May 1, 1951 E. N. GILKS 2,551,491

SAFETY CONTAINER FOR OPERATION WITH RADIOACTIVE SUBSTANCES

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FIG. 1.

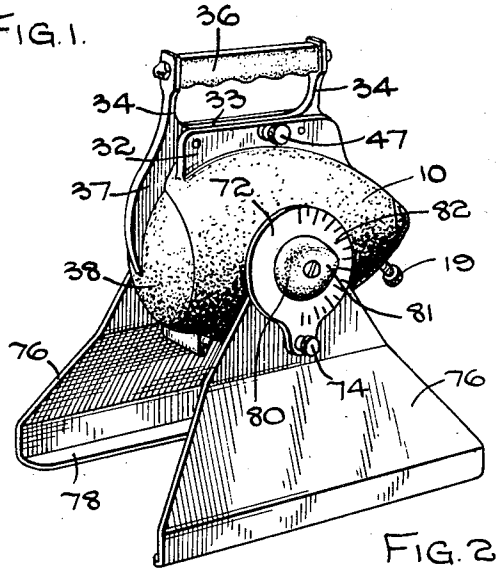
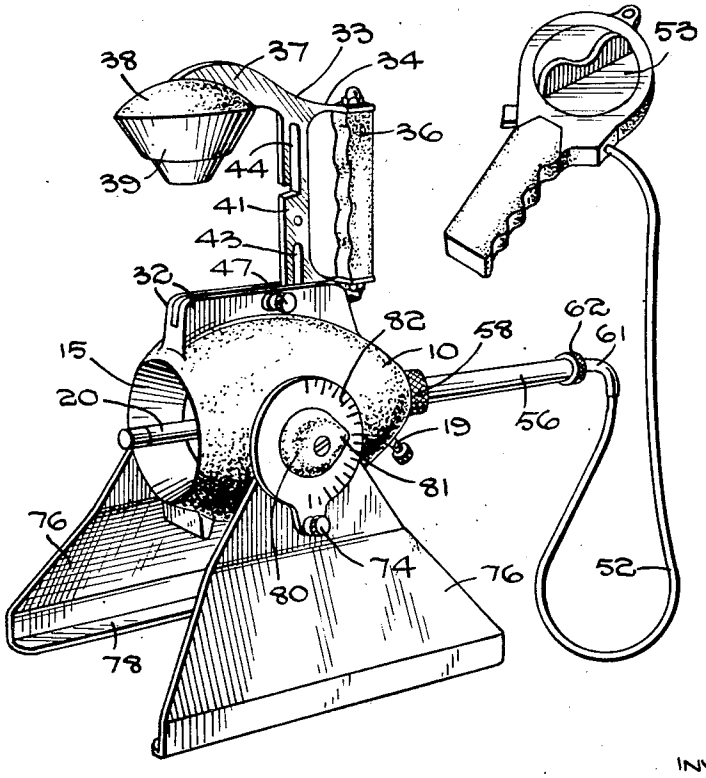


FIG. 2.



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SAFETY CONTAINER FOR OPERATION WITH RADIOACTIVE SUBSTANCES

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FIG. 3.

