

July 20, 1954

E. N. GILKS

2,684,447

CONTAINER FOR RADIOACTIVE OR LIKE SUBSTANCES

Filed July 15, 1952

4 Sheets-Sheet 1

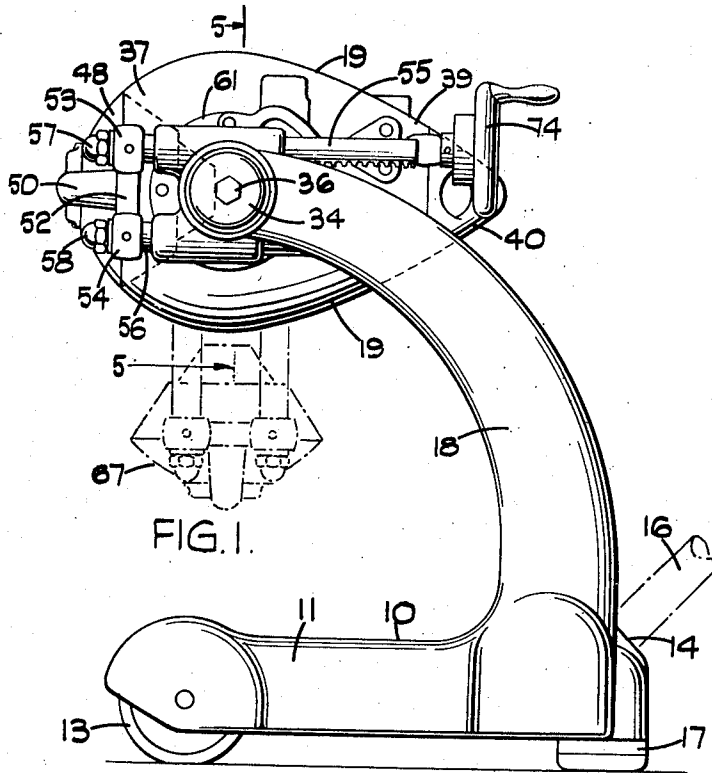


FIG. 1.

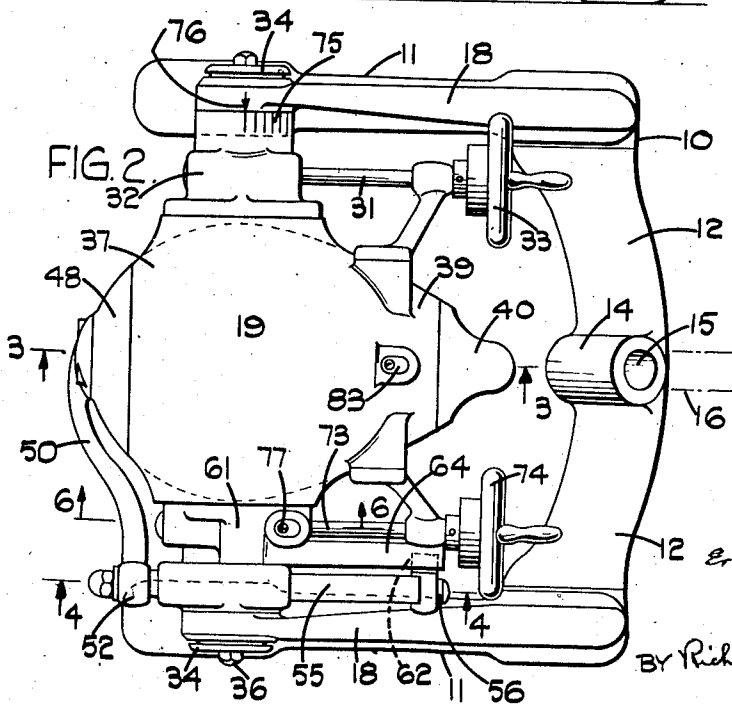


FIG. 2.

