

- [54] **CHILD-RESISTANT ENCLOSURE FOR HAZARDOUS MATERIALS**
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- [52] U.S. Cl. **215/222, 215/223**
- [51] Int. Cl. **B65d 55/02, B65d 85/56, A61j 1/00**
- [58] Field of Search **215/213, 9, 222, 223**

[56] **References Cited**

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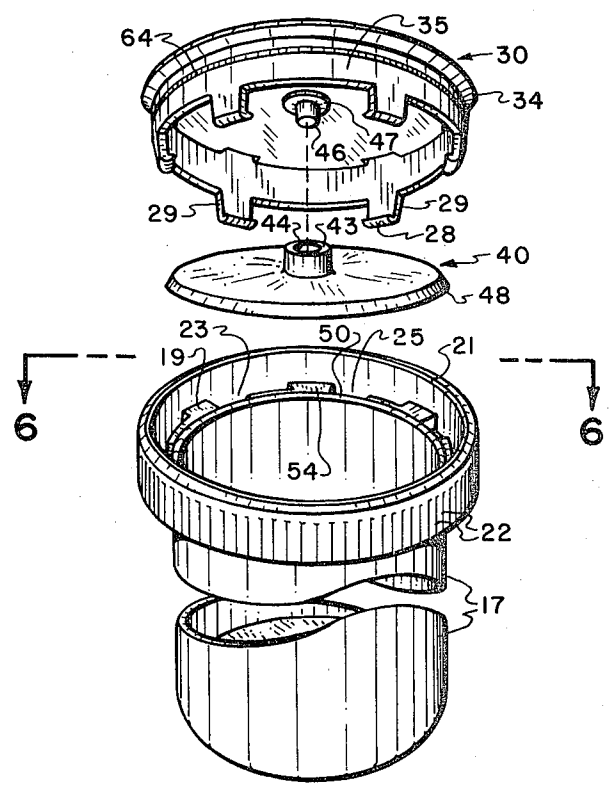
