

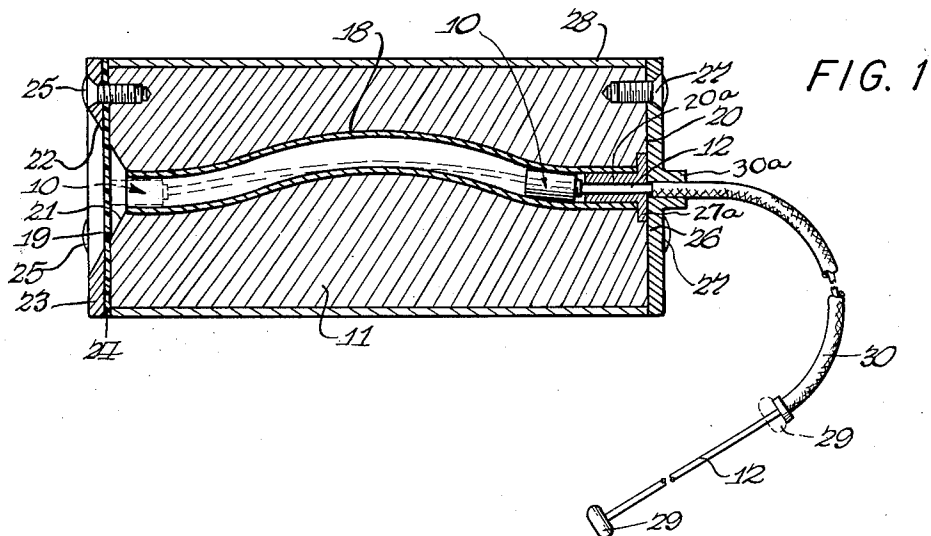
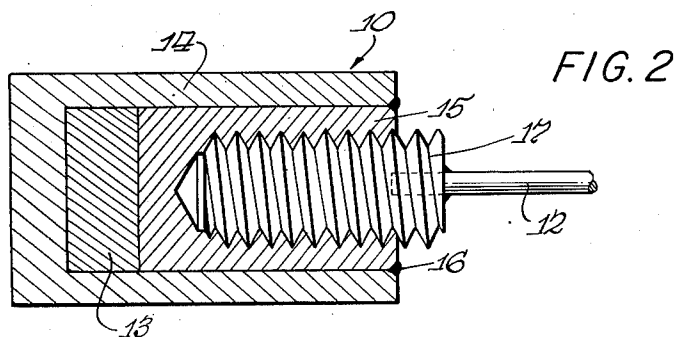
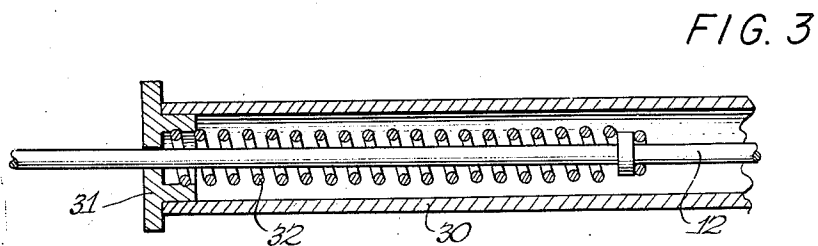
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PORTABLE X-RAY OR GAMMA SOURCE

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1

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PORTABLE X-RAY OR GAMMA SOURCE

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This invention relates to a source of radioactivity, and more particularly, to a radioactive source that is compact and portable.

The need is great for a radioactive source that can be carried by hand from place to place. A portable source of radioactivity could have considerable use by Army surgeons for emergency X-ray photography and fluoroscopy at advanced bases or in the field where use of a permanent X-ray apparatus is impossible. When the portable source emits gamma rays, there will be considerable use in industrial plants for testing purposes.

An object of the present invention is to provide a source of radioactivity that is compact and can readily be carried by hand. I have been able to accomplish this by designing the radioactive source so that the projection of its activity can be controlled without the use of a shutter, which I have found must be very large in order not to limit the useful solid angle of emission of radiation. A large shutter interferes with portability.

Other objects will become apparent from the drawing and description that follows.

In the drawing:

Fig. 1 is a sectional view taken through the novel radioactive source of the present invention;

Fig. 2 is a sectional view taken through the radioactive capsule employed in the above source; and

Fig. 3 is a sectional view taken through a portion of the releasing mechanism for the capsule.

The device that constitutes a radioactive source comprises essentially a radioactive capsule 10, a shielding body 11 having a crooked or curved passage, and a wire rod 12 for moving the capsule 10 between an operative position shown in dotted lines in Fig. 1 and an inoperative or inactive position shown in full lines in Fig. 1.

