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(54) **THREE SECTION PIG FOR RADIO-PHARMACEUTICALS**

DREITEILIGER BEHÄLTER FÜR RADIOPHARMAZEUTIKA

ETUI A TROIS SECTIONS POUR RADIOPHARMACEUTIQUE

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US-A1- 2005 198 800
US-B1- 6 614 040

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Description

Field of the Invention

[0001] The present invention relates to medical devices and, more specifically, to a device for transporting radio-pharmaceuticals used in positron emission tomography.

Description of the Prior Art

[0002] Positron emission tomography (PET) imaging is a diagnostic examination that involves acquiring physiologic images based on the detection of positron radiation. Positrons are particles emitted from radioactive substances. The radioactive substances used are injected into a patient and positrons from the radioactive substance are detected and imaged by a PET scanner. The resulting images are used to evaluate a variety of diseases.

[0003] Pharmaceutical compositions used in PET scans are administered in liquid form by injection into the patient. Radio-pharmacists typically calculate a unit dose based on the amount of decay that a dose will undergo during transport to the hospital at which the dose will be administered. In preparing the dose, the radio-pharmacist places the dose into a syringe and then places the syringe into a "pig" that shields those handling the dose from the radioactive contents of the syringe. The pig is then transported to the hospital for administration to a patient.

[0004] With many types of radio-pharmaceuticals, a lead pig is sufficient to shield those handling the dose. However, for radio-pharmaceuticals designed for PET scans, a typical lead-shielded pig does not provide sufficient protection by itself. To compensate, existing PET radio-pharmaceutical transport systems require an extra level of shielding. This is accomplished by providing a secondary shielded case for the pig. Such a shielded case includes lead shielding about a cylindrical opening into which the pig fits.

[0005] Existing PET radio-pharmaceutical pigs tend to need to be replaced on a regular basis. This is because the shielding quality of lead breaks down in the presence of PET pharmaceutical radiation. Thus, the cost is increased. Also, there is a danger of insufficient protection if a radio-pharmacist continues to use a pig past its designed life span.

[0006] Because most pigs are roughly cylindrical in shape (see e.g. US 4869299, US 5828073, or US 2005/0198800), rolling of such pigs is a problem. If a pig is allowed to roll, it could roll off of the surface on which it is placed and fall, causing injury, destroying the dose of the radio-pharmaceutical composition contained therein, or both. Some existing pigs include a flat surface milled into the outer surface of the pig. The milling is done by removing several exterior chords of the cylinder forming the pig, thereby forming flat surfaces. Also, several small evenly-spaced bumps may be added to the exterior surface of the pig. Both of these methods of preventing rolling may be satisfactory for ordinary conditions, but they do not provide a sufficient anti-roll capability in situations in which a pig is accidentally bumped with considerable force. Furthermore, most pigs include two sections that must be separated when accessing the syringe inside. However, many existing pigs usually include anti-roll texturing on only one section. Thus, if the section without the anti-roll texturing is placed on a table, it may roll off and cause injury.

[0007] Typical radio-pharmaceutical pigs have an inner chamber into which a filled syringe is placed. A plastic liner is frequently employed to prevent spillage from the syringe from accumulating inside the pig. Such a liner is typically made from rigid plastic and used only once. Because the liner is rigid, it takes up a considerable amount of space to store and to dispose of.

[0008] Typically, when administering a radio-pharmaceutical to a patient, the syringe is removed from the pig and placed in a shielded holder that protects the physician's hands from radiation while injecting the radio-pharmaceutical into an IV bag. The transfer of the syringe causes a brief exposure to the user and increases the risk that the syringe could fall and be harmed.

[0009] Therefore, it would be desirable for a radio-pharmaceutical pig to be capable of providing a mechanism for administering a radio-pharmaceutical without having to transfer it to a shielded holder.

SUMMARY OF THE INVENTION

[0010] The disadvantages of the prior art are overcome by the present invention which, in one aspect, is a radio-pharmaceutical pig according to the subject-matter of claim 1.

BRIEF DESCRIPTION OF THE FIGURES OF THE DRAWINGS

[0011]

FIG. 1 is a top perspective view of an illustrative example.

FIG. 2A is an elevational view of an example.

FIG. 2B is a cross-sectional view of the example shown in FIG. 2A, taken along line 2B-2B.

FIG. 2C is an expanded cross-sectional view of the example shown in FIG. 2B.

FIG. 2D is a bottom plan view of the example shown in FIG. 2A.

FIG. 2E is a bottom plan view of an alternate example.

FIG. 2F is a cross sectional view of a detail of the example shown in FIG. 2B.

FIG. 3 is a plan view of a plastic insert.

FIG. 4A is a cross-sectional view of the insert shown in FIG. 3, taken along line 4-4.

