OR 2,935,616

May 3, 1960 R. J. SMITH, JR., ET AL 2,935,616

RADIATION SHIELDING CONTAINER

Filed Feb. 14, 1955 2 Sheets-Sheet 1

Fig. 1.

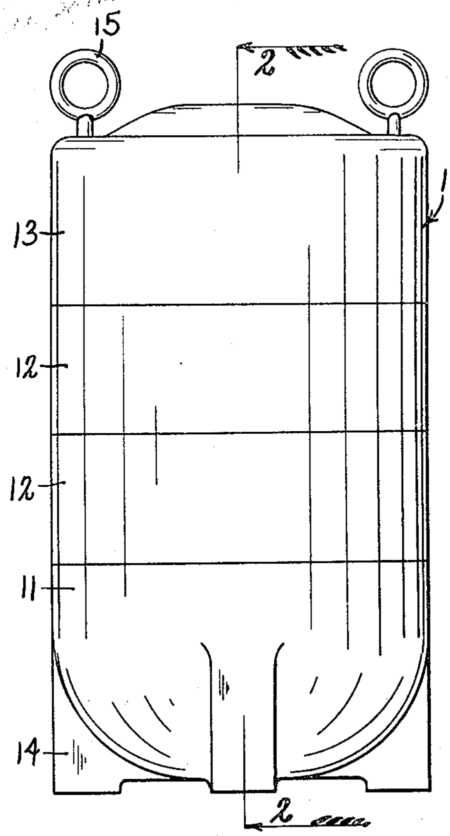

Fig. 2.

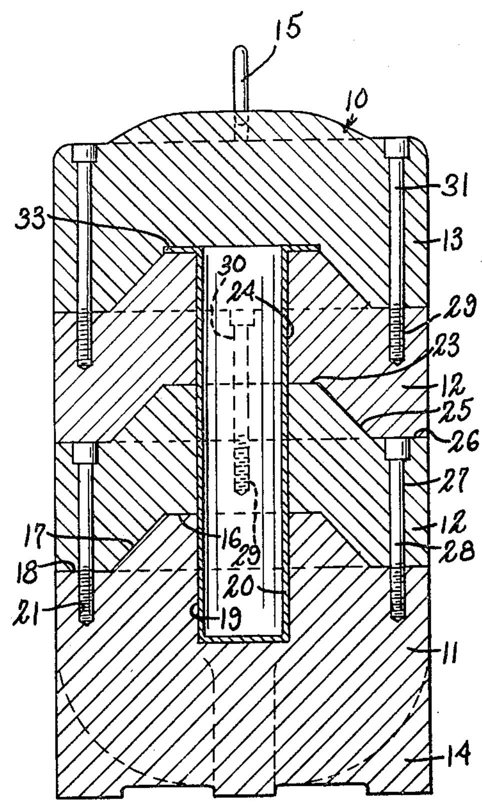

Fig. 3.

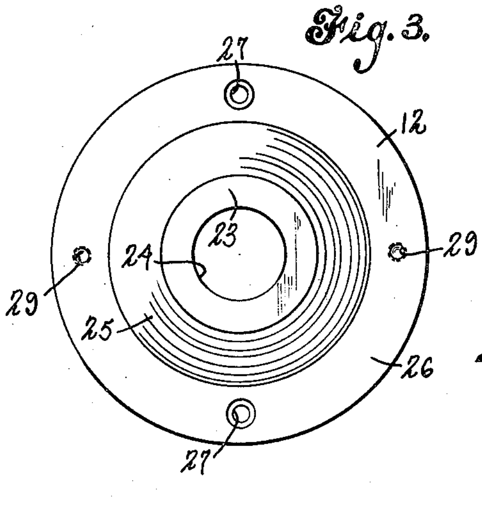

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Fig. 4.