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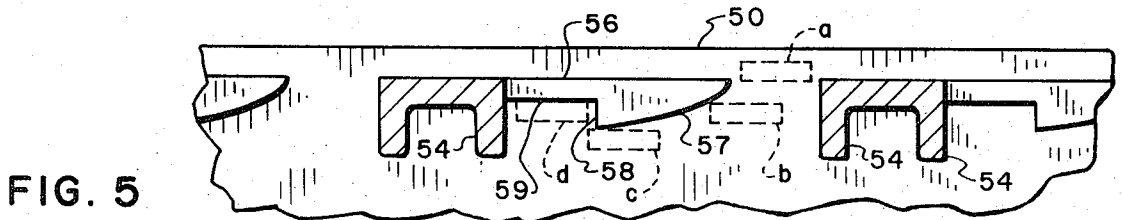
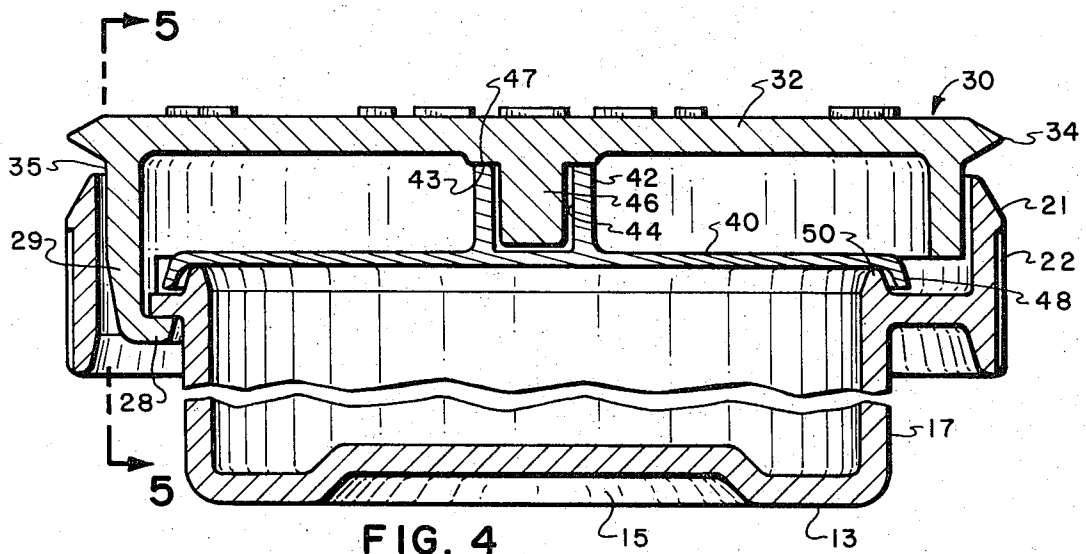
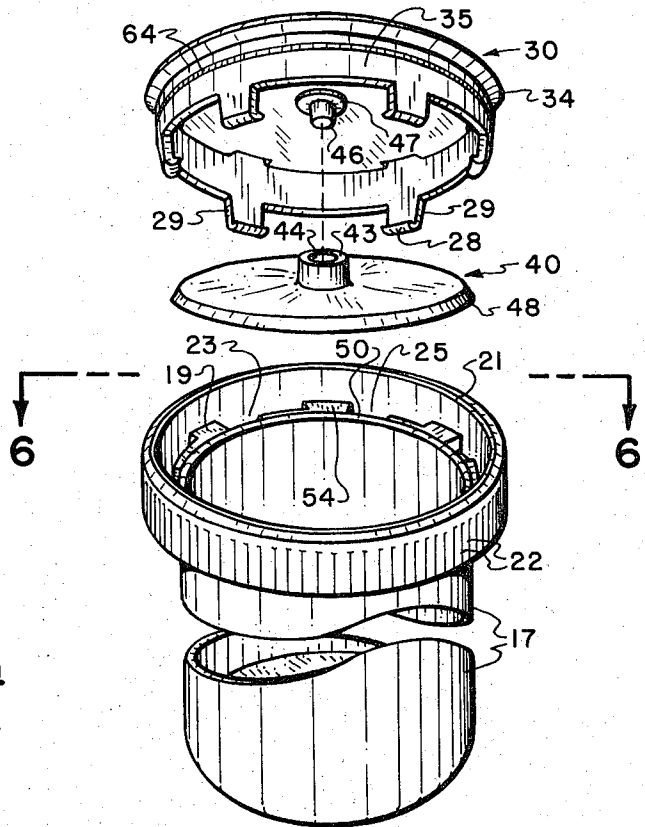
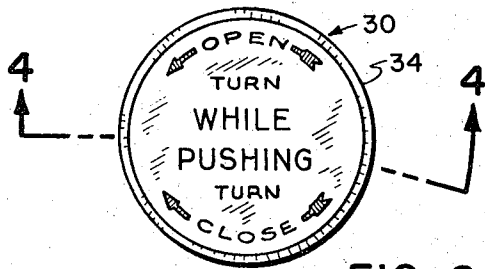
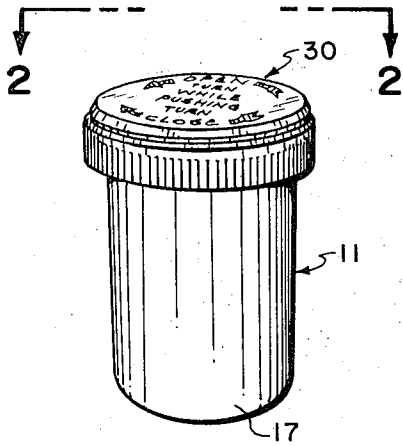
Primary Examiner—George T. Hall
 Attorney, Agent, or Firm—Edwin M. Thomas

