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E. P. GRUBEL ET AL

2,915,640

CONTAINER

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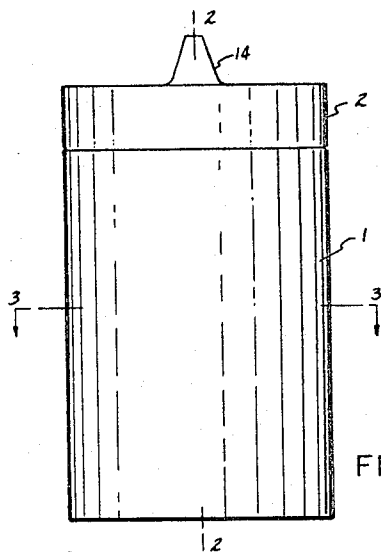


FIG-1

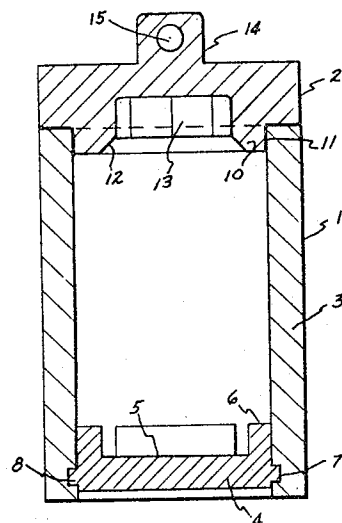


FIG-2

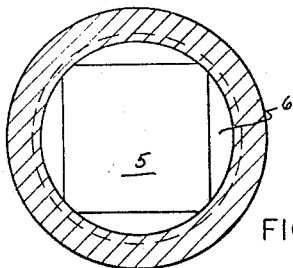


FIG-3

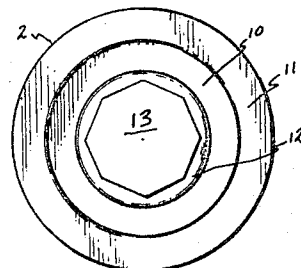


FIG-4

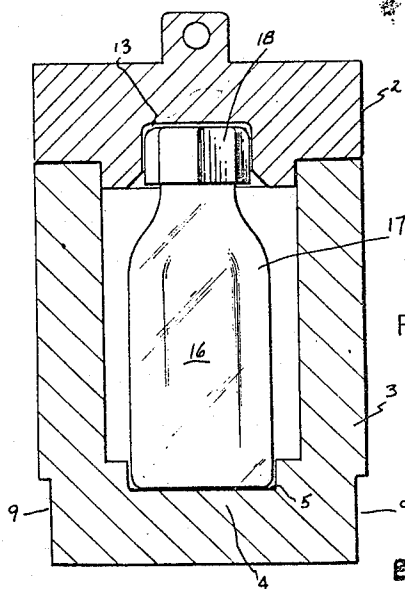


FIG-5

INVENTORS.

EDWARD P. GRUBEL
WILLIAM J. MILINCHUK
ARTHUR R. SCHETTEL

By *L. S. Levinson* Attorney

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2,915,640

CONTAINER

Edward P. Grubel, Union, William J. Milinchuk, Milltown, and Arthur R. Schettel, Nixon, N.J., assignors to Olin Mathieson Chemical Corporation, New York, N.Y., a corporation of Virginia

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7 Claims. (Cl. 250—108)

This invention relates to containers and, more particularly, to a shielding container for the storage and shipment of radioactive materials.

The increasing use of radioactive isotopes for the diagnosis and treatment of various conditions has resulted in an aggravation of the problems of storing and shipping these materials without endangering those who must handle them in transit and in administration. Prior to this invention, the shielding containers commonly employed for this purpose consisted of a cylindrical lead container of circular cross-section both internally and externally. Whereas such shielding containers were entirely adequate for parenteral formulations wherein the isotopes, in the form of a liquid preparation, were contained in a cylindrical bottle having a pierceable cap to permit introduction of a hypodermic needle, they suffered a real disadvantage when used for orally administrable liquid or solid formulations which had to be removed from an inner container, such as a bottle, for ingestion. In this instance, a clinician had to either partially or completely remove the bottle from the shielding container in which it was shipped in order to grasp the bottle while removing the screw cap commonly employed to close the bottle. He thereby exposed himself to considerable radiation from the contents of the bottle and subjected himself to the attendant dangers. Removal of the cap from the bottle without such exposure has heretofore required the use of clumsy mechanical devices.