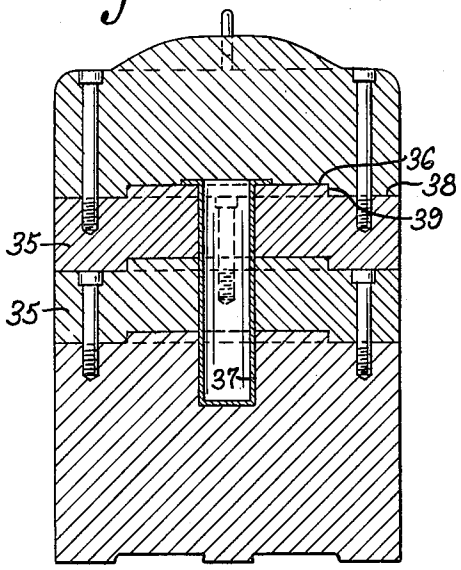


Fig. 5.

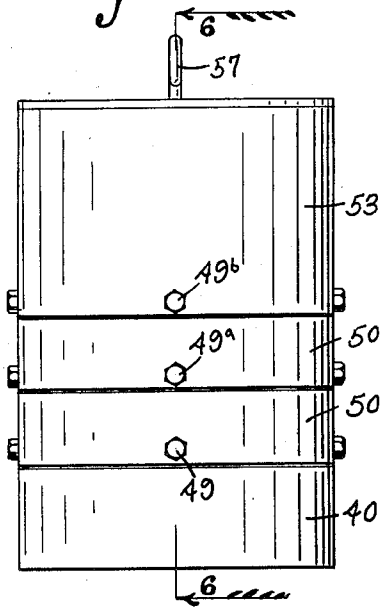


Fig. 6.

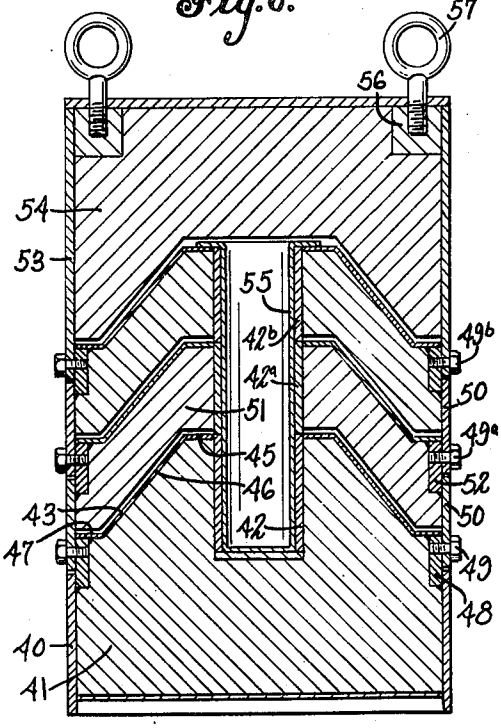
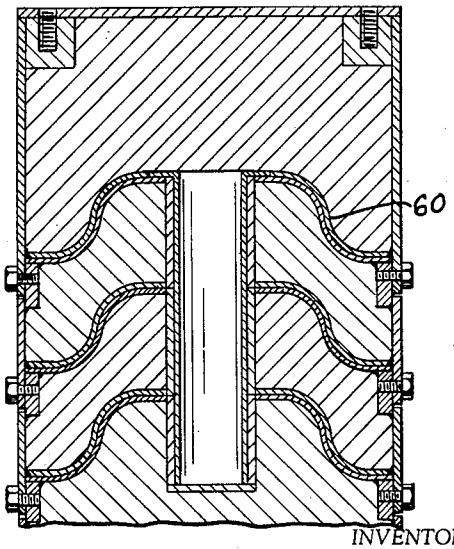


Fig. 7.



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RADIATION SHIELDING CONTAINER

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3 Claims. (Cl. 250—108)

This invention relates to a shielding container for radioactive materials, and more particularly to a container in which such materials may be shipped, stored or handled in any manner, and wherein they will be properly shielded so as to protect a person or surrounding material from the injurious effects of harmful rays which may emanate from the radioactive substances.