[57] **ABSTRACT**
 For poisonous or otherwise hazardous materials, an enclosure or enclosing package comprises a main container body and a tightly engaging closure or stopper therefor. The main container and the closure are provided with mutually interlocking means, the operation

of which is relatively complex for illiterate children but relatively simple for adults who follow operating instructions, preferably printed on the stopper. The stopper or closure is preferably a two-piece structure, comprising a resilient seal which is rotatable but held captive within a carrier cap. For opening, the carrier cap must be rotated with respect to the main body, normally by the user's palm, in a specified direction while it is simultaneously depressed towards the main body and against the resilient reaction of the seal which tends to push the carrier away from the main body. To operate in closing, essentially the reverse procedure is followed, except that the applied torque is opposite to that of opening. The stopper or closure is designed to provide a very limited peripheral surface area for gripping by a child's hands or teeth. A ring is fixed to the container to simulate in position and appearance the rim of a conventional screw cap, diverting efforts to its attempted removal rather than removal of the stopper from within this ring. Locking elements on the carrier engage the sides of slotted portions in an annular web which joins the ring to the main container body. In the two-piece stopper, separate pieces are each provided with an annular bearing surface of relatively small radius so that the torque required to release the closure from the body is minimal, even when the applied axial force is substantial, as it must be for safety.