An object of this invention, therefore, is to provide a safe shielding container for radioactive material which protects the user at all times from excessive exposure to radiation.

Another object of this invention is to provide a shielding container for radioactive materials which provides means for removing the cap of an inner container nested therein without necessitating prior removal of the inner container from the shielding container.

Still another object of this invention is the provision of a shielding container so constructed that it will immovably hold an inner container positioned therein against rotary motion.

These objects are achieved by the shielding container of this invention, preferred embodiments of which are illustrated in the accompanying drawings wherein:

Figure 1 is a side elevation of one embodiment of the shielding container;

Figure 2 is an axial sectional view of the shielding container shown in Figure 1, along the line 2—2;

Figure 3 is a sectional view taken along the line 3—3 in Figure 1, in the direction of the arrows;

Figure 4 is a bottom plan view of the closure element of the shielding container; and

Figure 5 is an axial sectional view of a modified shielding container within the purview of this invention, showing a bottle contained therein.

Considering Figures 1, 2, 3 and 4 of the drawings, the shielding container of this invention comprises generally

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a body 1 and a closure 2, said body having side walls (or wall section) 3 and a bottom section 4. Since the principal purpose of the shielding container is to store radioactive materials, the container is fabricated of lead or other material relatively impervious to radioactivity, such as a lead-antimony alloy. The wall section is of generally cylindrical shape and is closed on the bottom by means of bottom section 4.

A center portion of the inner face of bottom section 4 is recessed to provide a lower surface 5 of non-circular outline (preferably square outline as shown in Figure 3) and an upper surface 6 of (broken) circular outline.

The bottom section 4 may be formed integrally with wall section 3 (as by casting), as indicated in Figure 5, showing a modified shielding container. Alternatively (and preferably), it may be formed as indicated in Figure 2, namely, by first forming the wall section 3, cutting an annular groove 7 on the inside of the wall section 3 and, with the aid of an appropriately shaped mandrel, casting bottom section 4 in the wall section 3. The lead (for example) would enter groove 7 thus providing an interlocking annular projection 8. As a further alternative, a preformed bottom section 4 (without annular projection 8) can be merely forced into the bore of wall section 3 for frictional retention therein.

The closure 2 is adapted to fit into and close the top opening of the body 1. This closing is effected by means of depending flange 10, having a circular outer surface 11, the diameter thereof being slightly less than the diameter of the bore of wall section 3. The inner surface 12 of flange 10 is tapered upwardly, said tapered inner surface communicating with a recessed area 13 of non-circular, preferably polygonal, outline (a "wrench recess"), centrally located in the bottom of the closure, such as the octagonal outline shown in Figure 4. The tapering acts as a locating bell and guides the cap into the wrench recess in the cover.

The top of closure 2 is provided with an ear 14, preferably apertured at 15 to provide means for grasping and removing the closure.

Considering now Figure 5, a bottle 16 containing radioactive material (not shown), usually in an orally administrable form such as a liquid tablet or capsule, can be positioned within the container. This bottle is of conventional design, having a body 17 with its lower portion of square outline and a cap closure 18 of non-circular (or ribbed-circular) outline (preferably a screw cap of hexagonal or octagonal outline). When positioned in the container, the outer dimension of the body 17 of the bottle is such that it fits into the recessed portion of bottom section 4 and rests on the lower surface 5 thereof and, hence, is held therein against rotation because of the non-circular outline of the recess. When the shielding container closure 2 is in place, the cap 18 of the bottle rests in and is held against rotary motion by the recessed area 13 in closure 2. When the closure 2 is rotated counter-clockwise, therefore, the cap 18 is also turned; and since the body member 17 is held against rotation, this action will unscrew the cap 18 from the body 17 while the bottle is still retained in the shielding container.

Alternatively, to assist in preventing rotary motion of the body of the shielding container when the cover thereof is rotated, at least a section of the lower portion of the outer surface of wall section 3 can be formed flat in two or more (preferably diametrically spaced) locations, as indicated at 9 in Figure 5. This provides for holding the body by means of a suitably shaped tool.