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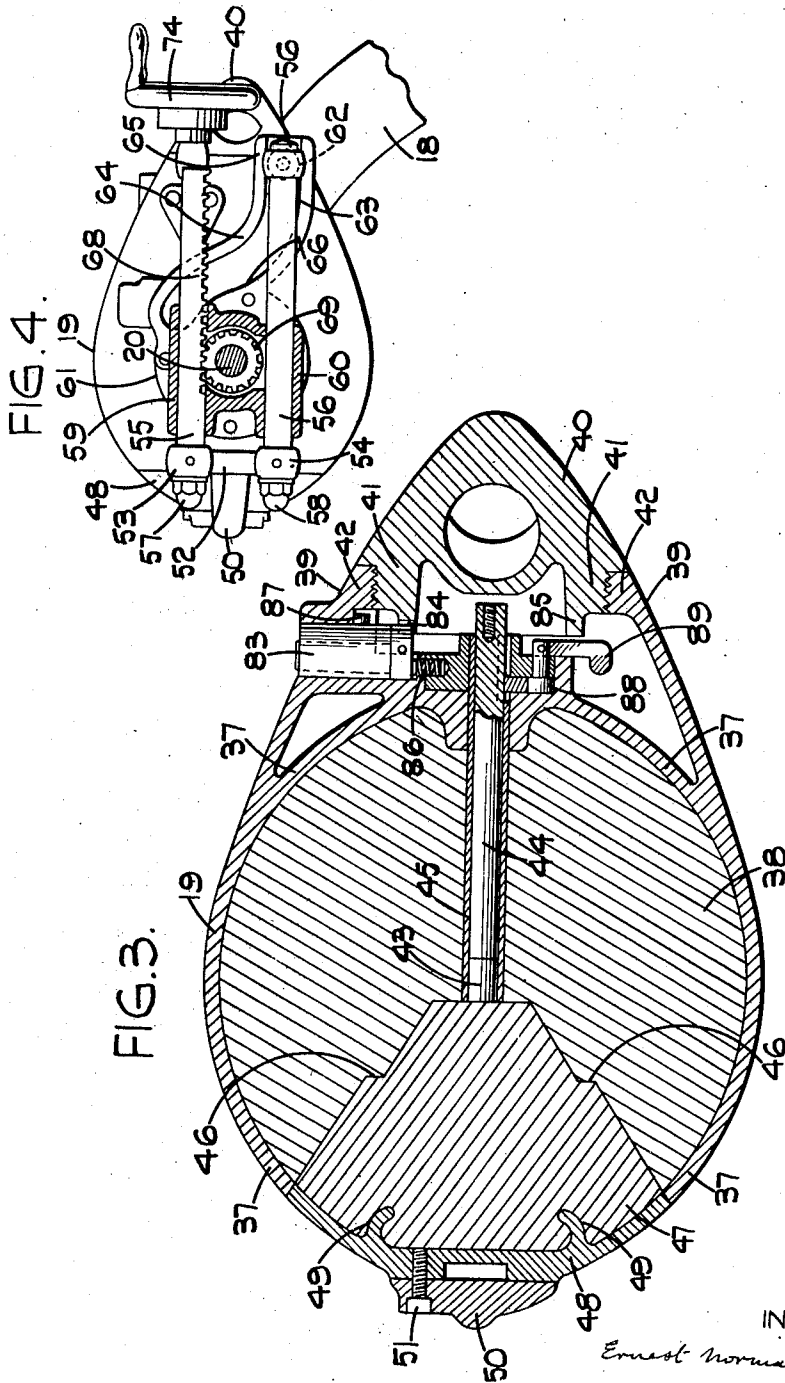
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4 Sheets-Sheet 2