In handling radioactive materials, protection must be afforded those who are handling the material and also to surrounding matter which may be affected by radiation from the material. Such protection may be afforded in the form of containers in which the radioactive material is placed or stored. These containers are of necessity somewhat heavy and bulky, and in many instances represent a major item of cost in the shipping of radioactive substances from place to place.

It is well known that the rays emanating from such substances tend to travel in straight lines and, if the container is of a sectional character or provided with joints, it is important that it be so designed as to provide a discontinuous or irregular cleavage plane between such joints so as to prevent the harmful rays passing outwardly through these joints. Also as the container must of necessity be somewhat heavy and bulky, it is desirable to achieve reduction in size and weight as much as possible in the shipping and handling of such substances so as to reduce the cost of shipping and handling and also to conserve valuable storage space as far as possible.

As the amount of the radioactive material to be handled may vary from time to time, it is desirable that the container be so made so that its size may be varied in order that an excessively large container will not have to be employed for a small amount of material or, in the alternative, that many sizes of containers will not have to be made in accordance with the amount of material which is to be stored or handled.

To this end it is contemplated by our invention to provide a sectional container which will properly shield material contained therein and which is so constructed that any number of sections may be employed so as to vary the size and weight of the container by varying the principal dimension thereof.

One object of the present invention is to provide a new and improved shielding container for radioactive materials.

A further object of the invention is to provide a shielding container for radioactive materials of sectional form so that by employing a predetermined number of sections a container of the desired size may be provided, which container will properly shield the material therein.

A still further object of the invention is to provide a shielding container of sectional form for radioactive substances, the sections being built up one upon another so that any predetermined number thereof may be employed and the sections being so constructed and assembled that regardless of the number used, the contained material will be properly shielded.

To these and other ends the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the accompanying drawings:

Fig. 1 is a side elevational view of a shielding container embodying our invention;

Fig. 2 is a sectional view on line 2—2 of Fig. 1;

Fig. 3 is a top plan view of one of the intermediate sections of the container;

Fig. 4 is a sectional view similar to Fig. 2 of a container of somewhat modified form;

Fig. 5 is a side elevational view of a further modification;

Fig. 6 is a sectional view on line 6—6 of Fig. 5; and

Fig. 7 is a sectional view of still another modification.

To illustrate a preferred embodiment of our invention, we have shown in Fig. 1 of the drawings a shielding container designated generally by the numeral **10**. This container, as will be hereinafter described, is provided with relatively thick walls and may be made of any desired material, such as iron, steel, lead or concrete, or any combination of these materials or other material having suitable shielding characteristics for the harmful rays which may emanate from the radioactive material stored within it.

As illustrated, this container is provided with a lower or base section **11**, intermediate sections **12** and an upper section **13**. It will be understood that while usually a base section and an upper or top section will be employed, as many intermediate sections may be provided as are necessary to provide a container of suitable size for the amount of material to be stored, shipped or otherwise handled. The lower or base section **11** may, if desired, be provided with suitable supporting legs **14**, and the upper section may be provided with eye members **15** by which the container may be handled.

As shown more especially in Fig. 2 the upper surface of the lower section is discontinuous or stepped in that it is provided with a substantially plane surface **16** adjacent its central portion, an inclined annular surface **17** surrounding the area **16**, and a peripheral annular surface **18** which may be in a plane substantially parallel to that of the surface **16**. Such an element provides a break in the joint between this lower section and the next upper section so that rays finding a way into this joint will not have a straight-line passage into the exterior of the container. The bottom section is also provided with a socket or depression **19** which does not extend to the bottom of the section but which opens through the top thereof substantially at the center of the area **16**. This socket or well provides for the insertion therein of a container **20** for the radioactive material to be shielded. The bottom section is also provided with threaded openings **21** which open through the portion **18** of the upper surface of this section in order to secure the next upper section thereto as will be later described.