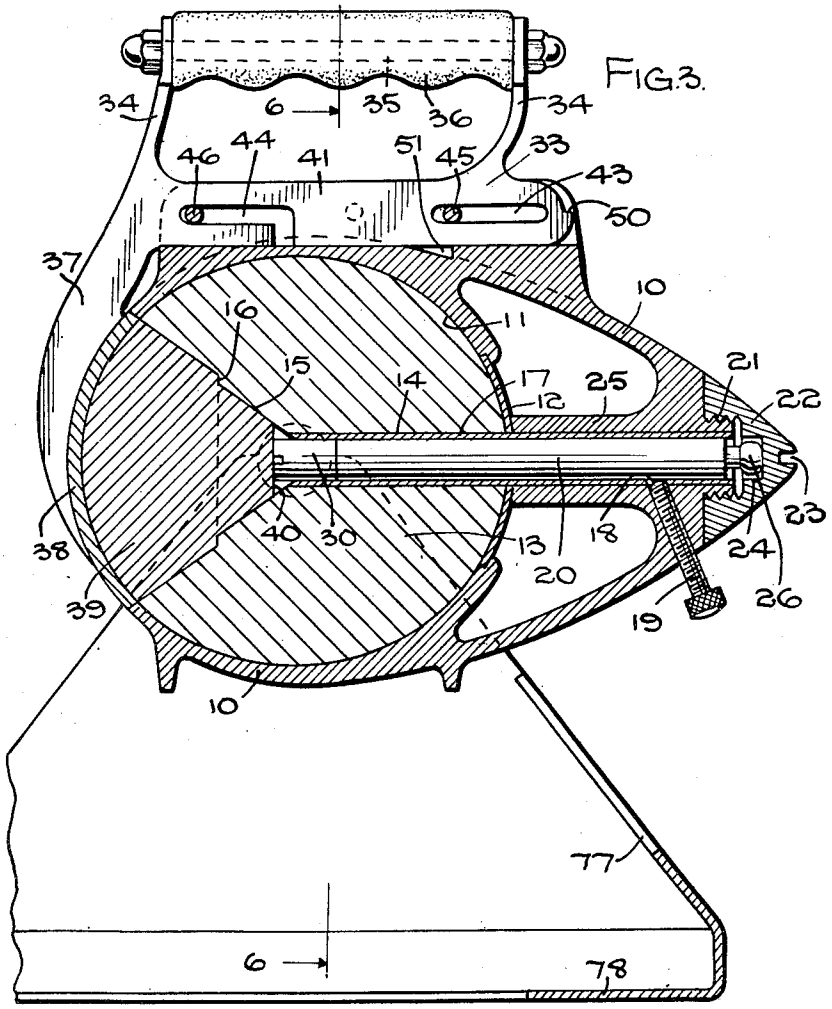


FIG. 4.

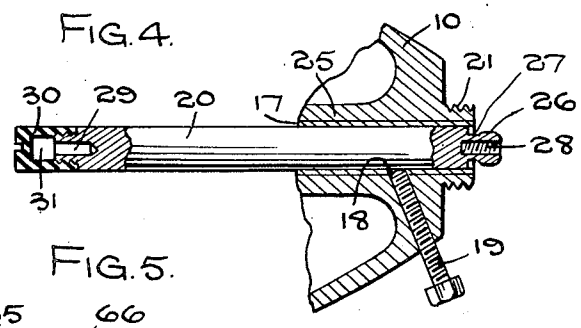
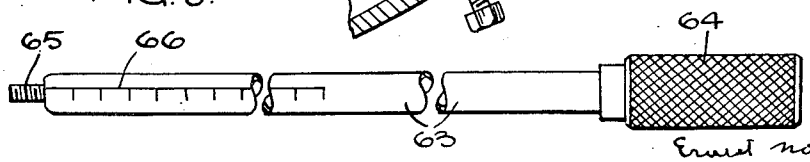


FIG. 5.