10 Claims, 11 Drawing Figures





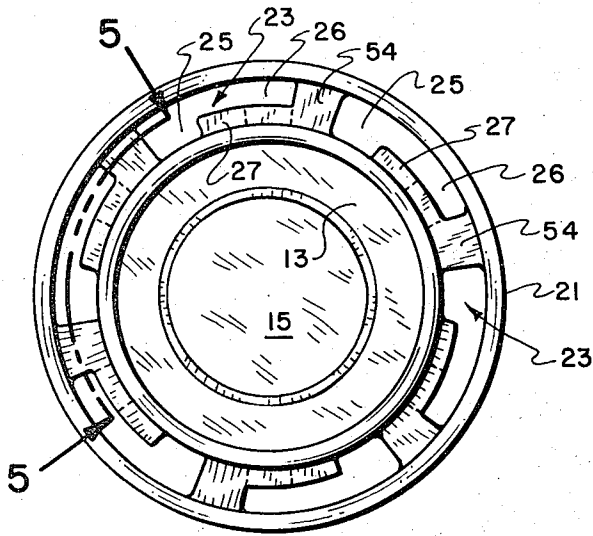


FIG. 6

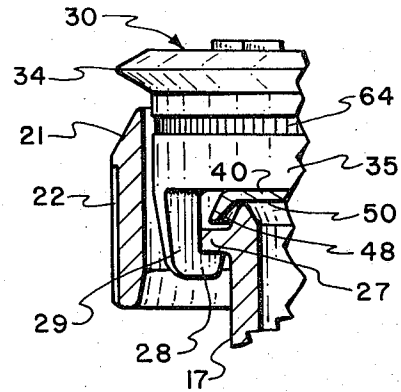


FIG. 7

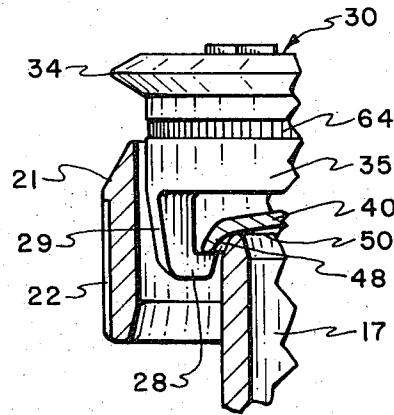


FIG. 8

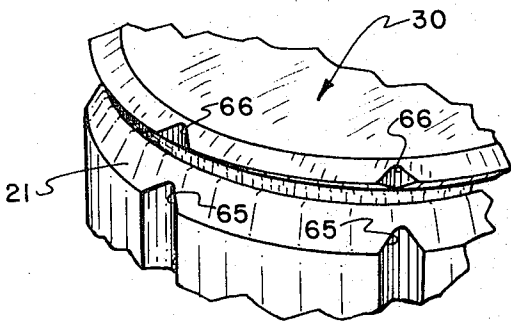


FIG. 9

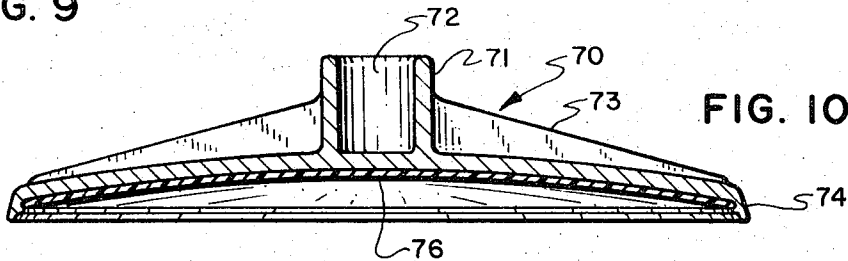


FIG. 10

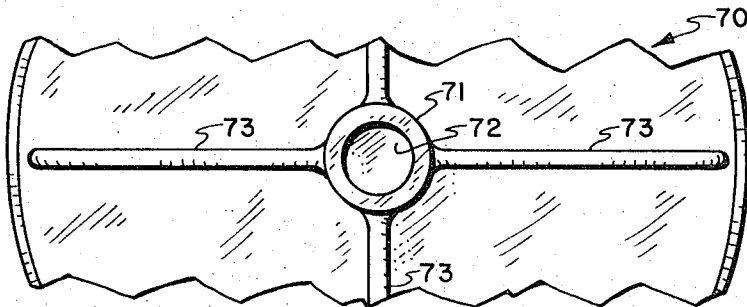


FIG. 11

CHILD-RESISTANT ENCLOSURE FOR HAZARDOUS MATERIALS

BACKGROUND AND PRIOR ART

Large and increasing numbers of small children have been injured by poisoning in recent years, due to their getting access to harmful materials in packages or enclosures which they can open. Drugs, medicines, cleaning compounds, and various toxic compositions have contributed injuries to such an extent that legislation has been enacted which places heavy responsibility on package makers as well as on marketers of such products. This legislation requires that commonly purchased materials found in normal homes, such as aspirin tablets, for example, must be kept in child-resistant containers or enclosing devices.

There is, consequently, a serious need for enclosures or containers for pills, tablets, capsules, powders, and other toxic or potentially toxic materials which cannot be opened by children. Such containers, however, must be capable of being opened for use by the average adult person without unreasonable effort; moreover, they should give good protection to their contents against moisture and other deteriorants. A number of such packages have been designed and placed on the market; some of them are not satisfactory for various reasons, such as lack of safety, undue difficulty in opening by an adult person, etc.

Among the various types of containers or enclosures proposed in the prior art are those known collectively as "palm and turn" types. In these, a locking mechanism is released by applying pressure by the palm of the hand in a direction axially of the container, which may vary widely in specific form. It may be a plastic vial, small bottle, or the like. While holding the parts thus, to keep the lock disengaged, the package body or main receptacle part and the closure are turned relatively, i.e., one with respect to the other, to clear the locking means, after which the closure is removed and the contents exposed. Depending on the shape and design of the container or receptacle, the force required for turning while the parts are held in tight frictional engagement may be very considerable and many complaints have been noted with some types of such receptacles that if a child cannot open a container, an adult can't open it either.

Whatever other merits a "safety" container or enclosure may have, if it cannot be opened for the intended purposes by application of reasonable force by a responsible adult, it is not acceptable. Some of the safety containers of the prior art are too tricky for the average user and he will reject them as unsatisfactory. Some require unusual dexterity; others may be too simple and a clever child, though of tender years, may be able to open them. Some of them are unreliable in operation; after being opened once or twice the locking elements are abraded or worn away and no longer effective. Some involve a "ratchet" action, permitting free or relatively free rotation of the cap while not releasing it. In some cases these invite experimentation by the child with possibly serious results. Some of them can be "forced", even by a fairly small child and hence are not acceptable.

Therefore, some of the objects of the present invention are (1) to develop and make available enclosure containers or receptacles of various sizes, shapes and materials which meet the safety requirements noted

above; (2) to design container and closure means of reasonable complexity and cost, consistent with safety requirements, and (3) to design containers and closures which give good weather protection to the packaged contents and give the necessary protection without being difficult or impossible for authorized adults to open when needed. Further objects are to minimize the turning movement or torque required for unlocking when the parts are subjected to adequate compressive force while making certain that the efforts of a child towards opening the container will be unavailing. Still further objects are to provide visible means for determining immediately whether or not the container is properly locked. Additional objects will appear more fully as this description proceeds.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view of a closed receptacle or enclosure, showing a preferred embodiment of the invention including a main container and a closure element.