FIG. 4B is a second cross-sectional view of the insert shown in FIG. 3, taken along line 4-4.

FIG. 5 is a cross-sectional view of an insert disposed within a pig.

FIG. 6 is a plan view of a plastic insert including stiffening ribs.

FIG. 7 is a side view of a roll of plastic inserts.

FIG. 8 is a plan view of a strip of plastic inserts.

FIG. 9 is a cross sectional view of a three section pig.

FIG. 10 is a cross sectional view of the center section of a three section pig as it is ready for administration of a radio-pharmaceutical.

FIG. 11 is a plan view of the center section shown in FIG. 10 being employed.

DETAILED DESCRIPTION OF THE INVENTION

[0012] Referring to the drawings, like numbers indicate like parts throughout the views. As used in the description herein and throughout the claims, the following terms take the meanings explicitly associated herein, unless the context clearly dictates otherwise: the meaning of "a," "an," and "the" includes plural reference, the meaning of "in" includes "in" and "on."

[0013] As used herein, "plastic" means capable of being deformed without rupture and a "plastic material" includes materials that are deformable. Plastic materials, as used herein, include, but are not limited to, synthetic polymer materials, natural latex materials, thin metal sheets and combinations thereof. It will be readily understood that many other materials, not specifically listed herein, will meet the criteria for being a plastic within the scope of the present invention.

[0014] As shown in FIG. 1, one illustrative example of a radio-pharmaceutical pig **100** includes a tungsten cylinder **110** having a first elongated member **112** and a second elongated member **114.** The outer surface of the first elongated member **112** and the second elongated member **114** includes a rough textured portion **120** that facilitates gripping of the pig **100** by a user. Typically, the pig **100** is formed from titanium stock and formed on a metal lathe using conventional methods.

[0015] As shown in FIGS. 2A-2C, the first elongated member **112** terminates in a first engagement surface **150** and an opposite first distal end **118**, the second elongated member **114** terminating in a second engagement surface **152** that is complimentary to the first engagement surface **150** and an opposite second distal end **116.** The pig **100** defines an elongated cavity **113** therein that is substantially coaxial with the tungsten cylinder **110**. The cavity **113** is of sufficient size to receive a syringe **10** therein. The tungsten cylinder **110** is thick enough to shield users from a PET radio-pharmaceutical without requiring additional shielding. The actual thickness may be calculated easily by referring to standard radiological shielding tables and depends on the type and amount of radio-pharmaceutical being used.

[0016] A recess **160** may be milled into either the first engagement surface **150** or the second engagement surface **152** (or both) to receive the finger grip tabs of the syringe **10,** thereby preventing the syringe **10** from rocking during transport. An O-ring **154** may be embedded in one of the engagement surfaces **150** or **152** to prevent leakage from the pig **100**.

[0017] Returning to FIG. 1, a first anti-roll member **132** extends outwardly from the first distal end **118** and a second anti-roll member **130** extends outwardly from the second distal end **116**. The first anti-roll member **132** and the second anti-roll member **130** each include at least three (and in the embodiment shown, four) flat surfaces **134** that inhibit rolling. Including an anti-roll member **132** and **130** on each of the first elongated member **112** and the second elongated member **114**, ensures that neither member will roll if left unattended on a flat surface. This may be a substantial advantage, given that each elongated member **112** and **114** will likely be quite heavy due to the thickness of the tungsten employed.

[0018] The second distal end **116** is supplied with a lifting ring **140** that facilitates lifting of the pig **100** out of any carrying container (not shown) used to transport the pig **100**. The lifting ring may be affixed to the top surface **136** of the pig **100** with an attachment **146** and a spacing plug **142** may be affixed to the top surface **136** inside the ring **140** when the ring **140** is in the down position.

[0019] As shown in FIG. 2D, the anti-roll members **132** are blocks of titanium that could include four flat sides **134**, or, as shown in FIG. 2E, only three flat sides **134**, or even more than four flat sides **134**, so long as the flat side **134** has dimensions sufficient to prevent rolling. The anti-roll members **132** may be formed from the same titanium stock as the rest of the pig **100**.

[0020] As shown in FIG. 2F, a stainless steel sleeve **220** may disposed about a portion of the tungsten cylinder **110**. The textured portion **222** may be cut into the stainless steel sleeve **220** and may include diamond patterned scoring.

[0021] As shown in FIGS. 3-5, a disposable plastic insert **300** is disposed within the cavity **113** to prevent leakage of radio-pharmaceutical materials into the cavity **113**. Each insert **300** includes an elongated plastic envelope **310** made from a first plastic sheet **309** and an oppositely-

disposed second plastic sheet **311** that are sealed together along a sealing surface **312** (through thermal sealing, for example) and that open to a top side **316,** thereby defining passage therein **318**. The passage is of sufficient size to allow a syringe **10** to fit therein. The disposable plastic insert **300** could be made of materials including polyethylene and polyvinyl chloride, but should be thick enough to resist punctures from any exposed needles placed into the insert **300**.