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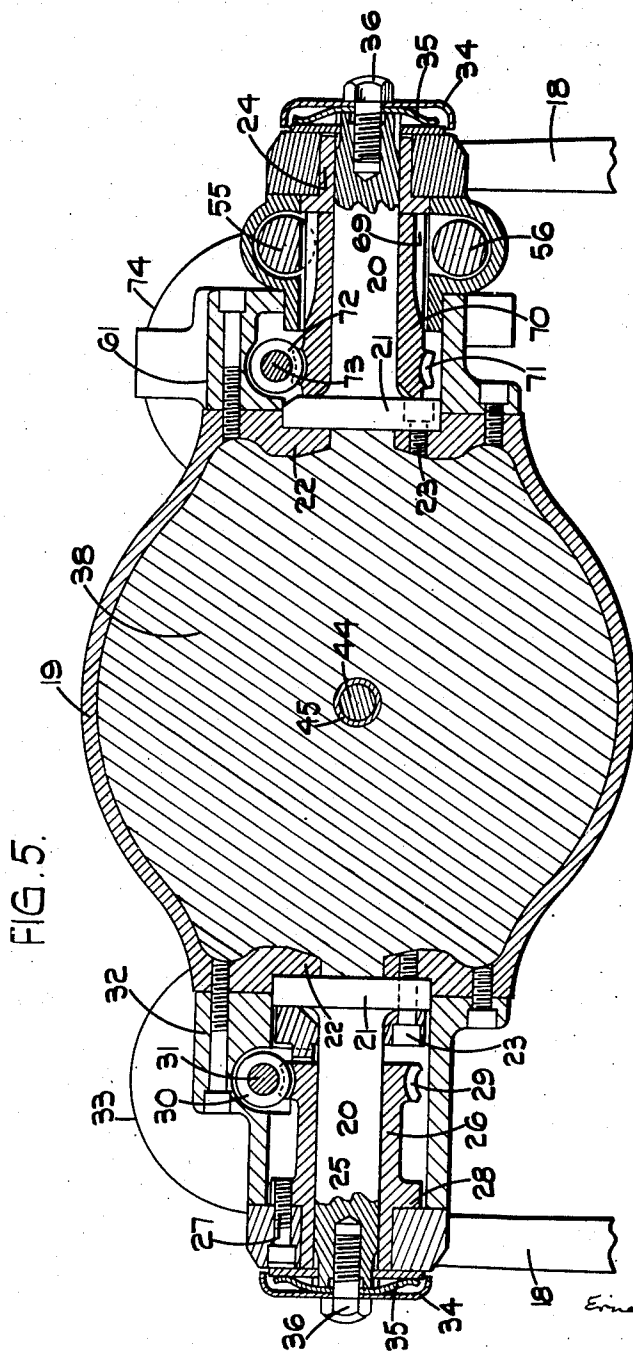
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CONTAINER FOR RADIOACTIVE OR LIKE SUBSTANCES

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4 Sheets-Sheet 3



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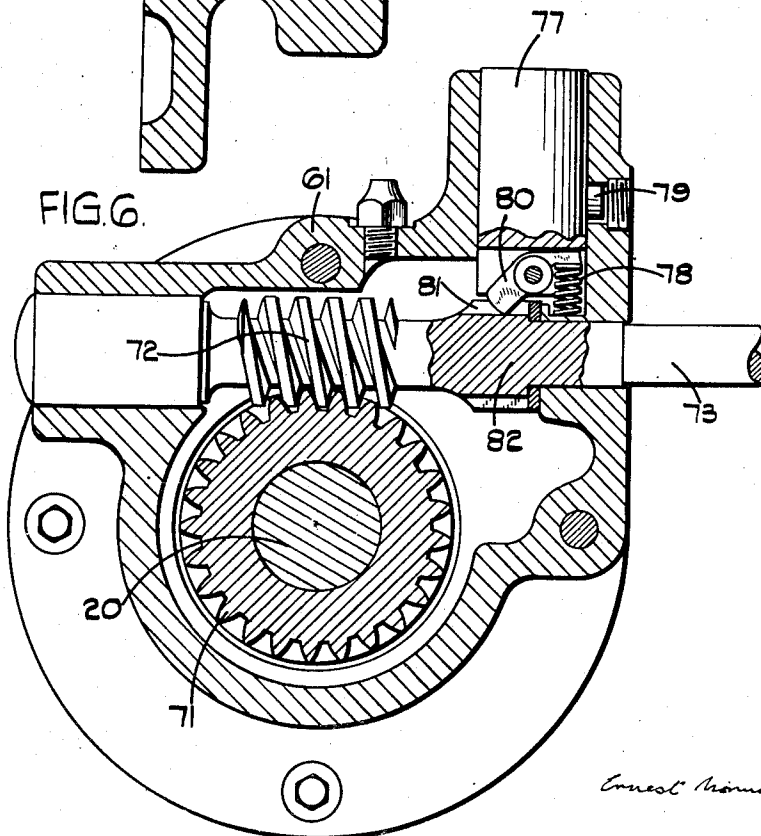
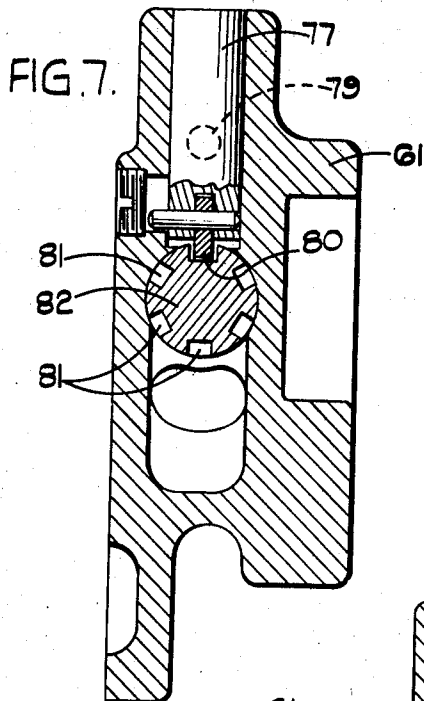
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CONTAINER FOR RADIOACTIVE OR LIKE SUBSTANCES