FIG. 2 is a top view of the closure element or stopper of FIG. 1, taken substantially from the line 2—2 of FIG. 1.

FIG. 3 is an exploded view of the main container and the two-component stopper or closure element of FIGS. 1 and 2.

FIG. 4 is an enlarged view in vertical section and with parts broken away, of the container and stopper-closure of FIGS. 1 to 3, taken substantially along the line 4—4 of FIG. 2.

FIG. 5 is enlarged fragmentary side view, with parts shown in section, taken substantially along the line 5—5 of FIGS. 4 and 6.

FIG. 6 is a top view of the container of FIGS. 1 to 5, without the stopper-type closure, taken substantially along the line 6—6 of FIG. 3.

FIG. 7 is a fragmentary sectional view of details showing the relationship between interlocking parts when the stopper-type closure, FIGS. 3 and 4, is secured in place.

FIG. 8 is another sectional detail view similar to FIG. 7 but showing the relationship between parts in the unlocked or free position.

FIG. 9 is a fragmentary perspective view, showing a modification of the stopper-type closure and a part of the container.

FIG. 10 is a vertical sectional view showing a modified resilient seal element.

FIG. 11 is a fragmentary top view of the seal of FIG. 10.

DESCRIPTION OF PREFERRED EMBODIMENT

FIGS. 1 and 2 show a first preferred embodiment and FIG. 3 shows an exploded view of an embodiment of the invention in a vial or plastic bottle 11. This is formed of tough plastic material which cannot easily be torn, broken or cut. The material is not subject to damage or destruction by water or by other common liquids. It preferably is made in a single piece by molding and comprises a more or less flat bottom wall portion 13, indented in its central bottom area at 15 to enhance its moldability and its stability when resting on a flat surface. Integral with the bottom wall 13 is a substantially vertical side wall 17. This is of essentially cylindrical configuration, although it may be slightly tapered or of frusto-conical shape to facilitate production by

molding, as will be obvious. Near its top end, the wall 17 is surrounded by an annular web element 19, the top surface of which lies in or substantially in a horizontal plane, i.e., perpendicular to the axis of the container, as shown. This web element 19 projects outward radially all around the upper part of the receptacle body 17 and supports around its periphery a band or ring member 21 which also has a vertical axis, being concentric with wall 19. Ring 21 is essentially a hollow cylinder in form, having its outer surface fluted or knurled as shown at 22 to more closely simulate the rim of a conventional screw cap. The fluting or knurling is not absolutely necessary but is desirable as it enhances the resemblance of the ring 21 to the normal downturned rim of such a screw cap. Thus, it appears superficially at least, to be a part of the cap or closure, rather than part of the main receptacle or container. A child trying to remove it with finger nails or teeth would not be operating on the closure at all, as will be explained. In a sense the ring 21 may be called a "dummy" or false cap, although it has no closure parts or functions. Its vertical width is sufficient to substantially cover the juncture between the container and the true closure, and their locking elements, as will be explained more fully below.

The annular web element 19, which supports the ring 21 and is preferably integral with this ring and with the container body 17, contains a series of perforations or bayonet slots 23, FIGS. 3 and 6. These are elongated arcuately extending slots each having a wider portion 25 at its rear or counterclockwise end, FIG. 6, and a longer narrow slot 26 at its forward or clockwise end. This narrower part 26 has a side bar or rib 27 which serves as a locking element, as will be more fully described below. An inturned hook end 28 on each of a series of depending hook members 29, FIG. 7, projecting downwardly from an upper and outer closure or lid member 30, engages each slot, as will be further explained.

The outer or carrier lid or cap 30 is formed, as best seen in FIG. 4, with a main upper wall 32, which lies substantially in a horizontal plane. Around its peripheral edges, the carrier top is tapered to a very narrow edge 34. The reason for this is to minimize the surface area which can be grasped for turning or pulling on the carrier cap 30. It has a dependent skirt or flange 35 set in somewhat from its extreme outer edge 34. The hook members 29 depend from and are integral with this flange 35. In number and spacing around the flange 35 the hooks are arranged to correspond with and fit the openings 23, etc., in the web member 19, mentioned above. When this carrier lid or cap is locked to the container through the hook 29 and the slot 23, its narrow rim 34 is only slightly spaced above the upper edge of ring member 21, so that these parts 21 and 34 appear superficially to be one unitary cap. This relationship is shown in FIG. 7; see also FIG. 4. FIG. 8 shows the relationship when the hook elements 28 are not engaged with the web 19.