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SAFETY CONTAINER FOR OPERATION WITH RADIOACTIVE SUBSTANCES

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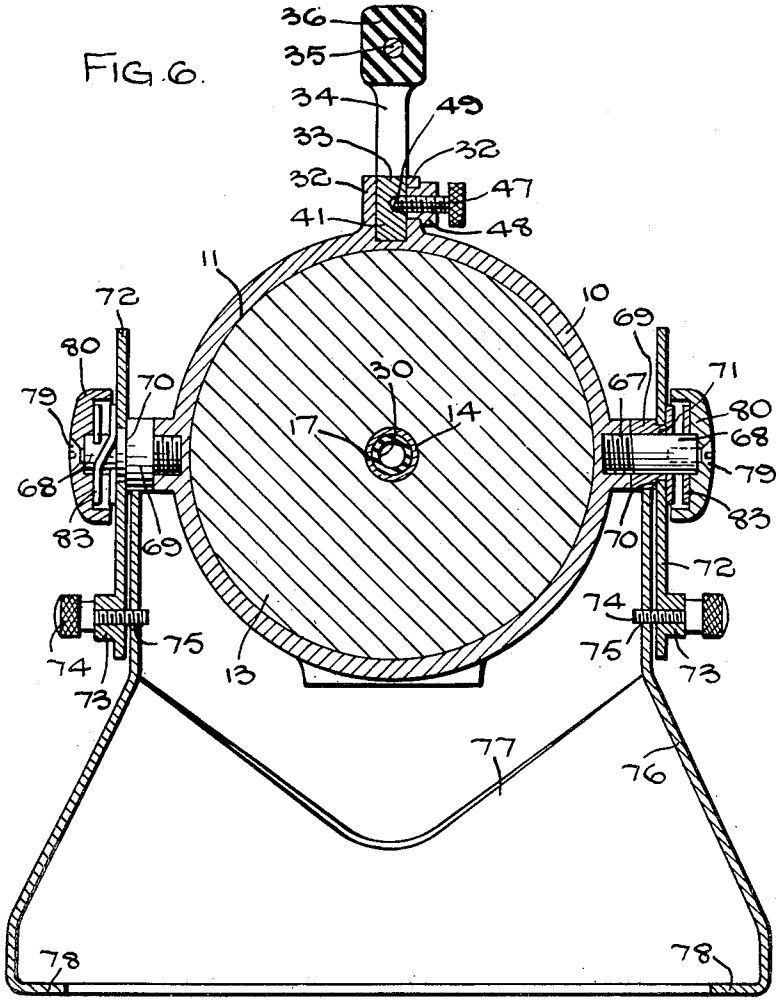
FIG. 6.



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SAFETY CONTAINER FOR OPERATION WITH RADIOACTIVE SUBSTANCES

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FIG. 7.

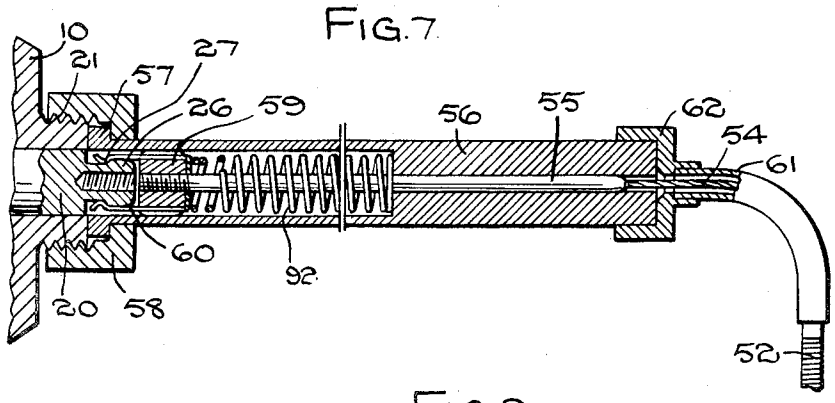


FIG. 9.

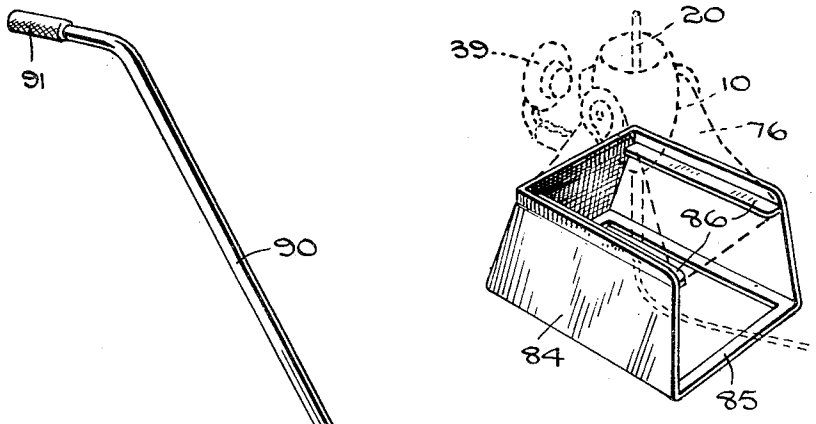
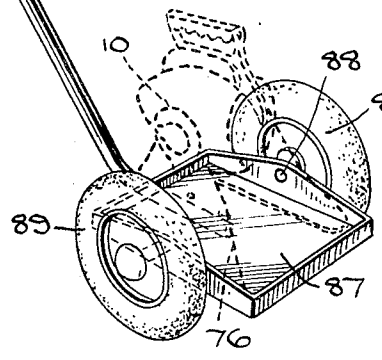


FIG. 8.



