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Czaplinski et al.

[11] **3,920,995**

[45] **Nov. 18, 1975**

[54] **RADIOACTIVE MATERIAL GENERATOR**

[75] Inventors: **Thomas V. Czaplinski**, North Brunswick; **Bernard J. Bolter**, Trenton; **Robert E. Heyer**, Hopatcong; **Gerald A. Bruno**, Shrewsbury, all of N.J.

[73] Assignee: **E. R. Squibb & Sons, Inc.**, Princeton, N.J.

[22] Filed: **May 20, 1974**

[21] Appl. No.: **471,636**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 357,433, May 4, 1973, abandoned.

[52] **U.S. Cl.** **250/432;** 250/493

[51] **Int. Cl.**[2] **G01M 21/24**

[58] **Field of Search** 250/432, 493

[56] **References Cited**

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3,774,035 11/1973 Litt 250/435

Primary Examiner—Harold A. Dixon

Attorney, Agent, or Firm—Lawrence S. Levinson; Merle J. Smith; John J. Archer

[57] **ABSTRACT**

A radioactive material generator includes radioactive material in a column, which column is connected to inlet and outlet conduits, the generator being embedded in a lead casing. The inlet and outlet conduits extend through the casing and are topped by pierceable closure caps. A fitting, containing means to connect an eluent supply and an eluate container, is adapted to pierce the closure caps. The lead casing and the fitting are compatibly contoured such that they will fit only if properly aligned with respect to each other.

