A shipping container for a bottle of radioactive material comprises a can having a safe therein for receiving the bottle, a screw cap for the can and the safe, and an annular bottle retainer extending downwardly in the safe from its upper end having an outwardly extending flange at its upper end clamped between the cap and the upper end of the safe and an inwardly extending flange at its lower end receiving the neck of the bottle. The cap carries a sponge to absorb spillage from the bottle.

9 Claims, 6 Drawing Figures
FIG. 4

Diagram showing a cross-sectional view of a device with labeled parts.

Legend:
- 47
- 13
- 101
- 43
- 105
- 19
- 5
- 103
- 9
- 107
- 27
- 109
- 23
- 29
SHIPPING CONTAINER FOR A BOTTLE OF RADIOACTIVE MATERIAL

BACKGROUND OF THE INVENTION

This invention relates to shipping containers, and more particularly to such a container for a bottle containing a radioactive material such as a radioactive pharmaceutical product.

The invention is in the same field as the container shown in the coassigned U.S. Pat. No. 3,531,644.

SUMMARY OF THE INVENTION

Among the several objects of this invention may be noted the provision of an improved shipping container having a safe therein for the safe transport and storage of a bottle containing a radioactive material, such as a radioactive pharmaceutical, which, while adapted to retain the bottle in the safe when the safe is inverted for suctioning out the bottle contents via a needle, also enables withdrawal of the bottle from the safe for reading the label on the bottle without undue danger from radiation; the provision of such a container wherein part of the bottle retainer is also utilized to provide a seal between the closure of the container and the safe; and the provision of such a container with means enabling removal of the screw cap of a screw-cap bottle while the bottle remains in the safe.

In general, a shipping container of this invention comprises an outer container having an open top and a receptacle constituting a safe within the outer container, the safe being open at the top for receiving a bottle. A closure is removably secured to said outer container for closing the top of the safe, and a bottle retainer is removably mounted in the safe extending downwardly in the safe from the upper end of the latter having an upper end portion disposed between the closure and the upper end of the safe and a lower end portion formed relatively closely to receive the neck of a bottle in the safe.

Other objects and features will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical section of a shipping container embodying the present invention;

FIG. 2 and FIG. 3 are horizontal sections on lines 2—2 and 3—3, respectively, of FIG. 1;

FIG. 4 is a vertical section similar to FIG. 1 showing a modification;

FIG. 5 illustrates the use of a cap-removing tool in conjunction with the FIG. 4 modification; and

FIG. 6 is a partial right-side view of a tool illustrated in FIG. 5.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1–3, there is generally indicated at 1 a shipping container of this invention for holding a bottle indicated in phantom at 3, the bottle containing a radioactive material. The shipping container 1 comprises an outer container 5 having an open top or upper end indicated at 7, and a receptacle 9 constituting a "safe" within the outer container, the safe being open at its upper end 11 to receive the bottle 3. A closure 13 is removably secured to the outer container 5 for closing the top of the safe 9 (and container 5), and a bottle retainer 15 is removably mounted in the safe 9, extending downwardly in the safe from the upper end thereof. The bottle retainer 15 has an upper end portion 17 disposed between the closure 13 and the upper end 11 of the safe 9 and a lower end portion 19 formed relatively closely to receive the neck of the bottle 3 in the safe.

The outer container 5 is constituted simply by a can having a cylindrical body 21 of fibreboard or any other suitable material (it need not be radiation-shielding) having a sheet metal bottom 23. The closure 13 is a screw cap type of closure and the body of the can is exteriorly screw-threaded at the top as indicated at 25 for screwing on the closure. The safe 9 has a lower cylindrical portion 27 of smaller outside diameter than the inside diameter of container 5, a raised bottom 29 (which may be formed integrally with portion 27), and an enlarged upper portion 31 including an upper cylindrical rim 33 having a relatively close fit in the can and flaring transitions 35 and 37 from the upper end of the lower portion 27 to the lower end of the upper cylindrical rim 33. The height of the safe corresponds generally to the height of the can 5 so that the upper edge 11 of the rim is generally at the same level as the upper edge of the can body 21. The lower portion 27 of the safe is of slightly greater diameter than the bottle, and of such height that the shouldered portion 39 and the neck 41 of the bottle project up out of the lower portion 27.