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UNITED STATES PATENT OFFICE

2,551,491

SAFETY CONTAINER FOR OPERATION WITH RADIOACTIVE SUBSTANCES

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Application July 5, 1950, Serial No. 172,126
In Great Britain July 11, 1949

16 Claims. (Cl. 250—106)

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Short penetrating rays, for example those known as gamma rays which may be emitted by substances such as radium and its isotopes cobalt 60 radon or other known agents, are frequently used in industry in a manner somewhat similar to Röntgen rays, that is to say the rays are directed towards and permitted to pass through metallic or other materials so that by their known action upon photographic film, radiographs may be produced which by recording variations in density may permit an examination of internal structures.

Various types of containers for radioactive substances have been used for the purpose above indicated which may permit emission of rays through controlled openings, such usually consisting essentially of a lead-lined box provided with a circular aperture fitted with a screwed cap or plug through which rays may be permitted to pass and be directed towards objects placed in their path.

Such type of apparatus may possess disadvantages, inasmuch as the manipulation of the screwed cap before and after exposure is a relatively slow operation, while in process of removal and replacement the operator's hand may become exposed to rays which are known to be harmful; moreover, owing to the fact that the radioactive substance is generally in a fixed position within the box the rays emitted are constrained by the aperture so that any area under examination will be limited to that which comes within a cone or beam of emitted rays.

One object of the present invention is to provide a container for radioactive material which enables the material to be housed and moved from one place to another without danger to persons in the vicinity.

A further object of the present invention is to provide a container for radioactive material which enables an aperture in the container to be uncovered for allowing discharge of rays without danger to the operator.

A further object of the present invention is to provide a container for radioactive material which enables the field of the rays discharged to be adjusted without danger to the operator.

A further object of the present invention is to provide a container for radioactive material in which the direction of discharge of the rays can be controlled.

A further object of the present invention is to provide a container for radioactive material which when required will enable a discharge therefrom in all directions.

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A further object of the present invention is to provide mobile supporting means for a radioactive container.

Other objects of the invention will become apparent from the following description of the container.

Referring to the drawings:

Figure 1 is a perspective view showing the container in the closed position;

Figure 2 is a perspective view showing the container in the open position and with the carrier or the radioactive material in a projected position allowing a large field of discharge;

Figure 3 is a sectional view in side elevation showing the container;

Figure 4 is a fragmentary sectional view showing the carrier stem for the radioactive material;

Figure 5 is a view in side elevation showing the adjusting member for adjusting the position of the radioactive material in the container;

Figure 6 is a sectional view on line 6—6 of Figure 3;

Figure 7 is a sectional view in side elevation showing the means employed for adjusting the carrier stem of the radioactive material in an endwise direction;

Figure 8 is a perspective view showing a mobile carrier for the container; and

Figure 9 is a perspective view showing a supporting stand which may be used for the container.

In the construction shown the container comprises a body 10, which is of streamline form and comprises a casing having at its larger end a part-spherical seating 11. The rear end of the seating is closed by a plate 12, and the forward end is temporarily closed by a part-spherical plate to allow a block 13 of lead to be run into the body so as to form an internal sphere.

An opening is made through this sphere, which opening has a cylindrical portion 14 extending to or slightly beyond the centre of the block, and which opening at the other end is of stepped tapering form, as shown at 15. The part 15 is shown with one internal shoulder 16 but more than one such shoulder may be provided if desired.

A guide tube 17 is cast in the opening 14, and this projects through the plate 12 and into the rear part of the body 10 wherein it may be a force fit. This guide tube is provided with an opening 18 through which the set screw 19 screwing into the body 10 may project so as to lock the carrier stem 20 against movement when desired.