7 Claims, 10 Drawing Figures

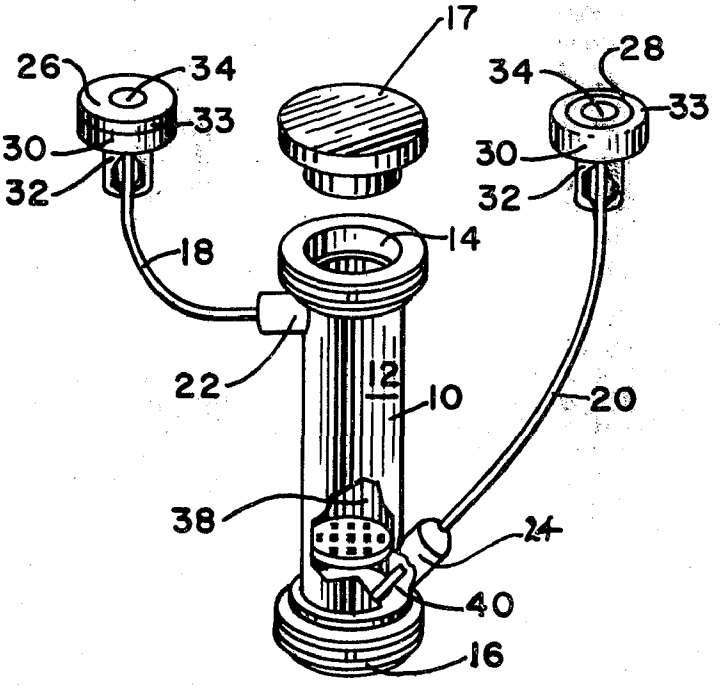


FIG. 1

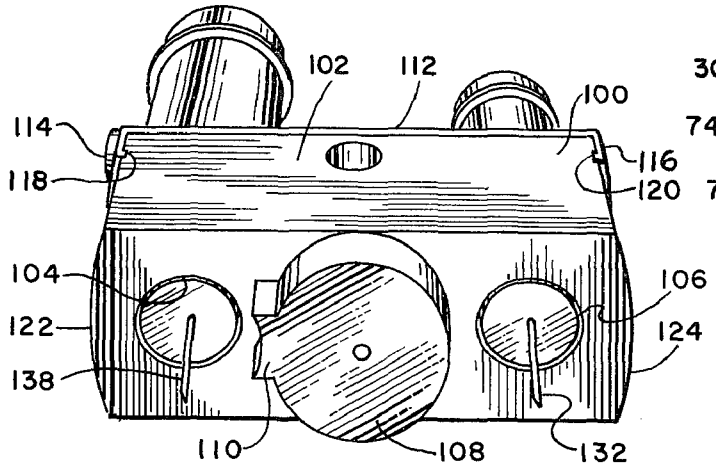


FIG. 2

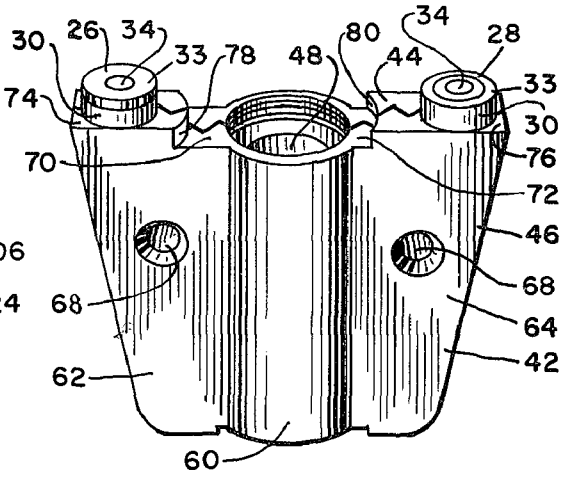


FIG. 3

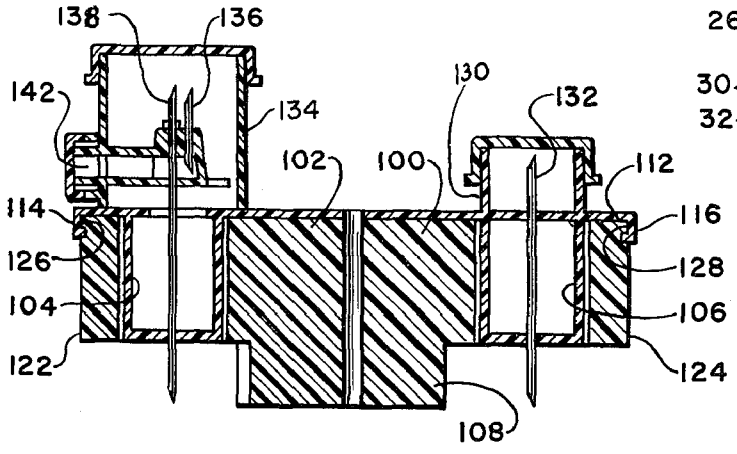
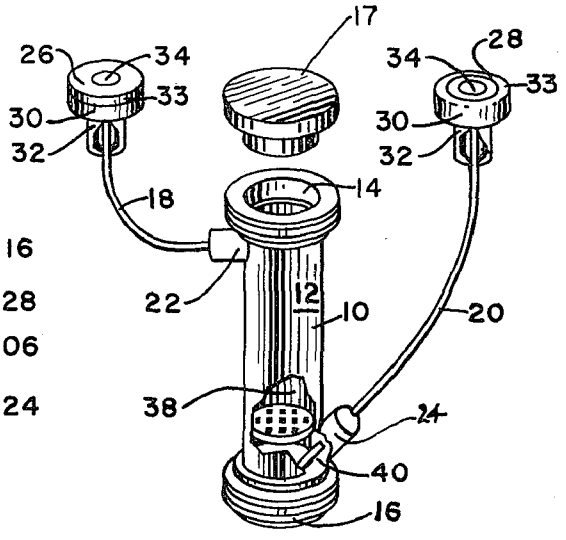