For holding bottles containing relatively highly radioactive material, the safe may be made of lead or other suitable radiation shielding material. For holding bottles containing materials of relatively low radioactivity, the safe may be molded of polyethylene or other suitable plastic material.

Generally, for shipment of a bottle of a given radioactive material, a selection will be made of a lead safe of appropriate thickness, or a polyethylene safe, whichever will meet the requirements of the U.S. Department of Transportation's regulations for shipment of hazardous materials, and whichever is the most economical to use. Lead safes may be supplied in two thicknesses, for example, one-eighth or one-quarter inch.

The closure 13 comprises a sheet metal screw cap having a circular screw-threaded rim 43 adapted to be screwed down on the upper end of the can 5. For use with a lead safe in the can, there is provided on the inside of the cap 13 (i.e., on its bottom) a shield constituted by a disk 45 of lead or other suitable radiation-shielding material. In conjunction with the use of a polyethylene safe holding a bottle containing a material of relatively low radioactivity, this disk may be omitted. There is also provided on the bottom of the cap (below the disk 45) a sponge 47 composed of suitable plastic sponge material, for example, for absorbing spillage from the bottle 3. The lead shield or disk 45 and the sponge 47 are held captive to the cap by a retainer 49, which may be molded of polyethylene or other suitable plastic, secured at its upper end to the cap and having an annular skirt 51 of inverted frustoconical form extending downwardly on the outside of the sponge 47 with an inwardly extending annular flange 53 at the lower end of the can 5 to hold up the sponge. The retainer has an outwardly extending annular flange 55 at the upper end of the skirt 51 and an upwardly extending rim 57 at the periphery of flange 55 extending
around the disk and fitting in and suitably secured (as by having a snap fit) in the rim 43 of the cap above the threads of the rim 43. The disk 45 has an annular flange 59 extending downwardly on the inside of the skirt 51 of the retainer 49 for shielding against radially outwardly directed radiation.

The sponge 47 has a recess 61 in its lower end for re-ception of the upper end of the bottle 3, the central opening 63 defined by the bottom flange 53 of the retainer 49 having its diameter corresponding generally to that of the recess 61 for passage of the upper end of the bottle. The sponge, as illustrated, is conveniently formed in two parts, an upper solid circular part 65 and a lower ring 67, the opening in the latter providing information on the bottle. When the clinician effects the concerted displacement movement of the bottle 3 and retainer 15, it should be noted that the clinician's fingers are gripping the retainer flange 17, which is a substantial distance above the bottle; thus the clinician is relatively safe from the radiations of the radioactive material in the bottle. The clinician may thereafter return the bottle 3 and retainer 15 toward their original positions in the safe 9 and apply a downward force on the retainer grippingly to reengage its upper portion with the rim portion 33 of the safe.

When the clinician desires to extract radioactive material from the bottle 3, the can 5 may be inverted to invert the bottle, while maintaining safe 9 in the can 5. Inversion of the bottle may be desirable to avoid extraction of air along with the radioactive material via the usual tubular needle pierced through the bottle stopper (not shown). When the can 5 and safe 9 are inverted, the retainer end wall 19 functions to hold up the bottle, and also to resist the retraction force of the needle being withdrawn from the stopper of the bottle.