At its rear end the body 10 is provided with an

opening in line with the opening 14, and around this opening the body is provided with a screw-thread 21 upon which screws a removable closure cap 22. This closure cap may have a screwdriver slot 23 at its end and internally it is provided with a cylindrical recess 24. The body 10 is provided with an internal forwardly-projecting tubular boss 25 which extends around the tube 17.

The carrier stem 20 at its rear end is provided with a projecting head 26 connected to the stem by an integral neck 27, and this portion 26, 27 is provided with an interior thread 28.

At the opposite end the stem 20 is provided with a central recess 29 and with a removable screwed cap 30 by which the radioactive material is enclosed. The radioactive material may be mounted on a carrier and placed in the chamber 31 formed within the cap 30.

The top of the body 10 is formed with a pair of spaced integral ribs, between which is a groove which is parallel to the axis of the tube 17. Mounted in this groove is a handle bracket 33 having two upwardly-projecting spaced arms 34 connected by a bolt 35 on which is mounted a handle 36.

The handle bracket is provided with an integral arm 37 upon the inner side of which is formed a part-spherical portion 38 which forms a closure for the opening in the forward end of the body. Cast on this portion 38 is a tapering shouldered plug 39 of lead or other material which is relatively impervious to the emanations from the radioactive material. This plug corresponds in shape and size with the shouldered tapering opening 15 in the forward part of the block 13.

The handle bracket is mounted for forward sliding movement sufficient to bring the rear end 40 of the plug 39 out of the opening in the block 13, after which the handle bracket can be turned pivotally about a horizontal axis, which is at right angles to the axis of the tube 17.

The portion 41 of the handle bracket which engages in the groove between the ribs 32 is provided at its rear part with a longitudinal elongated slot 43 and is provided with a second slot 44 of inverted L shape. These slots are engaged by pins 45, 46 extending between and fixed in the ribs 32. The arrangement is such that the handle bracket can slide forwardly as far as is permitted by the horizontal portions of the slots 43 and 44, and it can then be turned about the axis of the pin 45 now engaging the rear end of the slot 43, the vertical part of the slot 44 passing the pin 46 when the handle bracket is raised into the position shown in Figure 2.

When the handle bracket is in the position shown in Figure 3, which it occupies when the radioactive material is not in use, the portion 41 can be locked against movement by a set screw 47 engaging a thread in a bush 48 fitted in one of the ribs 32, the end of the set screw 47 engaging a threaded hole 49 in the part 41 of the handle bracket.

At the rear end the part 41 is provided with a tooth 50 which engages a correspondingly shaped recess 51 in the body at the bottom of the slot between the ribs 32. After the handle bracket has been slid forward and then turned upwardly about the axis of the pin 45 it makes a short downward movement to enable the tooth 50 to engage in the recess 51, so that the handle bracket is thus automatically retained in the raised position shown in Figure 2 until it is lifted

a short distance to bring the tooth 50 out of the recess 51, when it can be turned in an anticlockwise direction about the axis of the pin 45. When the handle bracket has been lowered into the horizontal position it can be slid backwardly into the position shown in Figure 3 and then locked by the set screw 47.

It will be observed that the handle 36 is out of line with the opening in the block 13 so that the handle can be operated and the opening at the front of the body can be uncovered to allow of a discharge from the radioactive material without danger to the operator's hands. Similarly, the return movement may be made without the operator's hand having to pass into the beam of rays from the radioactive material.

When the handle bracket has been moved into the position shown in Figure 2 a discharge from the radioactive material takes place through the opening 15. This discharge however is confined to the cone formed by the opening in the forward part of the block 13. If it is desired to increase the field of discharge the stem 20, which carries the radioactive material at its forward end, can be advanced through the tube 17. The field of discharge increases progressively as the stem is moved forwardly, and the stem can be locked in any desired position by the set screw 19.

I may provide a Bowden cable 52, and cable-operating appliance 53 of known form, for remotely controlling the position of the stem 20.

The inner member 54 of the cable is secured to a sliding pin 55 mounted in a tube 56.