FIG. 4



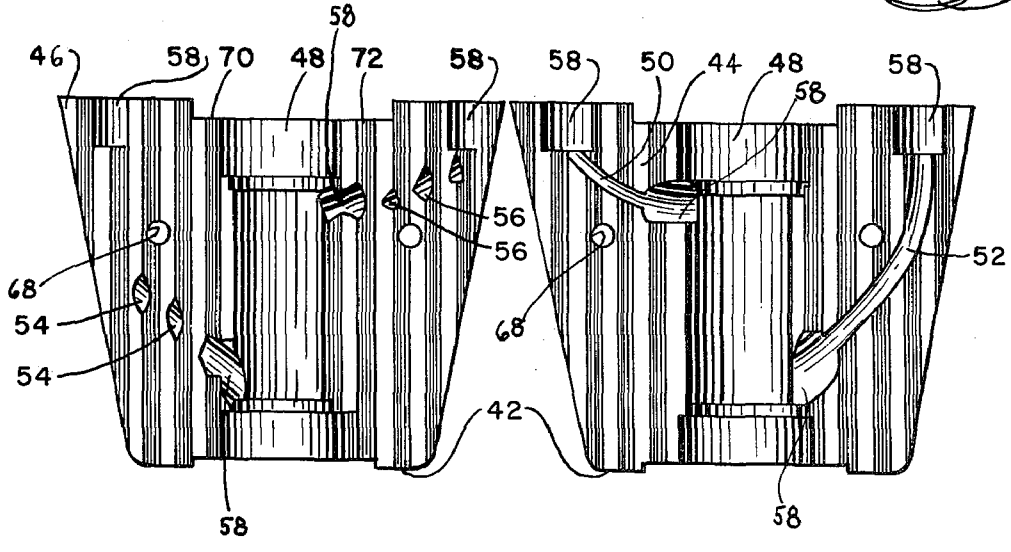


FIG. 5

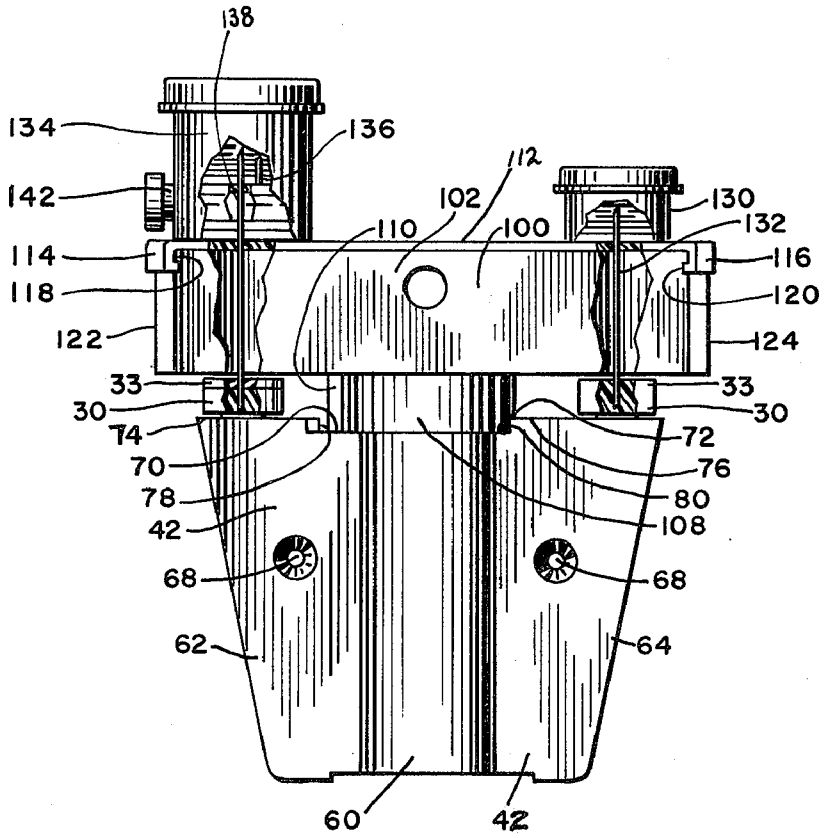

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FIG. 6

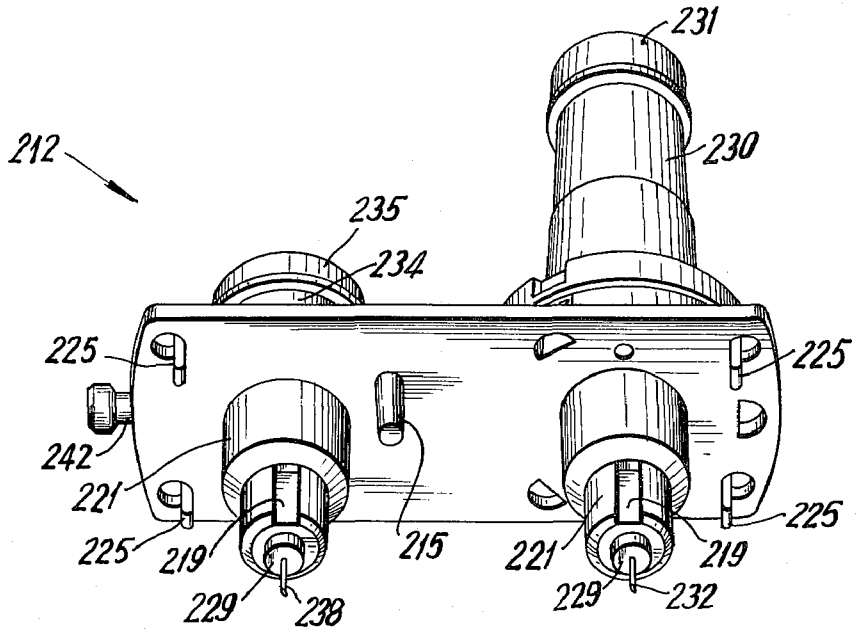
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FIG. 7

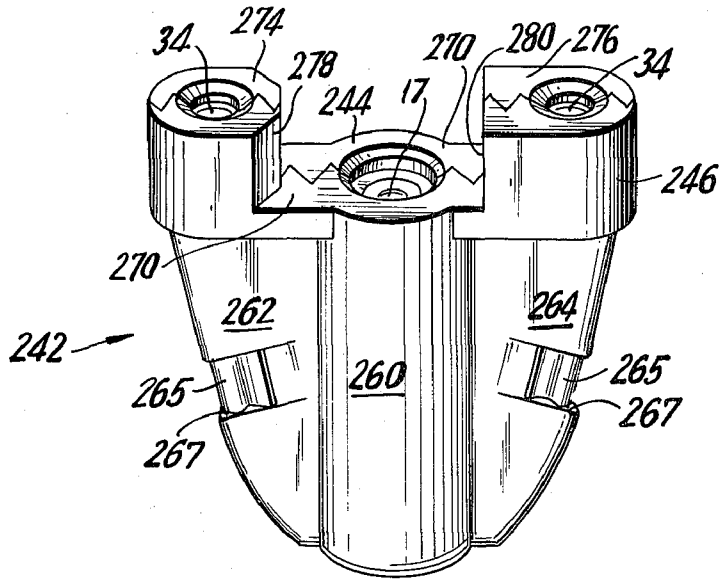
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FIG. 8

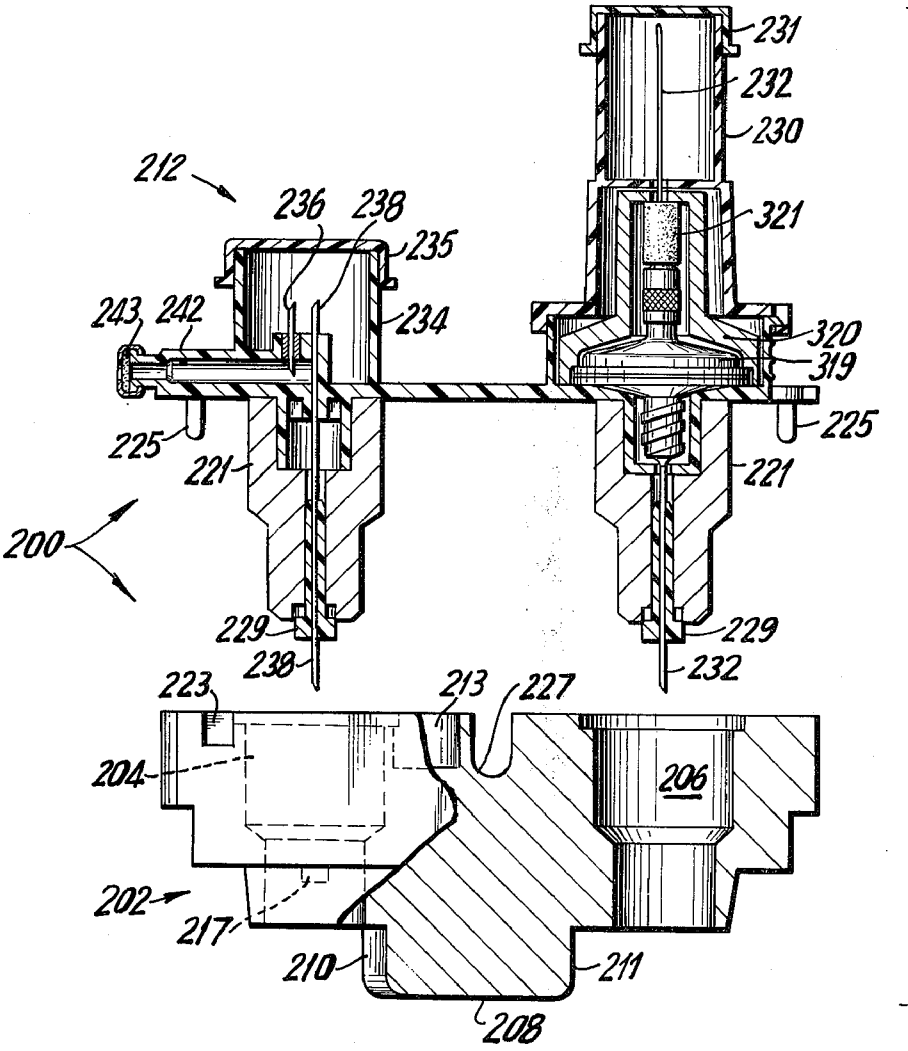
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FIG.9