The capsule 10 comprises an active core 13 and a casing formed of a cup 14 and plug 15 which completely enclose the core 13. The core is formed of a radioactive material, which emits radiation of the desired energy. Thulium-170, which emits 52 k. e. v. X-rays, and americium-242, which emits 40 k. e. v. gamma rays, are suitable sources for radiographic purposes, while cobalt-60 is a suitable source of 1.6 m. e. v. gamma rays for radiographic purposes and also for therapeutic purposes. The thulium can be a mixture of thulium-169 and thulium-170, which may be formed by the irradiation of thulium-169 in a neutronic reactor. The material of the core may be in the form of a metal disk, a compound of the metal, or an enclosure containing powder of the metal or a compound of the metal. If the core 13 is a disk of metallic thulium, it may be .16 in. in diameter and .070" in thickness. The dimensions listed for the parts about to be described are suitable when the core 13 is thulium or americium. Much larger dimensions are required if the core is cobalt. The cap 14 and plug 15 should be of a corrosion-resistant that does not emit undesirable radiation, such as aluminum. The cup 14 should be .375 in. in length, .050 in. in base thickness, .22 in. in outer diameter, and .16 in. in inner diameter.

2

The base of the aluminum cap 14 serves to filter out undesirable beta radiation from the thulium. The aluminum plug 15 should be .255 in. in length and .16 in. in outside diameter. There should be an annular bond 16 formed between the ends of the cup 14 and the plug 15 to seal the core 13 within the cup and the plug.

A fastening member 17, which is secured in a threaded connection to the plug 15, attaches one end of the wire rod 12 to the capsule 10. The fastening member 17 and the wire rod 12 may be formed of stainless steel and are attached to one another as by bonding.

The body 11 is preferably formed of lead and has a length of 4.19 in. and a diameter of 1.87 in. The crooked curved passage therein mounting the radioactive capsule 10 is formed by a stainless-steel tube 18 which is embedded in the body 11 and extends from the neighborhood of one end face 19 of the body through the body almost to an opposite end face 20. The internal diameter of the tube 18 is .25 in., so that the capsule 10, which has an external diameter of .22 in., has a loose sliding fit therein. The tube 18 is curved in a single plane or is spiral so that when the capsule 10 lies against the end of a stainless-steel bushing 20a located in one end of the tube 18, that is, lies in the inactive position shown in full lines in Fig. 1, there is no line of sight to the capsule 10 through the body from end face 19, and so emanations from the capsule 10 cannot get out at this end face. The relatively close fit of the wire rod 12 in the bushing 20a prevents escape of emanations from the capsule at end face 20. The opening in the bushing 20a may be .0625 in. in diameter, and the wire rod 12, .0458 in. in diameter. The bushing 20a is about one inch long so that in the inactive position of the capsule 10 about one inch of shielding body 11 lies between the end face 20 of the body and the capsule. Yet the lateral displacement of the intermediate portion of the tube 18 should not be so much as to reduce the minimum thickness of the body 11 at the intermediate portion of the tube 18 to the extent that emanations from the capsule 10 can escape radially through the body 11.

The end of the stainless-steel tube 18 adjacent the end face 19 of the body 11 is at the small end of a conical recess that has a solid angle of about 120° and is formed of a conical recess 21 in the body 11 having a diameter of .26 in. at its small end and a conical hole 22 formed in a stainless-steel plate 23. The outer diameter of the tube 18 is also .26 in., and this is the same size as the small end of the recess 21. The depth of the conical recess 21 is .19 in. The plate 23, which is .125 in. thick, serves to hold against end face 19 of body 11, a plastic plate 24 of .03 in. thickness formed of methyl methacrylate. The plate 24 shields the body 11 against the entrance of foreign material such as dust at the recess 21. The plate 23 is secured to the body 11 by three screws 25 spaced about 120° from one another about the conical recess 22. The end face 20 of the body 11 is covered by a plate 26 which is .125 in. thick and is secured thereto by three screws 27 spaced about 120° from one another about the tube 18. The bushing 20a has an end flange 27a by which the bushing is clamped in a recess in the end face 20 of the body 11 by the plate 26. The body 11 is encased in a cylindrical sheath 28 of stainless steel, which may be suitably bonded to the plates 23 and 26.

The wire rod 12 projects considerably beyond the protruding end of the tube 18 and has at its end remote from the capsule 10 a button 29, which may be of stainless steel. A flexible hose or tube 30, which may be of woven metal wire or cloth or both or of spirally wound wire, contains the wire rod 12 and has one end secured within a tubular flange 30a formed on the end plate 26 and a perforated metal disk 31 secured to its other end. The

3

rod 12 passes through the disk 31. A coil spring 32 which surrounds a portion of the rod 12 and lies within the hose 30 has one end secured to the disk 31 and the other end secured to the rod 12 and serves yieldingly to hold the capsule 10 in its inactive position and the button 29 spaced from the disk 31, both as shown in full lines in Fig. 1.