When it is desired to control the position of the stem 20 in this way the cap 22 is removed from the body and the tube 56, which has a flange 57 at its forward end, is secured to the body by a cap nut 58 which engages the flange 57.

The pin 55 is screwed into a sliding block 59 which is acted upon by a compression spring 92 and provided with a plurality of springs 60 which can engage over the head 26 and enter the neck 27.

The outer member 61 of the cable is provided with a cap 62 which is secured to the rear end of the tube 56.

Instead of adjusting the stem 20 in this way, a rod 63 may be used, this rod having a handle 64 and a screwed portion 65 at its forward end for screwing into the thread 28. The rod 63 may be marked with a scale 66, which can cooperate with the end of the portion 21 to indicate the distance by which the stem 20 has been advanced. When a desired position is reached the stem is locked by the screw 19 and the rod 63 is unscrewed or the tube 56 disconnected and the cap 22 replaced.

It should be observed that the provision of the shoulder 16 in the opening at the forward part of the block and the corresponding shoulder in the plug 39 is a feature which greatly increases the effectiveness of the appliance, as it prevents the emanations from the radioactive material from finding a direct conical path along the wall of the opening 15. The rays can pass along the wall of the inner part of the opening but they then meet with the shoulder on the plug 39 which engages with the shoulder 16 so that no straight-line direct path is provided for a leakage.

The body 10 is formed with oppositely-projecting hollow spigots 67 arranged on a diameter, and screwing into each of these is a trunnion pin 68. Mounted on each of the trunnion pins is a

sleeve 69 having a shoulder 70 beyond which is a reduced portion 71 upon which is mounted a plate 72. These plates 72 are provided with bosses 73 through which screw locking pins 74 engaging in holes 75 in a supporting cradle 76. This supporting cradle has two side walls integrally connected at one end by a web 77, and it has a flat bottom 78.

Each of the trunnion pins 68 has attached to it by a screw 79 a cap 80 formed with a radial projection 81 which acts as a pointer and cooperates with a scale 82 marked on the plate 72.

A spring washer 83 is mounted on each trunnion pin 68 and operates between the outer side of the plate 72 and the inner side of the cap 80.

The body 10, and the parts it contains, can be turned about the axis of the trunnion pin 68, and it retains any position into which it is moved by reason of the friction provided by the spring washers 83. The pointers 81, with the help of the scale 82, indicate the angle through which the body 10 has been turned from the zero or horizontal position. The body can be turned through 180° and can thus occupy any position between the horizontal, shown in Figures 1 and 2, and the vertical, indicated in dotted lines in Figure 9.

In certain circumstances it is convenient to move the body into a position in which the tube 17 is upright, and the stem 20 is advanced until the radioactive material in the chamber 31 is completely clear of the body. When in this position the appliance may be used for taking photographs through a number of bodies grouped in a circle around the appliance. The support 76 gives insufficient clearance to enable this to be done, and consequently a stand 84 may be provided having three upwardly-converging sides and a flat base 85 and horizontal inwardly-projecting ribs 86 upon which the support 76 may be mounted. This stand is illustrated in Figure 9.

Further, for transporting the appliance from one position to another, a carriage may be provided such as that shown in Figure 8, this carriage having a tray 87 supported upon stub axles 88 having ground-engaging wheels 89 which may be fitted with rubber tyres. The tray is provided with a long upwardly- and rearwardly-projecting hole 90 having a handle 91 at its upper end.

The appliance can be used with various kinds of radioactive materials the emanations from which vary in intensity, and if desired a number of handles such as 36 may be provided which differ in colour or form to indicate the radioactive material which is in use.

It will be seen that the appliance provides a means for housing radioactive material safely and without danger to persons in the vicinity. Further, the opening at the forward part of the appliance through which the discharge occurs can be opened and closed without danger to the operator.

The provision by which the position of the radioactive material can be adjusted in the block 13 enables the field of discharge to be adjusted as desired, and the manner in which the body is mounted enables the direction of discharge to be controlled as desired.

Further, as the stem 20 can be adjusted to bring the radioactive material completely clear of the body, it is possible to obtain a discharge in all directions.