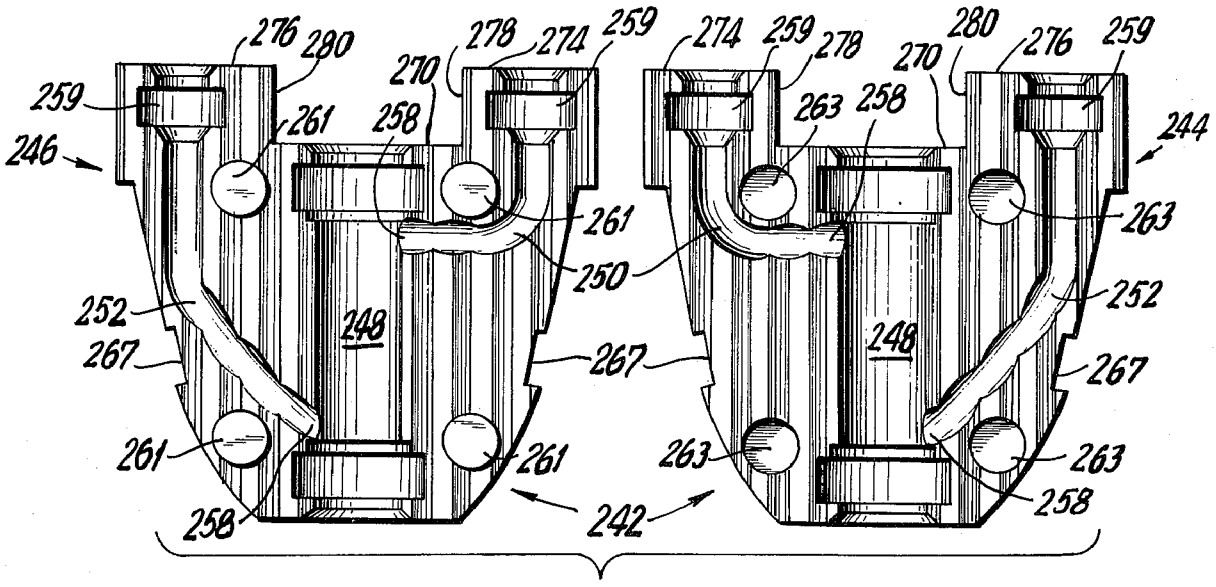
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FIG. 10

RADIOACTIVE MATERIAL GENERATOR

This is a continuation-in-part application of Ser. No. 357,433, filed May 4, 1973, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a radioactive material generator, and in particular, the combination of such a generator and a fitting which permits eluent supply means and eluate withdrawal means to be operatively coupled thereto.

The use of radiosotopes in medicine, for diagnosis and treatment, is well known and its use is under great expansion. Generally, isotope solution is eluted from a radioactive material generator when and as the material is to be utilized. THe reason for this is that the daughter isotope generally has an extremely short half-life and must be prepared at the proximate time of use. To satisfy this requirement, numerous systems have been devised to enable the physician to assemble the various components of the generator and then elute the usable solution.

The radioactive generators have traditionally been of the type shown in U.S. Pat. No. 3,369,121 issued Feb. 13, 1968 and U.S. Pat. NO. 3,440,423 issued Apr. 22, 1969. As there described, the generator comprises radioactive material such as a column of alumina impregnated with Mo^{99}. The daughter isotope, in this case Tc^{99m}, is eluted from the generator by means of a saline or dilute hydrochloric acid solution. The alumina is suspended in a plastic housing and naturally there must be means supplied to introduce the eluent and to withdraw the eluate, i.e., the isotope solution. In the prior art, these means have comprised pierceable stoppers through which the fluids are introduced and removed by means of hypodermic needles. Recent developments include the provision of inlet and outlet conduits which are similarly sealed by pierceable stoppers.

In all of the prior art embodiments, cumbersome and complex protective equipment had to be utilized to protect various personnel from being exposed to the emission of the generator. The various protective equipment utilized required the physician to assemble heavy parts and suspend various bottles, in short, calling upon him to perform far too many manipulations. The present invention is directed to a fitting which renders the generator quite simple to use, eliminates unnecessary manipulations, and at the same time provides complete protection against radioactive emissions.

SUMMARY OF THE INVENTION

The generator incorporated in the instant invention comprises a column of alumina inpregnated with Mo^{99}. The alumina is suspended in a cylindrical housing annd the housing is sealed at both ends. An inlet conduit, for the introduction of the eluting solution, is provided and connected to the upper portion of the housing. An outlet conduit, for withdrawing eluate from the generator, is provided and connected to the lower end of the housing. Both conduits are sealed by means of pierceable caps.

The housing and conduits are embedded in a wing-shaped, split lead casing, the casing interface being contoured to conform to the housing contour and the contours of the conduits. Each section of the split casing is suitably contoured to accept a portion of the housing and of each conduit. Additionally, the interface is composed of alternate ribs and grooves, and may include other means, such that there is only one position at which the casing sections can be joined. The casing sections are suitably joined, as for example, by means of nuts and bolts, snap clasps, or other suitable means.