Associated with the carrier member 30 is an inner stopper or sealing member 40. It comprises a resilient circular plate which preferably is not quite flat but slightly crowned. Member 40 is made of resilient material, of sufficient stiffness to push member 30 upwardly from main container 11 and thus hold locking elements 29, 28, 27 in place against the efforts of a small child. It is formed in one piece, in the case of FIGS. 1 to 9 and

has an upstanding central boss 42, with a recess 44 centrally located therein surrounded by a flat annular area 43. A downwardly projecting stud 46, attached in the center of the lower face or carrier member 30 fits in this recess 44. This keeps the seal member 40 centered with respect to the upper member 30. These parts may be cemented together, if desired, but preferably the disc 40 is retained though loosely and freely rotatable within flange 35 by the surrounding dependent hook members 29. The seal 40 has a downturned and rather thin peripheral edge 48 which, when the closure is not secured to the container, rests lightly on the inturned locking parts 28 of the hooks 29, as shown in FIG. 8. This disc can be snapped into place within the hook elements 29 by flexing the disc slightly. The hooks also may yield enough to facilitate such assembly. Once in place, the disc is difficult to remove from the cage formed by the hooks and it is normally retained in assembly with the outer cap 30, whether the latter is associated with a container 11 or not. The thin feather edge 48 is adapted to fit down and around the upper edge 50 of the receptacle wall 17, when the stopper is in place, as clearly shown in FIG. 4. In this Figure, the disc 40 is held under pressure, due to the latching of the hook elements 28 in openings 23, etc., of web member 19. It is then substantially flat and applies an upward force to the carrier cap 30 which keeps the hooks 28 tightly engaged unless and until pressure applied to the top of the carrier lid 30 overcomes this upward force of the flattened seal 40. The seal 40 is designed, taking into consideration its inherent elastic properties, its thickness, diameter, and other physical characteristics, so that the upward force it exerts usually cannot be overcome by a small child. Under this force, the marginal part of member 40 remains in good sealing contact with rim 50 as long as the hooks 29, 28 are engaged with elements 27 of web member 19.

Referring further to web element 19, which secures the ring 21 to the main container body 17, it comprises transverse strut portions 54 extending between and integral with the body 17 and the ring 21. These are located between the bayonet openings 23 previously mentioned. FIG. 6 shows a top view of these parts. FIG. 5 shows two strut portions 54 in section, this Figure being a projection of a curved surface defined approximately by the line 5—5 of FIG. 6. As shown in FIG. 5, the struts 54 are in the form of inverted channel members. Connected to each of these struts, and extending arcuately to the rear or counterclockwise alongside the narrow parts 27 of slots 23, are locking elements 56 of the web member 19. These elements 56 are shaped, when seen in elevation, as shown in FIG. 5, having a rearward down-facing curved portion 57, a vertical plane locking surface 58, and a downwardly facing rest or stop surface 59.

When a lid or cover is to be applied to the main container 11, the cover assembly, as shown best in FIG. 4, is placed over the container with the dependent hook or latch members 29 aligned with the wide parts 25 of bayonet openings 23. In FIG. 5 one of the hook ends or transversely extending lock elements 28 is shown as a small dotted rectangle in four different positions, *a*, *b*, *c* and *d*. In the first position *a*, it is shown to the right of member 57 and above the wide opening part 25 in the web member 19. This web member comprises elements 54, 56, etc., as well as the bayonet slots 23. As the lid assembly is pushed down, the hook elements 28

pass through the wide ends 25 of slots and then to the left; this is the second position *b*, where the member 28 is under and in contact with the downwardly facing curved surface 57 of element 56. The lid is pressed down farther, and turned to move element 28 farther to the left, FIG. 5, and still lower, to its third position *c*. Here it has reached its lowest point, now being under the left end of sloping surface 57. Finally, it is turned (moved still farther to the left) to clear the surface 57 and, due to resilience in seal member 40, it snaps up against retaining or rest surface 59. In this last or fourth position *d*, it positively locks the carrier 30, and all parts secured thereto, against rotation in either direction. The vertical surface 58 on the right, FIG. 5, prevents turning counterclockwise (FIG. 2) to unlock the hooks, whereas the strut 54 at the left of element 28 prevents further turning to the left (FIG. 5). Until and unless the carrier 30 is pressed down far enough for element 28 to clear the vertical locking surface 58, the hook elements cannot be disengaged from surfaces 59 and the container remains closed.