The intermediate sections **12** (and it will be understood that as many of these as desired may be employed) are of similar form and the description of one will suffice. Each of these sections is preferably of the same outside dimensions as that of the lower section so as to fit neatly thereon and on each other. They are, as shown, of cylindrical form although they may be of any other shape desired. Both upper and lower surfaces of these sections are provided with discontinuous cleavage planes in that the surfaces are stepped or broken so that they do not lie in the same plane to provide a straight-line path for emanated rays. These surfaces comprise an inner annular surface **23** surrounding a central through opening **24** and a surrounding inclined annular surface

25 which is in turn embraced by an annular plane surface 26.

It will be seen that when both upper and lower surfaces of the intermediate sections are so formed, one will fit snugly and closely upon the other and the lower of such sections will fit snugly and closely upon the upper surface of the base section 11 so as to provide a broken or discontinuous joint between each of the sections.

Each of these sections is provided with through openings 27 to receive screws or the like 28, which screws in the lowermost of the intermediate sections will be threaded into the openings 21 previously referred to so as to secure this section to the bottom section. The intermediate sections are also provided with upwardly facing screw-threaded openings 29 which, as shown, are formed in the annular portions 26 of such section to receive screws 30 extending through the next upper intermediate section or the screw 31 extending through the top section 13 if it is the upper one of the intermediate sections. This provides for the securement of the lowermost intermediate section to the bottom section and also for the securement of a further intermediate section or the top section in place regardless of the number of intermediate sections which may be employed.

The upper section is provided with lower stepped or broken surface complementary to the upper surface of the uppermost intermediate section so that it will fit snugly thereon and provide a discontinuous cleavage plane therebetween. The top section may also be provided with through openings 32 for the reception of the screws 31 so that the top section may be screwed in place as described.

The inner container or liner 20 may be formed of any suitable material, and this liner may be made in various lengths depending upon the number of sections of the outer container which it is desired to employ. This liner may be provided with an upper annular flange 33 which is fitted between the top section and the next lower section.

It will be apparent that with the above construction a shipping or storage container for radioactive materials is provided which is of sectional form so that any desired size of container may be employed by varying the vertical dimension thereof in that any number of sections may be employed. If desired, the top section may be seated directly upon the lower section or any number of intermediate sections employed between the upper and lower sections. In assembling the container, it is only necessary to select the liner of proper length to be employed depending upon the number of intermediate sections which are used. The contiguous surfaces of the sections are complementally formed so that they will fit closely together upon discontinuous cleavage plans so as to provide proper shielding of the radioactive material. Moreover, the upper and lower surfaces of the intermediate sections are of identical form and are of a form complemental to the upper surface of the lower section and the lower surface of the upper section to provide for the close fitting of all of the parts.

In Fig. 4 of the drawings we have shown a similar container except that the cleavage planes between the sections are separated by a sharp step or shoulder. In this form of our invention the upper and lower surfaces of the intermediate sections 35 are provided with an inner annular area 36 surrounding the central opening 37 and an outer annular area 38, the areas 36 and 38 being separated by a shoulder 39, the wall of which is at substantially right angles to the areas 36 and 38. It will, of course, be understood that the lower surface of the upper section and upper surface of the lower section are complementally shaped. The sections may be secured together by suitable screws as previously described in connection with the form of our invention shown in Figs. 1 to 3.

In Figs. 5 and 6 of the drawing there is illustrated a

further embodiment of our invention in which the container may be formed of lead or other moldable shielding material. In this form of the invention the lower section comprises an outer casing 40 which serves as a form for containing the lead filling 41. The central opening may be provided by a cylindrical sleeve 42, and the upper surface may be defined by the member 43 of a suitable metal. As shown, the upper surface of the lead portion of the casing covered by the material 43 is similar in shape to that of the sections shown in Fig. 1. That is, this area comprises a central annular portion 45 surrounding the sleeve 42, an annular frustoconical or inclined surface 46, and an annular peripheral surface 47 in a plane substantially parallel to that of the surface 45 so as to provide a broken joint between the upper surface of the bottom section and the next upper section.