Filed July 15, 1952

4 Sheets-Sheet 4



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2,684,447

CONTAINER FOR RADIOACTIVE OR LIKE SUBSTANCES

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Application July 15, 1952, Serial No. 299,050

Claims priority, application Great Britain
June 21, 1952

11 Claims. (Cl. 250—106)

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The present invention relates to containers for radioactive material of the kind having a block of material substantially impervious to radiations from the radioactive material formed with a cavity in which the radioactive material can be accommodated and from which a directionally-controlled exposure of the radioactive material can be effected by displacing a portion of the block formed as a removable plug and normally forming a closure member for the cavity. Such containers are hereinafter referred to as being of the kind specified.

The object of the present invention is to provide certain modifications or improvements in containers of the kind specified which are the subject of my U. S. A. Patent No. 2,551,491.

The first modification or improvement has reference to the means for operating the plug forming the closure member.

The particular object of this part of the invention is to provide an operating member situated out of the path of radiation permitted by the opening of the plug which is operatively connected to the plug by mechanism adapted to produce the required opening and closing movement of the plug without bodily shifting of the control member along a like path of movement.

A further object is to provide means for supporting and guiding the plug along a path of movement between a closed position and an open position in which the plug is displaced laterally from the path of radiation permitted in said open position, and actuating mechanism operatively connecting said plug with an operating member situated out of said path of radiation, said mechanism establishing a conversion as between the mode of movement of the operating member and the plug, whereby the former may remain in or substantially in a fixed location in relation to the body of the container whilst operated to move the plug.

Yet another object is to provide a container of the kind specified having plug controlling and operating means comprising a plug supporting and guiding structure establishing a predetermined path of movement for the plug between closed and open positions, and actuating mechanism operatively connected between said structure and a rotary operating member situated out of the path of radiation permitted by the opening of the plug.

A second modification or improvement has reference to the means for supporting the body of the container.

The object of this part of the invention is to

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provide a carriage having a base affording stable support on the ground or like surface and an upwardly-extending structure comprising members spaced apart laterally and having at or near their upper ends bearings in which the body is journaled on an axis parallel or approximately so to the base and worm and wormwheel or the like adjusting mechanism operatively connected between the carriage and the body for adjusting same angularly about said axis and retaining it in any desired orientation.

A third modification or improvement has reference to means whereby the source of radioactive material can be inserted in and removed from the container.

The object of this part of the invention is to provide an arrangement in which insertion of the source is effected through an opening in the block other than that closed by said plug, access to this opening being controlled by a removable cap forming a closure member for an opening in the body in line with that through the block, removal of this cap being controlled by a key-actuated lock.

A fourth modification or improvement has reference to the means for mounting the source of radioactive material in the block cavity.

The object of this part of the invention is to provide a stem or like member which extends through an opening in the block other than that closed by said plug, and in which this stem or like member can be secured in or freed from an adjusted position by a clamping device operable only from within the body, access thereto being had by removal of a cap forming a closure member for an opening in the body in line with that through the block.

The above-described parts or features of the invention may be utilised separately or in combination in a container of the kind specified all within the scope of the invention.