Referring now to FIGS. 4-6, a shipping container 101 is shown having substantially the same component parts and functioning in the same manner as the previously described shipping container 1 with the following exceptions:

Container 101 is particularly adapted to hold a so-called oral solution bottle, indicated in phantom at 103 having a screw cap 105. The neck of the bottle is grippingly engaged by the bottle retainer lower end flange 17. The base portion of the bottle is received in a recess 107 in a resilient insert or bottle socket 109 (made of rubber, for example) which has a tight fit in the lower portion 27 of the safe. With the bottle 103 so positioned in the insert in the safe 9, the sponge 47 is engaged with the bottle cap 105 and exerts some pressure on the bottle resiliently to hold it against heightwise movement in the safe. For unscrewing the cap 105 from the bottle 103, there is provided a tool 111 in the form of a wrench having a socket 113 provided with a resilient insert 115 (made of rubber, for example) having a recess 117 therein. The socket is placed over the cap 105 to enter the cap in the recess 117 and the clinician then applies a slight downwardly directed force on the wrench to urge the insert into gripping engagement with the cap and also urge the bottle 103 into gripping engagement with the safe insert 107. Then, the clinician turns the wrench while maintaining the downwardly directed force in order to unscrew the cap 105 from the bottle 103 while the bottle remains in the safe 9. The resilient gripping engagement between the bottle and safe insert 107 prevents rotation of the bottle relative to the safe 9, and the resilient gripping engagement between the wrench insert 111 and the cap 105 effects unscrewing of the cap from the bottle.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

3,882,315
1. A shipping container for a bottle which contains a radioactive material, the bottle having a neck, said container comprising an outer container having an open top, a receptacle constituting a safe within the outer container, said safe being open at the top for receiving a bottle, a bottle retainer removably secured to said outer container for closing the top of the safe, and a bottle retainer removably mounted in the safe extending downwardly in the safe from the upper end of the latter having an upper end portion disposed between the closure and the upper end of the safe and a lower end portion formed relatively closely to receive the neck of a bottle in the safe, said closure, when secured to said outer container positively holding said safe and said retainer in position within the outer container, said closure having means on the bottom thereof for absorbing spillage from the bottle, said absorbing means comprising sponge means held captive to the closure and having a recess in its lower end for reception of the upper end of the bottle.

2. A shipping container as set forth in claim 1 wherein the safe is formed of radiation-shielding material and the closure comprises a cap fitting on the upper end of the outer container, a disk of radiation-shielding material in the cap, the sponge means extending down from the disk, and having a retainer for holding the disk in the cap with the sponge means extending down from the disk.

3. A shipping container as set forth in claim 2 wherein the retainer for the disk and sponge means has an annular skirt extending downwardly on the outside of the sponge means, the upper end of the skirt being secured to the cap, the skirt having an inwardly extending annular flange at its lower end holding the sponge means, the latter flange defining an opening for reception of the upper end of the bottle.

4. A shipping container as set forth in claim 3 wherein said bottle retainer has an annular skirt extending downwardly in the safe, the skirt having an outwardly extending annular flange at its upper end constituting said upper end portion disposed between the closure and the upper end of the safe, and a bottom wall constituting said lower end portion having an opening adapted relatively closely to receive the neck of the bottle, and the skirt of the retainer for the disk and sponge means has an outwardly extending annular flange at its upper end engaging the bottom margin of the disk and sealing downwardly against the flange of the bottle retainer.

5. A shipping container as set forth in claim 4 wherein the disk has a downwardly extending flange on the inside of the skirt of the retainer for the disk and sponge means.

6. A shipping container as set forth in claim 5 wherein the outer container is cylindrical, and the safe has a lower portion of smaller diameter than the outer container for relative close fit of a bottle therein, and an enlarged upper portion accommodating said retainers and sponge means.

7. A shipping container for a bottle which contains a radioactive material, the bottle having a neck, said container comprising an outer container having an open top, a receptacle constituting a safe within the outer container, said safe being open at the top for receiving a bottle, a closure removably secured to said outer container for closing the top of the safe, and a bottle retainer removably mounted in the safe extending downwardly in the safe from the upper end of the latter having an upper end portion disposed between the closure and the upper end of the safe and a lower end portion formed relatively closely to receive the neck of a bottle in the safe, said closure, when secured to said outer container positively holding said safe and said retainer in position within the outer container, said closure having means on the bottom thereof for absorbing spillage from the bottle, said absorbing means comprising sponge means held captive to the closure and having a recess in its lower end for reception of the upper end of the bottle.