The spacing of the button 29 in its full-line position from the perforated disk 31 is about equal to the distance between the inactive full-line position of the capsule 10 and the active dotted-line position thereof, so that depression of the button 29 to the perforated disk 31 causes the capsule 10 to move from inactive position to active position. Engagement of the button 29 with the disk 31 limits the movement of the capsule 10 to the dotted-line position of Fig. 1, in which the capsule engages the plastic plate 24. This movement is carried out against the action of the spring 32, which is placed in tension thereby. Release of the button 29 permits the capsule 10 to be returned to its inactive full-line position through the action of spring 32. Depression of the button 29 to the disk 31 may be accomplished by engagement of the button 29 by the thumb and of the disk 31 by the index and middle fingers of the same hand, the disk 31 protruding radially outwardly beyond the tube 30 to make the latter engagement possible.

The significant thing about the device of the present invention is that the active capsule 10 moves from an exposed active position at one end of the shielding body 11 to an inactive position deep within the shielding body and that shifting of the active capsule between these positions is carried out manually by means of the wire rod 12 and the spring 32. This arrangement dispenses with the need for shutters or other movable closure elements at the end where the capsule lies exposed in its active position. Thus there are no moving parts where the active capsule is exposed, the construction is simple and compact, and the over-all dimensions are held to a minimum. It is to be noted that capsule 10 in its active position gives off radiation through a wide angle, about 120°, as shown. A rotary shutter at the outside of the plate 23 would have to be quite large in order to handle the wide angle of radiation. The large shutter would make associated parts large and the large over-all size would interfere with portability. It is also significant that the tube 18 in which the capsule 10 is moved between active and inactive positions is curved in such a way that, when the capsule is in its inactive position, there is no line of sight to the capsule through the end of the tube 18 adjacent the cover 24, and emanations cannot escape through this end of the tube. Emanations cannot escape from the other end of tube 18, because of the relatively close fit of the wire rod 12 in the tubular section 20a.

The intention is to limit the invention only within the scope of the appended claims.

What is claimed is:

1. An assembly comprising a body of shielding material having a curved passage extending therethrough between first and second opposite ends of the body, a capsule con-

4

taining radioactive material and being slidably mounted in the passage for movement between an active position in which it is adjacent said first end of the body and can project its activity through such first end and an inactive position in which it lies between and spaced from said first and second ends while being nearer the second end and is capable of projecting its activity through neither of said ends, a rod connected to the capsule and extending therefrom through the passage and out said second end of the body, a bushing mounted in the end of the tube adjacent the second end of the body and fitting the rod relatively closely, a flexible tube attached to said second end of the body and housing the portion of the rod exterior of said second end of the body while leaving the end of said exterior rod position exposed for manipulation, and resilient means acting between the rod and the end of the flexible tube beyond which the rod lies exposed whereby the capsule is urged to its inactive position.

2. The assembly specified in claim 1, the end of the curved passage at said first end of the body being conical, the assembly further comprising a plastic plate covering said first end of the body and the conical end of the curved passage to retain the capsule in the body, and a retaining plate holding the plastic plate against the body and having a conical opening formed as a continuation of the conical end of the curved passage in the body.

3. An assembly comprising a lead body having a curved passage extending therethrough between first and second opposite faces, a curved stainless-steel tube conforming to the passage throughout its length, a capsule having a radioactive core and an aluminum casing completely enclosing the core, the core being formed of a material emitting gamma rays having an energy of at least 40 k. e. v., said capsule being slidably mounted in the passage for movement between an active position in which it is adjacent said first end of the body and can project its activity through said first end and an inactive position in which it lies between and spaced from said first and second ends but nearer the second end and is capable of projecting its activity through neither of said ends, a rod connected to the capsule casing and extending therefrom through the stainless-steel tube and out of the end of the tube beyond said second face of the body, a bushing mounted in the tube adjacent the second face of the body and fitting the rod relatively closely, a flexible tube having one end connected to the second face of the body and containing the rod, the rod projecting beyond the other end of the flexible tube, and a spring acting between the rod and said other end of the flexible tube for acting through the rod to urge the capsule to its inactive position.

References Cited in the file of this patent

UNITED STATES PATENTS

55	2,412,174	Rhoades	Dec. 3, 1946
	2,551,491	Gilks	May 1, 1951
	2,622,209	Hjulian et al.	Dec. 16, 1952
	2,719,823	Zinn	Oct. 4, 1955
	2,750,517	Baum	June 12, 1956