The invention will now be described with reference to the accompanying drawings showing by way of example one embodiment thereof, and wherein:

Figure 1 shows in side elevation one construction of container of the kind specified in accordance with the invention;

Figure 2 is a plan view of the same construction;

Figure 3 is a cross-sectional view in side elevation and on an enlarged scale on the line 3—3 of Figure 2;

Figure 4 is a cross-sectional view in side elevation on the line 4—4 of Figure 2;

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Figure 5 is a cross-sectional view in front elevation on the line 5—5 of Figure 1, the view being taken on an enlarged scale;

Figure 6 is a fragmentary view on an enlarged scale and in cross section on the line 6—6 of Figure 2 showing the arrangement of driving mechanism for actuating the plug, including the lock therefor; and

Figure 7 is a view in cross section on the line 7—7 of Figure 6.

In the construction illustrated in the drawings the container proper is mounted on a carriage which comprises a base 10 having side members 11 united integrally with each other at corresponding ends by a transverse member 12, the whole being of U shape in plan, so that between the side members 11 extends a relatively large unobstructed space in which when required may be placed an article for examination.

The free or forward ends of the side members 11 of the base are equipped with wheels, such as seen at 13, and the transverse member has a boss 14 formed with a socket or like opening 15 in which may be secured a draw bar 16 or other handle by means of which the carriage can be moved from place to place as required. Beneath the boss 15 is formed a downwardly-extending foot 17, which in combination with the wheel 13 provides for a three-point support of the carriage on the ground or other flat surface on which it may be stood in operation.

The container proper is journaled between the upper ends of a pair of arcuate or similarly-curved arms 18 forming the superstructure of the carriage, these arms being united integrally with the base of the carriage in the region in which the side members 11 are joined to the transverse member 12, and it will be observed that the upper ends of the arms 18 lie approximately vertically over the wheels 13 of the carriage.

The container proper (see Figure 5) is pivotally supported by the arms 18 about an axis extending transversely of the base of the carriage and parallel thereto, and for this purpose the body 19 of the container has secured thereto a pair of aligned oppositely-extending stubs 20 having heads 21 of plate form located in suitable seatings in the side portions 22 of the body and secured thereto by means of machine screws 23.

The outer ends of these stubs 20 are journaled in bearing openings in the upper ends of the arms 18, one such arm having a bush 24 and the other having a bush-like portion 25 on a sleeve 26 fitted therein for this purpose. If desired, suitable roller or ball bearings could be provided.

At the lefthand side of the container as viewed in Figure 5 the sleeve 26 is made fast to the associated arm 18 by means of one or more machine screws 27 extending through openings in the arm and entering tapped holes in a flange 28 of the sleeve, and the inner end of this sleeve is formed with an integral wormwheel portion 29 with which meshes a worm 30.

The worm 30 is fixed on a shaft 31 journaled in a housing 32 secured to the body of the container and rotatable by means of a hand wheel or like rotary member 33 so as to adjust or orientate the housing, and hence the body, angularly about the axis of the sleeve 26, the sleeve being fixed in relation to the arm 18, as previously described. The pitch of the worm is such that this worm and wormwheel mechanism has a low reversed mechanical efficiency, and the body of the container is therefore automatically retained in any position to which it is adjusted.

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At the end of the stubs 20 are provided suitable caps 34 and seals 35 held in place by screws 36 for retaining lubricant in the bearing and mechanism.

The container proper, the construction of which is best seen in Figure 3, comprises a hollow body, indicated generally at 19, which includes a part-spherical portion 37 in which is housed a block 38 of lead or other material substantially impervious to radiations emanating from the radioactive material with which the container is required to be used, and a rear portion 39 having an opening or aperture which is normally closed when the container is not in operation by means of a cap 40 of approximately conical form having a screwthreaded spigot 41 engaging with an internally-threaded portion 42 of the body.

The block 38, which is of part-spherical form, has a central cavity in which is accommodated a capsule 43 containing the radioactive material, and this capsule is supported in position by a stem 44 which extends through a guide tube 45, itself located in a bore or opening extending in a radial direction from the cavity towards the centre of the opening, which is closed by the cap 40.

The cap 40 is of course removed for loading the stem and source into position and for projecting the source forwardly to a controlled extent when the container is in operation in connection with the examination of an article by controlled radiation from the source.

In front of the cavity in which the capsule 43 is disposed, that is to say diametrically opposite the opening or bore in which the tube 45 is located, the block 38 has a divergent opening of generally conical form, which may be stepped as illustrated at 46, and which is closed by a plug 47 of complementary shape.