The conduit sealing caps may protrude above the top surface of the casing, above raised platforms which are situate at the top left and top right corners of the casing, or these conduit sealing caps or covers may be housed within the lead casing to provide additional radiation shielding. The interior sidewalls of the platforms are formed into parallel arcuate sections or other nonsymmetrical surfaces. This formation constitutes a key-way which insures proper alignment of the fitting when it is assembled to the casing.

The fitting incorporated into the instant invention comprises a lead bar having adjacent the respective ends thereof, holes into which inserts are received, which inserts accommodate eluent supply means and eluate withdrawal means. Those holes are positioned such that they are directly above the sealing caps of the inlet and outlet conduits upon assemblage of the fitting to the casing. The eluent supply and eluate withdrawal means are adapted to accommodate the eluent container and the eluate container, preferably an evacuated vial which draws the desired solution out of the generator.

To insure proper assemblage of the fitting and the casing, the fitting is provided on the undersurface thereof with a plug or boss having lateral surfaces complementary to the surfaces of the interior sidewalls of the raised platforms on the top of the casing. When such interior sidewalls are parallel arcuate sections, the boss may be of generally circular shape (the diameter being identical to that of the arc of each interior sidewall of the platforms) so that the boss mates with one of the sidewalls, and a guide section, which is adjacent to and of the same arcuate contour as the other platform sidewall, mates with the other sidewall. The provision of what is effectively a key and key-way structure eliminates the possibility that the fitting will be improperly assembled to the casing.

The eluent supply means and eluate withdrawal means are preferably incorporated into a unitary molded plastic receptacle holder for the eluent container and the eluate container. This receptacle holder also provides the means, including the two double ended hypodermic needles, for fluid connection between the eluent container and the inlet conduit and between the eluate container and outlet conduit through the pierceable closure caps of the containers and the conduits. The receptacle holder may be connected to the lead bar of the fitting to form an integrated unit or the receptacle holder may be provided with a locating or positioning pin and releasable fasteners so that it may be mounted on the lead bar in the proper operative position at the time of use.

The above and other aspects of the present invention will be further amplified as the description continues, and when read in conjunction with the appended drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a fitting showing all the structure on the bottom thereof;

FIG. 2 is a perspective view of a casing showing the structure on the top thereof;

FIG. 3 is a front elevational view of a fitting, cross-sectioned to show the needle structure thereof;

FIG. 4 is a perspective view of a generator partially cut-away to reveal the connection therewith of the outlet conduit;

FIG. 5 is a front elevational view of the casing of FIG. 2 showing the interior of the split sections of the casing in side by side relation;

FIG. 6 is a front elevational view of the fitting of FIGS. 1 and 3 assembled to the casing of FIGS. 2 and 5, partially cut-away to expose the needles piercing the sealing caps;

FIG. 7 is a perspective view of an alternative embodiment of a portion of a fitting showing a receptacle holder with needle adapter assembly and the structure on the bottom thereof;

FIG. 8 is a perspective view of an alternative embodiment of a casing showing the structure on the top thereof;

FIG. 9 is a front elevational view of an alternative embodiment of a fitting, exploded and partly in cross-section to show the receptacle holder with needle adapter assembly of FIG. 7 and the manner of joining the receptacle holder and the lead bar portions of the fitting; and

FIG. 10 is a front elevational view of the casing of FIG. 8 showing the interior of the split sections of the casing in side by side relation.

DETAILED DESCRIPTION

The present invention incorporates a radioactive material generator **10** as illustrated in FIG. **4**. That generator is similar in operative aspects as that shown and described in U.S. Pat. No. **3,369,121** and **3,440,423**. The generator **10** comprises the cylindrical housing **12** in which a chromatographic grade of alumina, impregnated with Mo^{99}, is suspended. The generator **10** is milked of its product solution, containing Tc^{99m}, by means of an eluent which may be saline, dilute hydrochloric acid or other suitable solutions. The system for eluate withdrawal from the generator and for introducing the eluent will be described in greater detail as the description continues.

The generator **10** is sealed at its top **14** and bottom **16** by stoppers **17** which are adapted to be pierced by hypodermic needles for the purpose of loading the generator **10**. The radioactive molybdenum solution can thereby be introduced by pypodermic needle and connected syringe or other suitable means through the top stopper **17** into contact with the alumina and the excess solution drawn off by piercing the bottom stopper **17** with a hypodermic needle connected to a syringe or to a vacuum line. The stoppers **17** are preferably formed of a gas pervious, pierceable material which is autoclavable, such as silicone, e.g., methylvinylpolysiloxane. As noted in U.S. Pat. No. **3,801,818** issued Apr. **2, 1974**, such closures or stoppers are capable of venting gases which may be internally generated during the autoclaving procedure by which the generator **10** is sterilized.

In most prior art generators in which the top and bottom are closed by pierceable seals, the eluent is added and the eluate is withdrawn through such seals. The generator **10** of the instant invention provides for eluent addition via a conduit **18** and eluate removal via conduit **20**. In this embodiment the conduits are shown as being separate tubes encapsulated within projections **22, 24** which are unitary with the housing **12**. It should be evident that the conduits **18, 20** may be unitary with the housing **12**, the entire unit being formed of a molded plastic. It is to be noted that the outer terminal ends of the conduits **18, 20** are sealed by means of covers or caps **26, 28**. The covers **26, 28**, according to FIG. **4**, comprise a molded cup **30** having a stem **32**, which stem encapsulates the upper terminus of the conduits **18, 20**. The open ends of the conduits **18, 20** however, are not blocked by cup **30**, but are open to the cup chamber. A pierceable closure **34**, fabricated from material such as silicone or neoprene, is sealingly received in the cup **30**, and is held in place by means of a flexible metallic ring **33** which is crimped about the cup **30** and the closure **34**.