Secured to the wall 40 by welding or the like is a ring 48 so that an intermediate section may be secured to the lower section just described by screws 49. Any number of intermediate sections may be used as before, and each of these intermediate sections comprises an outer casing 50 surrounding the inner lead portion 51, and brazed or welded to the outer member 50 is the ring 52 which corresponds to the ring 48 previously described. The upper and lower surfaces of this intermediate section are similar in shape and shaped to complement the upper surface of the lower section so that the parts may be nested as previously described and secured by the screws 49, 49^a and 49^b.

The upper section, as shown in Fig. 6, comprises an outer form 53 containing the lead filling 54, the lower surface of this section being shaped to complement the upper surface of the intermediate section immediately below it so as to break the joint between the sections. An inner container 55 may be positioned within the sleeve sections 42, 42^a and 42^b. It will be understood that the sections 42^a and 42^b are sections of the two intermediate sections shown.

The upper section may also be provided with blocks 56 within which may be screwed the eyes 57 to enable the device to be readily handled.

In Fig. 7 we have shown a further modification of our invention which is similar to that described with respect to Figs. 5 and 6 except that it is provided with discontinuous cleavage planes between the sections, the elements of which are in the form of a reverse curve shown at 60. It will be understood that any form of broken or discontinuous joints between the sections may be employed that will prevent the emanation of rays through the joints between the sections in straight lines.

While we have shown and described some preferred embodiments of our invention, it will be understood that it is not to be limited to all of the details shown, but is capable of modification and variation within the spirit of the invention and within the scope of the claims.

What we claim is:

1. A shielding container for radioactive material, said container comprising a lower section having a cavity therein closed at its lower end but opening through the upper surface of the section, said section being provided with a centrally disposed frusto-conical projection at its upper surface surrounding said cavity, an intermediate section having a central recess of frusto-conical shape at its lower surface to snugly receive the frusto-conical projection on the lower section when the intermediate section is superposed thereon, said intermediate section having a centrally disposed frusto-conical projection at its upper surface of the same dimensions as the recess at its lower surface, and a central opening extending entirely through the section to register with the cavity opening in the lower section, and an upper section having, in its lower surface a centrally disposed recess of frusto-conical shape and of the same dimensions as the recess in the lower surface of the intermediate section to snugly receive the frusto-conical projection on the upper surface

of said intermediate section, the upper section having a solid portion to close the upper end of the opening in the intermediate section, and means for securing all of said sections together, all of said sections being of radioactive shielding material.

2. A shielding container as in claim 1 wherein a plurality of intermediate sections of the identical form described are employed between the upper and lower sections to provide a cavity of desired length.

3. A shielding container for radioactive material, said container comprising a lower section having a cavity therein closed at its lower end but opening through the upper surface of the section, said section being provided with a centrally disposed frusto-conical projection at its upper surface surrounding said cavity, an intermediate section having a central recess of frusto-conical shape at its lower surface to receive the frusto-conical projection on the lower section when the intermediate section is superposed thereon, said intermediate section having a centrally disposed frusto-conical projection at its upper surface, and a central opening extending entirely through the section to register with the cavity opening in the lower section, and an upper section having a centrally disposed recess of frusto-conical shape in its lower surface to receive the frusto-conical projection on the upper surface of said intermediate section, the projections on the upper surfaces of the lower and intermediate sections and the recesses in the lower surfaces of the top and intermediate sections being of the same dimensions, the upper section having a solid portion to close the opening in said intermediate section, and means for securing all of said sections together, all of said sections being of radioactive shielding material.

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