What I claim then is:

1. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, said handle bracket having an arm, a closure plug on said arm for said secondary opening, said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, and a handle on said handle bracket.

2. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, and a handle on said handle bracket.

3. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, one end of said opening being of tapering form with the larger end at the periphery of the block, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, and a handle on said handle bracket.

4. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, one end of said opening being of stepped tapering form with the larger end at the periphery of the block, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, and a closure plug on said handle bracket, said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block.

5. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an

opening therethrough, one end of said opening being of stepped tapering form with the larger end at the periphery of the block, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, and a closure plug on said handle bracket, said closure plug being of a material impervious to emanations from radioactive material and being of stepped tapering form corresponding with the form of the stepped tapering opening of the end of the opening in the block and being adapted to fill this end of said opening.

6. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, and means on the body constraining said handle bracket to make a forward sliding movement to bring said plug clear of the body prior to the handle bracket pivoting on an axis disposed transversely to the opening through the block.

7. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, guiding means on the exterior of the body for guiding said handle bracket thereon, said guide means being disposed parallel to the axis of the opening through the block, the handle bracket having two spaced slots, and transverse pins on the body engaging said slots, one of said slots being straight and having closed ends and the other being of inverted L form, whereby the handle bracket can be slid forwardly and then pivoted on one of said pins for the purpose of bringing the closure plug out of the opening in the block and then moving it out of line with said opening.

8. A container according to claim 7 having cooperaitng means on the handle bracket and on the body for retaining the handle bracket in the raised position.

9. A container according to claim 7, having guide means formed by a pair of spaced longitudinal ribs on the body one of which has a set screw for locking the handle bracket against movement.

10. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a guide tube mounted in the block and extending towards said primary opening, a stem in said guide tube, said stem having means at its inner end for carrying the radioactive material, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, and said closure plug inclding a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block.

11. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a guide tube mounted in the block and extending towards said primary opening, a stem in said guide tube, said stem having means at its inner end for carrying the radioactive material, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, and said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, said stem engaging at its forward end the rear face of said closure plug, and at its rear end engaging said movable closure, whereby the stem is retained in a definite position in relation to said block.

12. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and a secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a guide tube mounted in the block and extending towards said primary opening, a stem in said guide tube, said stem having means at its inner end for carrying the radioactive material, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, and said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, said stem having at its rear end means for engagement by a device for moving it along the guide tube.

13. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing

the primary opening, a guide tube mounted in the block and extending towards said primary opening, a stem in said guide tube, said stem having means at its inner end for carrying the radioactive material, means in the body for locking the stem against endwise movement, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, and said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block.

14. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, trunnion pins on opposite sides of the body, and a supporting cradle for the body, said trunnion pins being supported by the supporting cradle.

15. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, trunnion pins on opposite sides of the body,

a sleeve on each of these pins, a plate marked with a scale of angles on one of said sleeves, a cap formed as an indicating pointer fixed to the end of one of said trunnion pins, a spring washer on one of said pins and disposed between the cap and the plate, a supporting cradle for the body, said trunnion pins being supported by the supporting cradle, and means for locking said plate to said supporting cradle.

16. A container for radioactive material comprising a body containing a block of material which is relatively impervious to the emanations from radioactive material, said block having an opening therethrough, said body having primary and secondary spaced openings one opposite and in line with each end of the opening through the block, a movable closure on the body for closing the primary opening, a movable handle bracket on the exterior of the body and disposed out of line with the secondary opening, a closure plug on said handle bracket, said closure plug including a mass of material which is impervious to the emanations from radioactive material for engaging in one end of the opening through said block, trunnion pins on opposite sides of the body, a sleeve on each of these pins, a plate marked with a scale of angles on one of said sleeves, a cap formed as an indicating pointer fixed to the end of one of said trunnion pins, a spring washer on one of said pins and disposed between the cap and the plate, a supporting cradle for the body, said cradle having spaced side portions and a base, the said portions engaging under said sleeves, and means for locking said plate to said supporting cradle.

ERNEST NORMAN GILKS.

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