From the structure thus far described, it follows that eluent is injected into the generator **10** by being passed through the closure **34** into the cup **30**, and from there into inlet conduit **18**. By providing a reduced pressure in cover **28**, the eluent is sucked through the generator **10**, passing through the alumina bed where it picks up the Tc^{99m}, into the lower chamber **38**, and into the lower terminus **40** of the outlet conduit **20**. An evacuated container is advantageously used to provide the reduced pressure in cover **28**, and it draws the fluid out of cup **30** in cover **28**. This eluate is immediately ready to be injected into a patient.

The generator hereinbefore described must be properly shielded inasmuch as the physician and the patient should not be unnecessarily exposed to the emissions therefrom. Accordingly, a lead casing is provided to house the entire generator **10**. As shown in FIGS. **2** and **5**, the casing **42** is vertically split into two parts **44, 46**. The mating interior surfaces which form the interface of joinder are suitably contoured to closely accommodate therein the generator **10** and the conduits **18, 20**. To this end, each is provided with a central depression **48** which accepts the cylindrical housing in close confinement. Channels **50, 52** are provided for the acceptance of the conduits **18, 20**. The part **44** may be made thicker than part **46** and will therefore more deeply accommodate the generator **10** and conduits **18, 20**. In this fashion the channels will be formed in the part **44**, there being only slight depressions **54, 56** in the part **46** to complement the channels **50, 52**. Depressions **58** are provided in various positions to accommodate the projections **22, 24** and stems **32**. The interior surfaces of the parts **44, 46** are ribbed and grooved to insure that those parts are properly mated.

As shown in FIG. **2**, when the parts **44, 46** are joined the casing **42** resembles a fuselage-like section **60** flanked by wings **62, 64**. The parts **44, 46** may be joined by means of screws (not shown) received in openings **68**, and nuts (not shown) received in countersunk holes in one of the parts to provide a secure joinder. It is obvious that other means of joining parts **44** and **46** may be used. The wings **62, 64** are seen to terminate in upper flat surfaces **70, 72**, which surfaces integrate into the fuselage **60**. The surfaces **70, 72** respectively step up to platforms **74, 76** which are also flat. It is important to note the configuration of the respective sidewalls **78, 80** of those steps. Each sidewall is arcuate and they are essentially parallel. This configuration provides a key-way the function of which has been described previously and will be more evident as the de-

scription continues. It is to be recognized, that when the generator **10** is enclosed in casing **42**, the covers **26**, 28 are situate above the platforms **74, 76** to make them accessible to the eluent supply and eluate withdrawal equipment illustrated in FIGS. **1** and **3**.

Turning now to FIGS. **1, 3** and **6** the eluent supply and eluate withdrawal equipment is integrated into a fitting **100**. That fitting's major component is a rectangular lead bar **102** which includes the holes **104, 106** adjacent the respective ends thereof. Protruding from the undersurface of the bar **102** is a boss or disc-like member **108** which can be of unitary construction with that bar. The disc **108** is of sufficient diameter to generally cover the entire area between the platforms **74, 76.** That disc includes a guide surface **110** which is of the same contour as the sidewall **78**. It should be evident that the guide surface **110** will mate only with sidewall **78** and not with sidewall **80.** This insures that when the fitting **100** is assembled to casing **42** they will be properly aligned.

As shown in FIGS. **1, 3** and **6,** a unitary molded plastic receptacle holder **112** is connected to the upper surface of bar **102** by way of the skirts **114, 116** which depend into recesses **118, 120** in the bar sidewalls **122,** 124 and are crimped about ribs **126, 128** respectively. The receptacle holder **112** includes a holder **130** for an eluate container, preferably an evacuated vial. That holder extends into hole **106** and above the top surface of receptacle holder **112.** The holder **130** is sealed at the top and bottom of the bar **102** except for the central portion which supports a double ended hypodermic needle **132.** It is through that needle that the eluate is withdrawn via outlet conduit **20.** The receptacle holder **112** also includes an eluent container holder **134** which, like holder **130** extends into the bar **102** and projects thereabove. The holder **134** is also similarly sealed and supports the hypodermic needles **136, 138.** Needle **138** is similar to needle **132,** it is double ended and serves to conduct eluent into the generator **10.** The needle **136** does not extend below the upper surface of bar **102** and serves only to provide an inlet for air into an eluent container. The conduit **142** connects needle **136** with the atmosphere through a hydrophobic filter (not shown). A filter (not shown) may be incorporated at the lower portion of the holder **130** to remove any particulate matter that may pass into the needle **132.**

In use, the physician assembles the components of the system illustrated in FIGS. **1** through **6** at the proximate time of usage. Initially, the generator **10,** enclosed in the casing **42,** may be stored in a lead pig for further protection against emission. The fitting **100** is then assembled to the casing **42** by properly aligning the disc **108** and pressing on the fitting until the needles **132,** 138 pierce the respective closures **26, 28** of the inlet and outlet conduits **18, 20.** An eluent container (not shown) is assembled upside down on the holder **134,** the neck thereof being received therein; and the needles **136, 138** pierce a sealing diaphragm of that container. A completed entry path from the eluent container through needle **138** and inlet conduit **18** is now defined into the interior of generator **10.** An evacuated vial is then similarly assembled atop the holder **130** as the eluate container, with the needle **132** piercing its sealing diaphragm. The pressure differential produced by the evacuated eluate container draws the eluent through the needle **138,** through the closure **34,** through conduit **18** and through the alumina where it picks up the Tc^{99m}. Thereafter the eluate is drawn into bottom chamber **38** from which it passes into conduit **20.** It is then drawn through needle **132** and into the eluate container.