When this plug is in position as illustrated radiation in the forward direction from the source is substantially prevented since the plug is of the same material as the block, but when the plug is removed a cone of radiation is permitted in the forward direction.

The plug 47 is supported on a structure comprising a body portion 48 of approximately part-spherical form and which is a continuation of the body portion 37, this portion 48 being provided at its inner side with keying lugs 49 embedded in the material of the plug, and externally being mounted on the inner extremity of an arm 50 to which it is secured by means of machine screws, such as that seen at 51.

At its outer end the arm 50 terminates in a cross head 52 (Figures 1, 2 and 4) having a pair of vertically-spaced bosses 53 and 54 in which are secured respectively the forward ends of guide bars 55 and 56 in any suitable manner, as for example by nuts 57 and 58 screwing onto threaded end portions of these bars.

Both these bars are slidably mounted for endwise movement in bores or guides 59 and 60 respectively formed in a housing 61, and means are provided for effecting endwise movement of the bars.

The rearward end of the guide bar 55 carries a follower 62 which operates in a cam track 63 formed in a rearward extension 64 of the housing 61, so that when the guide bars are moved forwardly in unison the constraint imposed by this cam track on the follower 62 ensures that the plug is removed from its closed position towards an open position along a predetermined path the

configuration of which is determined by the form of the cam track.

As illustrated, it will be observed that the initial path of the opening movement is more or less along the axis of the plug, this occurring when the follower is travelling along the part 65 of the cam track, and the later path of the movement when the follower is travelling along the part 66 of the cam track causes the rear end of the guide bar 56 to be raised and the plug consequently to be lowered so that it eventually reaches a fully-open position beneath the container proper, as indicated in chain lines at 67 (Figure 1).

The means for effecting endwise movement of the guide bars comprises in the construction illustrated rack teeth 62 formed on the underside of the guide bar 55, with which teeth meshes a pinion portion 69 formed at the outer extremity of sleeve 70, which is journaled rotatably on one of the stubs 28, as illustrated.

The inner end of this sleeve is formed as a wormwheel 71 with which meshes a worm 72 fixed on a shaft 73 which extends rearwardly and carries at its rearward end a rotary control member, such as the handwheel 74.

It will thus be observed that both the handwheels 33 and 74 are disposed adjacent to the rear portion of the container proper, i. e. remote from the opening through which controlled radiation is permitted to pass on displacement of the plug to its open position 67, and that whilst these handwheels are of course rotatable and move bodily with the container proper there is no bodily displacement of the handwheel 74 along a path equivalent to that traced out by the plug in moving between its closed and open positions, and that in consequence the operator's hand is not advanced nearer to the danger zone in opening the plug.

The housing 32 and associated arm 18 carry respectively graduated markings 75 and an index mark 76 by means of which the orientation of the container about the axis of the stub 28 can be read or set to a predetermined figure, and the other housing 81 is provided with a key-operated lock whereby the plug-actuated mechanism may be secured against unauthorised operation.

In the construction illustrated the housing 61 is provided with a bore in which is located the cylinder 77 of a cylinder-type lock which is free to move axially in this bore in an upward direction under the influence of coiled compression spring 78 whenever the locking plunger 79 is withdrawn into the body of the cylinder by placing the lock in the unlocked condition.

When this is done the cylinder moves upwardly in the bore and a pivoted interlock member 80 carried on a lug at the lower end of the cylinder is disengaged from the particular one of a number of axially-extending slots 81 formed on an enlarged part 82 of the shaft 73, with which this member was engaged in the locked position.

It will be appreciated that by providing a number of slots 81 at angularly spaced intervals the shaft 73 can be turned to a position in which the plug is tightly closed, and one of the slots 81 is in registration with the pivoted member 80 so that the cylinder can be depressed and the key turned to the locked position.

A similar arrangement is adopted at the rear portion of the body for securing the closure cap 40 in position. In this case the cylinder lock is indicated at 83 and its inner end coacts in this case with a single slot 84 formed in a flange 85 on the inner extremity of the spigot 41 of the cap

when the latter is screwed fully home, and this slot is in consequence brought into registration with the cylinder 83. As in the case of the other cylinder lock, a coiled compression spring 86 serves to spring-load the cylinder in an outward direction to which it is moved automatically on withdrawal of the locking plunger 87 into the cylinder.

