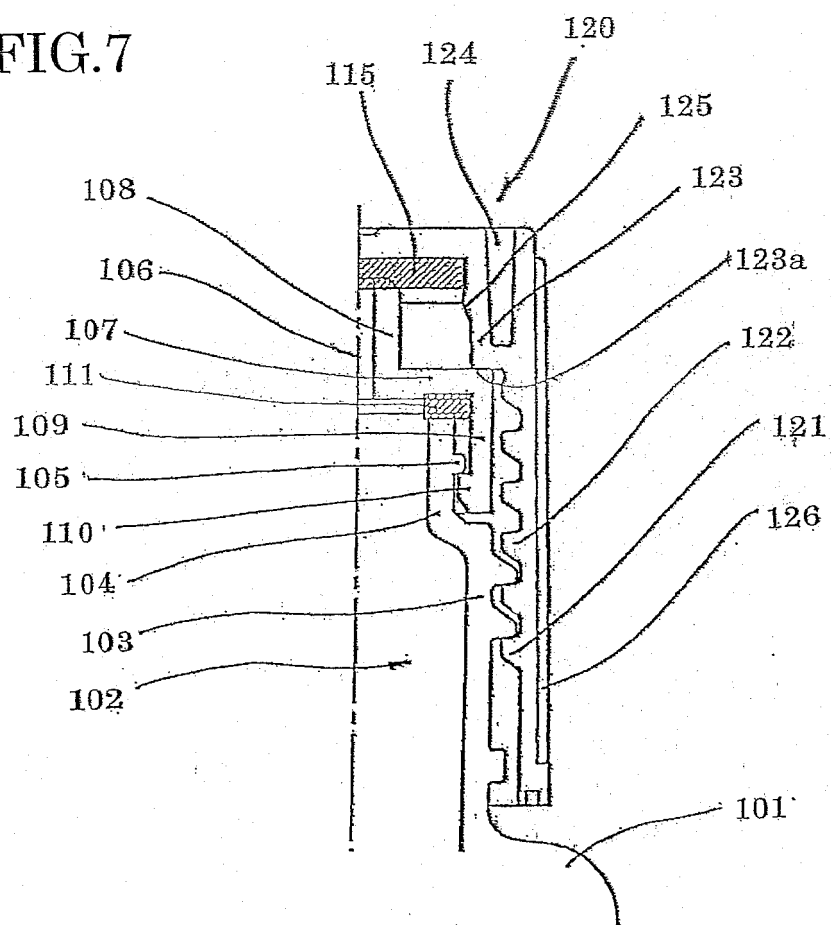


FIG. 6A

FIG. 6B

FIG.7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/318551

A. CLASSIFICATION OF SUBJECT MATTER

B65D41/04(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65D41/04, B65D47/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2006

Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	GB 960929 A (S.C. JOHNSON & SON, INC.), 17 June, 1964 (17.06.64), Page 3, lines 82 to 88; page 4, lines 14 to 19 & CH 000399216 A	1, 2, 7, 9, 10 3-6, 8
Y	DE 3838450 A1 (Fa. Andreas Stihl), 17 May, 1990 (17.05.90), Column 2, lines 55 to 66 & FR 2639030 A	3-6
Y	JP 8-276948 A (Japan Crown Cork Co., Ltd.) 22 October, 1996 (22.10.96), Par. Nos. [0005] to [0007] (Family: none)	3-6

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
23 October, 2006 (23.10.06)Date of mailing of the international search report
07 November, 2006 (07.11.06)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/318551

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2001-355830 A (Sharp Corp.), 26 December, 2001 (26.12.01), Par. Nos. [0048] to [0051] & EP 1256762 A & WO 2001/057441 A1 & CN 1396998 A	8
A	US 5340228 A (The Flagship Group II, Inc.), 23 August, 1994 (23.08.94), Column 6, lines 65 to 68 (Family: none)	1-10
A	US 5634496 A (Teledyne Industries, Inc.), 03 June, 1997 (03.06.97), Fig. 4 & CA 2194939 A	1-10

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/318551

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

A matter common to the inventions in Claims 1-10 is such a point that "the inner plug part is formed by projecting the inner plug member from the disk part abutting on the tip of the container mouth part, and forming the small diameter part allowed to abut on the disk part and restricting the interference on the inside of the intermediate part of the cap". Since the result of search reveals that the matter is not novel since it is disclosed in Document GB 960929 A (S.C. JOHNSON & SON, INC.), 17 June, 1964 (17.06.64). Since the common matter "the inner plug part is formed by projecting the inner plug member from the disk part abutting (continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest
the

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, payment of a protest fee..
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

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on the tip of the container mouth part, and forming the small diameter part allowed to abut on the disk part and restricting the interference on the inside of the intermediate part of the cap" makes no contribution over the prior art, it is not a special technical feature in the meaning of the second sentence of PCT Rule 13.2. Accordingly, there is no common matter to all the inventions in Claims 1-10. Since there is no other common matter considered to be a special technical feature in the meaning of the second sentence of PCT Rule 13.2, any technical relation in the meaning of PCT Rule 13 cannot be found among these different inventions. As a result, it is clear that the inventions in Claims 1-10 do not fulfill the requirement of unity of invention.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP SHO5912541 B [0006] [0007] [0009]