An alternative embodiment of the casing and of the fitting are illustrated in FIGS. **7** through **10.**

As shown in FIGS. **8** and **10,** the lead casing **242** is very similar to the embodiment illustrated in FIGS. **2** and **5.** The casing **242** is in two vertical sections **244,** 246. The mating interior surfaces of the sections **244** and **246** which form the interface of joinder are suitably contoured to closely accommodate therein the generator **10,** the inlet and outlet conduits **18, 20,** and the covers or caps **26, 28.** For this purpose, each of the sections **244, 246** is provided with a central depression **248** which accommodates the cylindrical housing **12** of the generator **10** in close confinement. The depression **248** extends from the top to the bottom of each of the sections **244, 246** to provide in the assembled casing **242** an access opening to each of the pierceable stoppers **17** at the top **14** and the bottom **16** of the housing **12** of the generator **10** contained within the casing **242.** These openings are provided to permit loading of the generator **10** after it has been enclosed within the lead casing **242.** Channels **250, 252** are provided for the inlet and outlet conduits **18, 20.** The sections **244, 246** are substantially the same thickness, and therefore, each provides substantial portions of these channels **250, 252** for the conduits **18, 20.** The interior ends **258** of the channels **250, 252** accommodate the connections (shown in FIG. **4** as projections **22, 24**) of the conduits **18, 20** to the cylindrical housing **12** of the generator **10.** As shown in FIG. **10,** channels **250, 252** provide for a housing **12** and conduits **18, 20** which are molded as a single unit so that no projections (such as **22, 24** of FIG. **4**) are present at the connections of conduits **18, 20** to housing **12.** Depressions **259** are provided to accommodate the covers or caps **26, 28** which seal the outer terminal ends of the conduits **18, 20.** In this embodiment of FIGS. **8** and **10,** the covers **26, 28** are within the lead casing **242** to provide additional radiation shielding. The depressions **259** extend to the top surfaces of the platforms **274** and **276** of the casing **242** so that when sections **244, 246** are joined an opening is provided permitting access to the pierceable closures **34** of the covers **26, 28** of inlet and outlet conduits **18, 20.** The interior surfaces of the sections **244,** 246 are ribbed and grooved to insure that the sections **244, 246** are properly mated. In addition, four locating lugs **261** fit into four depressions **263** to hold the sections **244, 246** in proper position with respect to each other.

In FIG. **8,** the sections **244, 246** are shown joined to form the casing **242** which is very similar to the casing **42** of FIG. **2,** i.e., the casing **242** also resembles a fuselage-like portion **260** flanked by wing-like portions **262,** 264. The sections **244, 246** may be fastened together by any suitable means providing a secure joinder. As shown in FIG. **8,** the sections **244, 246** are held together by spring clips **265,** which may be formed of any suitable material such as metal or plastic, in the notches **267** provided in the outside surface of each of the wing-like portions **262, 264** of sections **244, 246.** The top of the casing **242** is formed of three flat surfaces **270, 274** and **276.** The surface **270** surrounds the opening, formed by depression **248** in each of sections **244** and **246,** at the top of the fuselage-like portion **260** and also

extends over part of the top of each of the wing-like portions **262, 264** to the base of sidewalls **278** and **280** of the raised platforms **274** and **276** the top surfaces of which are flat and coplanar. The surfaces **274** and **276** each surround an opening formed by the depressions **259** in the sections **244** and **246.** The sidewall **278** is formed by three angled vertical surfaces approximating an arc, and the sidewall **280** is a single vertical surface lateral to the sections **244, 246.** Together these sidewalls **278, 280** form a keyway to cooperate with a key **208** of the fitting **200** to position the fitting **200** correctly on the casing **242** as will be described more fully later in the description. The platforms **274** and **276** are of sufficient height to enclose the covers **26, 28** of the generator **10.**

FIGS. **7** and **9** illustrate features of an alternative embodiment of a fitting **200** which provides the means for eluent supply and eluate withdrawal. In this embodiment of the fitting **200,** a lead bar **202** and a separate receptacle holder including needle adapter assembly **212** are joined on top of the casing **242** when the generator **10** is to be eluted. Lead bar **202** is provided on its underside with a boss or key **208** which is suitably an integral part of bar **202.** The boss **208** has a curved surface **210** and a flat surface **211** at opposite ends to form a key which will mate with the keyway provided by the sidewalls **278** and **280** of the casing **242** to insure that the lead bar **202** can be mounted only in one position on the casing **242.** The lead bar **202** may remain in place on the casing **242** to provide additional radiation shielding. The casing **242** and lead bar **202** are customarily retained at all times in a lead pig (not shown) having a cavity contoured to the shape of the casing **242** and lead bar **202** to provide additional radiation shielding. The top of the lead bar **202** is exposed when it is in place in the lead pig so that wells **204** and **206** are accessible to the needle adapter assembly of receptacle holder **212.** The locator hole **213** in lead bar **202** in cooperation with the locating pin **215** of the receptacle holder **212** requires that assembly may be accomplished in only the correct position. Each of the wells **204, 206** includes a lug or key **217** on the inside wall to mate with keyways **219** of the needle shielding guides or plugs **221** when the receptacle holder **212** is mounted on the lead bar **202.** These lugs **217** also provide means for retaining radiation shielding plugs (not shown) in the wells **204, 206** when the generator **10** is not being eluted. A rectangular cut out **223** near each corner of the lead bar **202** provides for the guides **225** which assist in assembling the receptacle holder **212** to the lead bar **202** and which may include lugs (not shown) to act as releasable fasteners to a protective plastic cover (not shown) which might be used over the lead bar **202** and lead pig (not shown). The slot **227** is provided as a means to secure the lead bar **202** to the lead pig (not shown).