[0022] A first adhesive tab **320** is placed on the first sheet **309** adjacent the top side **316** and a second adhesive tab **320** is placed on the second sheet **311** adjacent the top side **316**. The first adhesive tab **320** and the second adhesive tab **320** each include a peel-off cover that may be peeled off to allow exposure of the adhesive tabs **320** so as to facilitate sealing the top side (as shown in FIG. 4B). This facilitates easy sealing of the syringe **10** for disposal after use.

[0023] As shown in FIG. 6, the disposable plastic insert **300** may also include a plurality of elongated rib structures **610** embedded in one of the plastic sheets **310** and **311** to provide structural support to the plastic insert **300**. The elongated ridge structures **610** could include wires embedded in one of the plastic sheets **310** and **311**, or could be thickened plastic that is molded into the plastic sheets **310** and **311** using commony-known plastic sheet forming methods.

[0024] As shown in FIG. 7, because the inserts **300** are flexible, a plurality of inserts **300** may be formed continuously and stored in the form of a roll **700**. This facilitates easy manufacturing and storage of the inserts. As shown in FIG. 8, when the inserts are formed as a continuous strip **800**, a serration **810** may be cut in the sealed portion between each successive insert **300** in the strip **800** to facilitate separation of the inserts **300**.

[0025] An embodiment of the present invention is shown in FIGS. 9-11. As shown in FIG. 9, the radio-pharmaceutical pig **900** includes a first cylindrical member **910,** a second cylindrical member **930** and a third cylindrical member **950.** The first cylindrical member **910** includes a first tungsten body **912** defining a first cavity **916** that opens to a first end **922**. A first anti-roll structure **918** extends outwardly from a second end **920.** The first cylindrical member **910** also includes a first external stainless steel sleeve **914** that covers a portion of the first cylindrical member **910**. Cut into the first external stainless steel sleeve **914** is a gripping surface **902**, which could be a diamond pattern scored surface.

[0026] The second cylindrical member **930** includes a second tungsten body **932** that defines a second cavity **936** therethrough. The second cylindrical member **930** includes a proximal end **940** and an opposite distal end **942**. The proximal end **940** is capable of engaging (such as with complimentary threading, etc.) the first end **922** of the first cylindrical member **910** so that the first cavity **916** is in substantial alignment with the second cavity **936.** A second anti-roll structure **938** extends outwardly from a portion of the second cylindrical member **930.** As demonstrated in FIG. 11, the second anti-roll structure **938** also prevents slippage of the second cylindrical member **930** when it is being used to shield the user during delivery of the radio-pharmaceutical. Returning to FIG. 9, the second cylindrical member **930** also includes a second external stainless steel sleeve **934** that covers a portion of the second cylindrical member **930**, with a gripping surface **902** cut into the second external stainless steel sleeve **934**.

[0027] The third cylindrical member **950** includes a third tungsten body **952** that defines a third cavity **956** that opens to a primary end **960.** The primary end **960** is capable of engaging the distal end **942** of the second cylindrical member **930** so that the third cavity **956** is in substantial alignment with the second cavity **936.** A third anti-roll structure **958** extends outwardly from a secondary end **962** of the third cylindrical member **950.** The third cylindrical member **950** also includes a third external stainless steel sleeve **954** that covers a portion of the third cylindrical member **950** with a gripping surface **902** cut into the third external stainless steel sleeve **954.** The first cavity **916,** the second cavity **936** and the third cavity **956**are shaped so as to be complimentary in shape of the syringe **10.**

[0028] As shown in FIG. 10, the second cylinder member **930** may be disengaged from the first cylinder member **910** and the third cylinder member **950.** The second cylinder member **930** has dimensions that allow it to be used to shield the syringe **10** while the syringe **10** is being used to deliver the radio-pharmaceutical to a receptacle. This is shown in FIG. 11, wherein the physician **14** grips the second cylinder member **930** with the syringe **10** disposed therein. The needle **12** extends from the second cylinder member **930** so that the physician **14** can inject the contents of the syringe **10** into a receptacle **16** (such as an injection port of an IV bag).

[0029] The above described embodiment, while including the preferred embodiment and the best mode of the invention known to the inventor at the time of filing, is given as illustrative example only. It will be readily appreciated that many deviations may be made from the specific embodiments disclosed in this specification without departing from the scope of the invention. Accordingly, the scope of the invention is to be determined by the claims below rather than being limited to the specifically described embodiment above.