The frictional relationship between the upper carrier disc 30 and the lower or sealing disc 40 will now be described. As previously explained, the disc 40 is resilient and may be deformed by pressure applied to the top of carrier 30. The reaction force of this deformation holds the cap locked to the container and this force must be overcome before the parts can be disengaged. This reaction force is transmitted to the carrier cap 30 through the small annular surface 43 on top of the central boss 42 of member 40. This small annular area 43 contacts a similar area 47 on the lower face of member 32 (the body of the disc 30), FIG. 3. These contacting small annular areas are under considerable unit pressure and a turning moment or torque *t* is required to overcome the frictional resistance they offer to relative rotation between the upper and lower parts. As soon as the outer periphery of disc 40 engages the top edge 50 of receptacle wall 17 by substantial friction, it is no longer rotatable. The large radius of contact and substantial areas of the contacting parts preclude such rotation. In order to rotate the upper disc 30, the frictional resistance between areas 43 and 47 must be overcome. The required torque *t* is proportional to the product of the force *n*, applied normally to these surfaces, to their radii *r*, and to the coefficient of friction *u* between the contacting surfaces, that is $t = u r n$. Since *r* at this area of contact is quite small, the product of $u r n$ is likewise small, much smaller than it would be if, for example, the seal member 40 had to be rotated with respect to the large-radius contacting surface 50. Some of the prior art safety receptacles require relative movement around the rim of the container, just as would be required here if member 40 had to be turned with respect to rim 50 while under the pressure required to unlock the engaged locking parts. For this reason, some of them are too difficult to turn; persons, even adults of moderate strength, have found it impossible to turn the cap to unlock the mechanism, even though the force required to unlatch (force applied by pressure of the palm of the hand) is not unreasonably great. The small radius of the contacting areas described above avoids this difficulty. The parts may be turned with relative ease after the locking means are released by substantial pressure on the cap applied by the palm of the hand.

It is desirable to provide visible means on the enclosure package to indicate at a glance when it is not prop-

erly closed. For this purpose, a distinctively colored stripe or band 64 is provided around the downwardly extending peripheral flange of the upper or outer cap, as shown in FIGS. 3, 7 and 8. This stripe is not visible when the cap is tightly closed but is plainly seen if the cap is merely resting on the top of the container as in FIG. 8. Compare FIGS. 7 and 8.

In lieu of or in addition to the stripe or band 64 on the flange of the outer cap, pointer or marker means 65 and 66 may be formed on the upper edge of band 21 and on the outer cap member 30, respectively. These are so placed that when the parts are properly locked together the pointers are in alignment, as seen in FIG. 9. If the pointers are not aligned, this is clear visual indication that the parts have not been turned fully to locking position.

FIGS. 10 and 11 show a modification of the inner plug or sealing cap member 70 which may replace the member 40 of FIGS. 1, 3, 4, 7 and 8. In this case the member 70 is formed as an elastic domed structure, having the upraised central boss 71 provided with a central opening 72 to receive a downwardly projecting stud, such as shown at 46 in the modification described above, FIGS. 3 and 4. In the case of FIGS. 10 and 11, the cap or closure 70 is provided with reinforcing or stiffening ribs 73 which enhance its resistance to deformation and thus require greater pressure to bring the interlocking elements (not shown in these Figures) into proper engagement. This is particularly desirable in cases where the cap 70 is of relatively large diameter or is formed of relatively thin and flexible material.