Operation

The shielding container of this invention is employed for the shipment and storage of radioactive materials.

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To transport orally administrable radioactive isotopes which are supplied in liquid or solid form, a bottle of square cross-section, closed with a screw cap of the usually octagonal cross-section, is placed in the body of the shielding container so that it rests on the centrally located recessed portion of the bottom section of the shielding container. The closure for the shielding container is then placed over the cap of the bottle so that the upper portion of the cap rests in the recessed area therein and the flange thereof fits into the top portion of the body member of the shielding container. The two sections are then usually detachably connected either by means of staples or by tape. The container is thus ready for shipment.

When the radioactive isotopes are to be removed, the staples or tape is removed, and the closure for the shielding container is rotated counter-clockwise to unscrew the cap. The closure may be rotated by hand or by means of a pair of pliers or tongs; preferably, to minimize the chance of exposure, a long spike is inserted into the aperture in the ear on the closure for performing this operation. As an alternative, the ear may be grasped by means of a long-handled pair of tongs and thus rotated. To prevent movement of the body portion of the shielding container during this operational step, the container is preferably positioned between a pair of parallel strips (not shown) fastened to a working surface, so that the flattened portions 9 of the wall section are held by the strips and hence the body portion of the container is prevented from turning.

After the cap has been unscrewed, the closure of the shielding container is removed. Since the recessed area in the closure is of greater dimension than is the cap, the cap, though unscrewed, remains on the bottle. The cap can then be removed by means of a long-handled pair of tongs and the desired amount of the contents of the bottle removed, by appropriate instrument, e.g., tongs or pipette (for liquids).

To close the bottle, the cap can be placed loosely on the bottle, the closure repositioned over the cap and rotated in a clockwise direction to screw the cap onto the bottle.

If the container is to be used for the shipment of liquid parenteral forms of radioisotopes, the bottle (not shown), which usually is of cylindrical shape and greater diameter than the bottle used for oral preparations, is placed in the container and rests on the upper surface of the inner face of bottom section 4. Since such bottles are permanently closed with a pierceable disc or stopper, the problem of removing the bottle closure does not arise.

The invention may be otherwise embodied within the scope of the appended claims.

What is claimed is:

1. A shielding container for radioactive material, which comprises a body and a closure therefor, said body comprising a wall section and a bottom section having a center portion of the inner face thereof recessed to provide a lower surface of non-circular outline.

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2. A shielding container for radioactive material, which comprises a body and a closure therefor, said body comprising a generally cylindrical wall section closed on the bottom by means of a bottom section, said bottom section having a center portion of the inner face thereof recessed to provide a lower surface of non-circular outline and an upper surface of circular outline, said closure having a centrally located recessed area of non-circular outline in the bottom surface thereof.

3. A shielding container for radioactive material, which comprises a lead body and a lead closure therefor, said body comprising generally a cylindrical wall section closed on the bottom by means of a bottom section, said bottom section having a center portion of the inner face thereof recessed to provide a lower surface of non-circular outline and an upper surface of circular outline, said closure having a depending flange, the outer surface of which is of circular outline and is adapted to fit telescopically inside said wall section and the inner surface of which tapers upwardly and communicates with a centrally located recessed area of non-circular outline in the bottom surface of the closure.

4. The container of claim 3, wherein at least one segment of the lower outer surface of said wall section is flattened.

5. A package of radioactive material which comprises an outer shielding container comprising a lead body and a lead closure therefor, said body comprising generally a cylindrical wall section closed on the bottom by means of a bottom section, said bottom section having a center portion of the inner face thereof recessed to provide a lower surface of non-circular outline and an upper surface of circular outline, said closure having a depending flange, the outer surface of which is of circular outline and is adapted to fit inside said wall section and having a centrally located recessed area of non-circular outline in the bottom surface thereof, and a bottle positioned inside said container comprising a body member and a cap therefor, said body member having a lower portion of non-circular cross-section fitting into the recessed center portion of the inner face of the bottom section of said shielding container and resting on the lower surface thereof and said cap being of non-circular cross-section and fitting into the recessed area in said closure.

6. The package of claim 5, wherein recessed center portion of said bottom section and said lower portion of the bottle are both of square cross-section.

7. The package of claim 6, wherein the recessed area in said closure and said cap are both of polygonal cross-section.

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