The receptacle holder **212** shown in FIG. **7** and **9** is a unitary molded plastic holder for an eluent container (not shown) and an eluate container (not shown). The eluate container is preferably an evacuated vial and is inserted upside down into holder **230,** after removal of protective cap **231,** where double ended hypodermic needle **232** is positioned to pierce the closure of the eluate container. The needle **232** may include an intermediate filter **319** with associated lead shielding **320** and spring means **321** to hold it in place, and the bottom portion of the needle **232** is supported and centered by needle shielding guide or plug **221** mounted on the underside of holder **230** and which contains the collapsible needle shield **229.** This needle shield **229** can be drawn down over the needle **232** to protect it when the receptacle holder **212** is not in use and is pushed out of the way into plug **221** when the receptacle holder **212** is mounted on the lead bar **202** and casing **242.**

The receptacle holder **212** also includes holder **234** for an eluent container (not shown) which is inserted in an inverted position, after the removal of protective cover **235,** so that needles **236** and **238** may pierce its closure. The needles **236** and **238** are supported within the holder **234.** Needle **238** is a double ended hypodermic needle to conduct eluent into generator **10,** and it is supported and centered by guide **221** and protected by needle shield **229** in the same manner as described above with respect to needle **232.** Needle **236** serves to provide an inlet for air into the eluent container by connecting it to the atmosphere through conduit **242** and a hydrophobic filter **243.**

The alternative embodiment of the fitting illustrated in FIGS. **7** and **9** includes as an optional but preferred feature the filter **319.** This filter **319** is placed in the eluate collection line formed by conduit **20** and needle **232** and serves to further insure that the eluate collected from the generator **10** will be sterile and particle free and thereby suitable for immediate injection into a patient for diagnostic use. This filter **319** may be any suitable filter but is preferably a MIllipore filter, i.e., a microporous membrane filter composed of cellulose esters or similar polymeric materials, such as described in U.S. Pat. No. **3,386,585,** issued June **4, 1968,** or U.S. Pat. No. **3,471,019,** issued Oct. **7, 1969,** and manufactured by Millipore Corporation of Bedford, Massachusetts. A particularly desirable filter is a **0.22** micron Millipore filter in which part of the filter is hydrophobic. This filter has very good flow characteristics, and maintains good flow characteristics after the initial elution, i.e., on subsequent runs after the hydrophilic portion has already been wetted.

When the generator **10** is to be eluted with the embodiments of the casing **242** and fitting **200** illustrated in FIGS. **7** through **10,** the technician removes lead plugs (not shown) from the two wells **204, 206** of the bar **202** in position on the casing **242** containing the generator **10.** The locator pin **215** is aligned with the depression **213** and this permits the insertion of the needle shielding plugs **221** with needles **238** and **232** of the receptacle holder **212.** The needles **238** and **232** pass down through the wells **204, 206** and pierce the covers **26, 28** of the inlet and outlet conduits **18, 20.** When the eluent container and eluate container have been inserted into holders **234** and **230** to pierce their closures with the needles **236, 238** and **232,** the elution will take place when a reduced pressure is present at the top of needle **232** in the eluate container. This reduced pressure is preferably obtained by the use of an evacuated vial as an eluate container. As elution proceeds, eluent is drawn through needle **238** into and through inlet conduit **18,** through the alumina in generator **10** where it picks up the Tc^{99m}, to the bottom of generator **10** where it passes into and through outlet conduit **20,** through the bottom portion of needle **232,** through the filter **319** which interrupts needle **232,** through the balance of needle **232** and into the eluate container.

At no time is this system rendered vulnerable to the inflow of contaminents nor does it permit leakage of the emissive fluids. The system is simple to assemble, there being little room for error in aligning the parts. All concerned parties are adequately protected from emission until the preparation is withdrawn for injection.

Many changes may be made in the details of the instant invention, in the method and materials of fabrication, in the configuration and assemblage of the constituent elements without departing from the spirit and scope of the appended claims, which changes are intended to be embraced therewithin.

What is claimed is:

1. A generator for sterile, elutable radioactive material which comprises a hollow column containing elutable radioactive material, said column including inlet and outlet ports which are each in communication with one end of inlet and outlet conduits respectively, the other ends of said conduits being terminated by pierceable closure caps, which caps prevent the inflow of contaminents through said conduits, said column, inlet and outlet conduits and caps being embedded in a casing adapted to permit the caps to be pierced, a fitting adapted to be joined to said casing, means to properly align said fitting on said casing to effect joinder therebetween, said fitting including means to pierce said caps, and said fitting including means in communication with said piercing means for the cap on said inlet conduit to connect a container of eluent, said eluent being passable through said inlet conduit into said column, means in communication with said piercing means for the cap on said outlet conduit to connect a collecting container for eluate to said fitting, and means to establish a pressure differential between said eluent and collecting containers causing the eluent to flow through said conduits and into said collecting container.

2. The generator of claim **1** wherein the means to join said casing and said fitting in proper alignment comprise a boss on said fitting adapted to be received in an opening in said casing, a guide segment connected to said boss and a mating segment connected to said casing, whereby said fitting and said casing can be joined only when said segments are mated.

3. The generator of claim **1** wherein said casing is formed of vertically split sections, each section including appropriate interior depressions to accommodate said conduits and said column therein.

4. The generator of claim **3** wherein said split sections include spaced interior ribs and grooves, there being only one position in which respective grooves and ribs are matable.

5. The generator of claim **1** including needles, depending from each of said means to connect said container of eluent, and said means to connect said collecting container, each adapted to pierce the respective caps, thereby to define a complete fluid flow path between said eluent and said collecting containers.

6. The generator of claim **1** including means to admit air into said eluent container upon the evacuation of the eluent therefrom.

7. The generator of claim **1** wherein the means to establish a pressure differential between said eluent and collecting containers is an evacuated eluate collecting container.

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