On its lower surface, the cap 70 is provided with a sealing element or layer 76 which is of material having superior properties for excluding air, moisture, etc. The use of such a liner enhances protection of the contents of the package against entry of unwanted vapors such as moisture, which may be particularly needed in cases where the contents are deliquescent or subject to damage by moisture. The body of the cap 70 supports and backs up the liner in its sealing function, its marginal edges 74 being formed down and around the edges of the liner to retain it in proper position.

The materials selected and the design of the container may vary quite widely, depending on the sizes required and the specific properties of the material employed. A tough synthetic resin which can be precision molded is preferred; in any case, it should have the requisite strength, resilience, resistance to moisture and weather, etc. It will be obvious to those skilled in the art that other modifications not mentioned above may be made without departing from the spirit and purpose of the invention. It is intended by the claims which follow to cover those obvious changes in form and detail which would suggest themselves to those skilled in the art, as broadly as the state of the prior art properly permits.

What is claimed is:

1. A safety receptacle or enclosure for hazardous materials of the character described for preventing access by small children to contents which comprises, in combination, a main container body having a peripheral wall and a bottom, said wall having a closure-receiving upper sealing rim around its opening, a cap-simulating ring secured to said container and surrounding but annularly spaced from said upper rim, first locking elements on the container body disposed between said ring and said peripheral wall, an upper carrier cap

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member having dependent locking elements adapted to engage cooperatively with said first locking elements by relative rotational movement, said cooperative locking elements including means for positively blocking said elements against said relative rotational movement, and resilient means associated with the carrier cap member for urging said carrier cap away from the said upper rim of the main container body, thereby forcibly holding the locking elements in locked and blocked position, said resilient means being of such strength and resilience as to apply an urging force greater than that which a small child is physically capable of overcoming.

2. A receptacle or enclosure according to claim 1 which includes an inner sealing cap or plug element supported by the carrier cap and adapted to engage said upper rim of the container body with effective sealing force when said locking elements are interengaged.

3. A receptacle or enclosure according to claim 1 in which an inner sealing cap or plug is mounted in compressible resilient relationship with respect to the carrier cap member, said cap or plug comprising resilient means which produce the holding force for the locking elements.

4. A receptacle or enclosure according to claim 1 which includes a web element securing the cap-simulating ring firmly to the main container body, a plurality of locking slots in the form of bayonet openings being set in said web element, and a hook means on said dependent locking elements for engaging a web under-surface adjacent each of said bayonet openings.

5. A receptacle or enclosure according to claim 4 in which the bayonet slots comprise multiple surfaces for engagement with the hook means, said multiple surfaces including a vertical surface adapted positively to prevent relative rotational movement between the hook means and said bayonet slots when the hook means are engaged with said web under surfaces.

6. A receptacle or enclosure according to claim 4 in which the bayonet slots are each bounded by a peripheral surface and an under locking surface, said web ele-

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ment also including a vertical surface for positively preventing rotational movement of the hooks for disengagement with said slots, and wherein the resilient means holds the hook and bayonet slot elements parts in locking engagement with an urging force greater than a small child can overcome.

7. A receptacle or enclosure according to claim 1 which includes a sealing element supported by the carrier cap and in which the resilient urging force to be overcome for unlocking the receptacle is applied to respective annular areas of small radius on the carrier cap and the sealing element to limit the torque force required for turning the carrier cap with respect to the sealing element.

8. A safety receptacle or enclosure according to claim 1 in which the main container body is circular in horizontal section and which comprises an integral annular web connecting the cap-simulating ring with the main container body, a series of bayonet slots each having respectively wider and narrower slot portions, an equal number of hook elements dependent from and integral with said carrier cap, each hook being adapted to move freely into and out of the wider slot portion but to be locked to the web when moved rotatively into the narrower slot portion.

9. A safety receptacle or enclosure according to claim 8 in which vertical locking surfaces on the annular web are positioned to positively prevent relative rotational movement between the hook elements and the narrower slot portions unless the carrier cap is moved towards the main container body with sufficient force to overcome said urging force.

10. A safety receptacle or enclosure according to claim 9 wherein an inner sealing element is carried by the carrier cap to engage the main container upper rim firmly when said hooks are engaged in said narrower slot portions, said carrier cap and said sealing element bearing respectively opposing and similar annular bearing areas of substantially smaller radius than the circular section of the main container body.

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