For retaining the mounting stem 44 for the source, a clamping device is provided in the body of the container, this device comprising a cam 88 adapted by rotation to bear frictionally against the side of the stem 44 where this is exposed by a cutaway portion of the guide tube 45, or to be released therefrom in another position of rotation of the cam.

Such rotation may be effected by a thumb lever 89 to which access may be obtained by removal of the closure cap 40. This device ensures that the source cannot be released from the clamped position except by removal of the closure cap, which of course necessitates possession of the key for releasing the cylinder lock 83.

What I claim then is:

1. A container for radioactive material comprising a body including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radioactive material can be accommodated, and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material, a removable plug normally located in said opening to form a closure member for said cavity, means for supporting and guiding said plug between a closed position and an open position in which the plug is displaced transversely from the path of radiation permitted in said open position, an operating member situated permanently out of said path of radiation, and actuating mechanism operatively connecting said operating member with said plug, a key-actuated lock operatively connected with the actuating mechanism to enable the plug to be locked in the closed position, and means for securing said lock permanently in position on the body.

2. A container for radioactive material comprising a body including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radioactive material can be accommodated, and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material, a removable plug normally located in said opening to form a closure member for said cavity, means for supporting and guiding said plug between a closed position and an open position in which the plug is displaced transversely from the path of radiation permitted in said open position, an operating member situated permanently out of said path of radiation, and actuating mechanism operatively connecting said operating member with said plug, the container body having a housing, a permanently installed key actuated cylinder lock disposed in said housing and displaceable axially therein between locked and released positions in the former of which it coacts with said mechanism to prevent unauthorised operation thereof, and in the latter of which it frees said mechanism for operation.

3. A container for radioactive material comprising a carriage having a base comprising spaced side members connected by a transverse member, and an upwardly-extending structure comprising a pair of arms, one connected to each

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side member, and having bearings near their upper ends, a body journaled in said bearings and including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radioactive material can be accommodated, and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material, a removable plug normally located in said opening to form a closure member for said cavity, means for supporting and guiding said plug between a closed position and an open position in which the plug is displaced transversely from the path of radiation permitted in said open position, and worm and wormwheel mechanism operatively connected between said body and at least one of said arms for adjusting the body angularly in elevation about the axis of said bearings and for retaining it automatically in an adjusted position.

4. A container for radioactive material comprising a body including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radioactive material can be accommodated, and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material, a removable plug normally located in said opening to form a closure member for said cavity, and means for supporting and guiding said plug between a closed position and an open position in which the plug is displaced transversely from the path of radiation permitted in said open position, said block having a further opening for insertion and removal of the radioactive material, a removable cap on the body for controlling access to said further opening, and a key-actuated lock operatively associated with said cap for preventing unauthorized removal thereof, and means for securing said lock permanently in position on the body.

5. A container for radioactive material comprising a body including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radioactive material can be accommodated, and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material, a removable plug normally located in said opening to form a closure member for said cavity, and means for supporting and guiding said plug between a closed position and an open position in which the plug is displaced transversely from the path of radiation permitted in said open position, said block having a further opening for insertion and removal of the radioactive material, a removable cap on the body for controlling access to said further opening, said body having a housing, a permanently installed key actuated cylinder lock disposed in said housing and displaceable axially therein between locked and released positions, in the former of which it coacts with said cap to prevent removal thereof and in the latter of which it frees said cap for removal.

6. A container for radioactive material comprising a body including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radioactive material can be accommodated, and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material, a

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removable plug normally located in said opening to form a closure member for said cavity, and means for supporting and guiding said plug between a closed position and an open position in which the plug is displaced transversely from the path of radiation permitted in said open position, said block having a further opening for insertion and removal of the radioactive material, a stem operating in said opening and adapted at its inner end to support the source of radioactive material, a clamping device disposed in said body and cooperating with said stem to retain same against or free same for endwise movement in said opening, a removable cap on the body for controlling access to said further opening and said clamping device, a key-actuated lock operatively associated with said cap for preventing unauthorized removal thereof, and means for securing said lock permanently in position on said body.

7. In a container for radioactive material of the kind comprising a body including a block of material substantially impervious to radiations from the radioactive material said block having a cavity in which the radioactive material can be accommodated and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material, and a removable plug normally located in said opening to form a closure member for said cavity; the provision of means for supporting and guiding said plug between a closed position and an open position in which the plug is displaced transversely from the path of radiation permitted in said open position, and operating member structurally separate from said plug supporting and guiding means and mounted for movement in a substantially fixed location in relation to the body of the container situated out of the path of radiation so that at no stage in its operation does it approach the path of radiation, and actuating mechanism connecting said operating member with said plug and including means for effecting conversion from the mode of movement of the operating member in its substantially fixed location to the mode of movement entailed in displacement of the plug from its closed to its open position.

8. In a container for radioactive material of the kind comprising a body including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radioactive material can be accommodated, and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material, and a removable plug normally located in said opening to form a closure member for said cavity; the provision of means for supporting and guiding said plug between a closed position and an open position in which the plug is displaced transversely from the path of radiation permitted in said open position, and operating member structurally separate from said plug supporting and guiding means, and mounted for movement in a substantially fixed location in relation to the body of the container situated out of the path of radiation so that at no stage in its operation does it approach the path of radiation, and actuating mechanism connecting said operating member with said plug and including transmission elements affording a relatively high velocity ratio and low reversed mechanical efficiency to reduce the load presented to the operator in opening and closing the plug and to retain

the latter automatically in any adjusted position, and including means for effecting conversion from the mode of movement of the operating member in its substantially fixed location to the mode of movement entailed in displacement.

9. In a container for radioactive material of the kind comprising a body including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radioactive material can be accommodated, and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material and a removable plug normally located in said opening to form a closure member for said cavity, the provision of, plug supporting and guiding structure including a cam track establishing correlated outward and transverse movement of the plug with respect to the cavity, a rotary operating member structurally separate from said plug supporting and guiding structure and mounted for movement in a substantially fixed location in relation to the body of the container situated out of the path of radiation so that at no stage in its operation does it approach the path of radiation, and actuating mechanism connecting said operating member with said plug.

10. In a container for radio active material of the kind comprising a body including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radioactive material can be accommodated and an opening communicating with said cavity for permitting directionally-controlled exposure of the radioactive material, and a removable plug normally located in said opening to form a closure member for said cavity, the provision of plug supporting and guiding structure establishing a predetermined path of movement for the plug between closed and open positions comprising a guide member mounted on said body for pivotal movement about an axis transverse to an outward path of movement to be followed by the plug in moving from a closed to an open position, said guide member having guideway means extending lengthwise in relation to said outward path, a plug supporting assembly carrying said plug and having a part movably supported by said guideway means for movement therealong, a cam track and a follower one of which is mounted on to said body and the other on said plug supporting assembly, the cam track being shaped to establish pivotal movement of the guide member about said axis in predetermined relationship to the position occupied by the plug along said outward path so that the plug initially moves substantially rectilinearly from its closed position and is then displaced transversely

from the path of radiation permitted in its open position, an operating member and mounted for movement in a substantially fixed location in relation to the body of the container situated out of the path of radiation so that at no stage in its operation does it approach the path of radiation and actuating mechanism connecting said operating member with said plug for moving same along said outward path.

11. In a container for radio active material of the kind comprising a body including a block of material substantially impervious to radiations from the radioactive material, said block having a cavity in which the radio active material can be accommodated, and an opening communicating with said cavity for permitting directionally-controlled exposure of the radio active material, and the provision of plug supporting and guiding structure establishing a predetermined path of movement for the plug between closed and open positions comprising a guide member mounted on said body for pivotal movement about an axis transverse to an outward path of movement to be followed by the plug in moving from a closed to an open position, said guide member having spaced parallel guideways extending lengthwise in relation to said outward path, a plug supporting assembly carrying said plug and having guide elements disposed in said guideways for movement therealong, a cam track mounted on said body and a follower mounted on one of said guide elements the cam track being shaped to establish pivotal movement of the guide member about said axis in predetermined relationship to the position occupied by the plug along said outward path so that the plug initially moves substantially rectilinearly from its closed position and is then displaced transversely from the path of radiation permitted in its open position, an operating member and mounted for movement in a substantially fixed location in relation to the body of the container situated out of the path of radiation so that at no stage in its operation does it approach the path of radiation, and actuating mechanism including a rotary pinion mounted on the body coaxially with the guide member and a toothed rack on one of said guide elements meshing with said pinion.

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