Claims

1. A radio-pharmaceutical pig (900), for transporting a syringe containing a radiopharmaceutical, comprising:

    a. a first cylindrical member (910), including a first tungsten body (912) defining a first cavity (916) therein opening to a first end (922);
    b. a second cylindrical member (930), including

a second tungsten body (932) defining a second cavity (936) therethrough, including a proximal end (940) and an opposite distal end (942), the proximal end capable of engagement with the first end (922) of the first cylindrical member (910) so that the first cavity (916) is in substantial alignment with the second cavity (936), the second cylindrical member (930) also including an external stainless steel sleeve (934) covering a portion of the second cylindrical member with a gripping surface (902) cut into the second external stainless steel sleeve;

c. a third cylindrical member (950), including a third tungsten body (952) defining a third cavity (956) opening to a primary end (960), the primary end capable of engagement with the distal end (942) of the second cylindrical member (930) so that the third cavity (956) is in substantial alignment with the second cavity (936),

wherein the first cavity (916), the second cavity (936) and the third cavity (956) are shaped so as to be complementary in shape of the syringe (10),

wherein a first anti-roll member (918) extends outwardly from the second end (920) of the first cylindrical member (910), a second anti-roll member (938) extends outwardly from a portion of the second cylindrical member (930) and a third anti-roll member (958) extends outwardly from the secondary end (962) of the third cylindrical member (950).

2. The radio-pharmaceutical pig (900) of claim 1; wherein:

the first cylindrical member (910) includes a first external stainless steel sleeve (914) covering a portion of the first cylindrical member with a gripping surface (902) cut into the first external stainless steel sleeve; and

the third cylindrical member (950) includes a third external stainless steel sleeve (954) covering a portion of the third cylindrical member (950) with a gripping surface cut into the third external stainless steel sleeve.

3. The radio-pharmaceutical pig (900) of Claim 1 or 2, wherein the second cylinder member (930) may be disengaged from the first cylinder member (910) and the third cylinder member (950) and wherein the second cylinder member has dimensions that allow the second cylinder member to be used to shield the syringe (10) while the syringe is being used to deliver the radio-pharmaceutical to a receptacle.

4. The radio-pharmaceutical pig (900) of Claim 1 or 2, wherein the gripping surface (902) comprises a diamond pattern scored surface.

5. The radio-pharmaceutical pig (900) of Claim 1 or 2, wherein the first anti-roll member (918) and the second anti-roll member (938) each comprise a block that extends outwardly from the tungsten body, the block having at least three substantially flat sides.

6. The radio-pharmaceutical pig (900) of Claim 5, wherein the block has four substantially flat sides.

Patentansprüche

1. Radiopharmazeutischer Behälter (900) zum Transportieren einer Spritze, die einen radiopharmazeutischen Stoff enthält, mit:

a. einem ersten zylindrischen Element (910), das einen ersten Wolframkörper (912) aufweist, der darin einen ersten Hohlraum (916) definiert, der zu einem ersten Ende (922) geöffnet ist;

b. ein zweites zylindrisches Element (930), das einen zweiten Wolframkörper (932) umfasst, der einen zweiten Hohlraum (936) dadurch definiert, und das ein proximales Ende (940) und ein entgegengesetztes distales Ende (942) umfasst, wobei das proximale Ende in der Lage ist, mit dem ersten Ende (922) des ersten zylindrischen Elementes (910) so zusammenzuwirken, dass der erste Hohlraum (916) im Wesentlichen mit dem zweiten Hohlraum (936) ausgerichtet ist, wobei das zweite zylindrische Element (930) auch eine äußere Hülse (934) aus nicht rostenden Stahl, die einen Bereich des zweiten zylindrischen Elementes mit einer Greiffläche (902) bedeckt, mit einer Greifoberfläche (902) umfasst, die in die zweite äußere Hülse aus nicht rostenden Stahl geschnitten ist;

c. ein drittes zylindrisches Element (950), das einen dritten Wolframkörper (952) umfasst, der einen dritten Hohlraum (956) definiert, der sich zu einem primären Ende (960) öffnet, wobei das primäre Ende in der Lage ist mit dem distalen Ende (942) des zweiten zylindrischen Elementes (930) zusammenzuwirken, so dass sich der dritte Hohlraum (956) im Wesentlichen in Ausrichtung mit dem zweiten Hohlraum (936) befindet,

wobei der erste Hohlraum (916), der zweite Hohlraum (936) und der dritte Hohlraum (956) so geformt sind, dass sie komplementär zur Form der Spritze (10) sind,

wobei sich ein erstes Anti-Roll-Element (918) auswärts von dem zweiten Ende (920) des ersten zylindrischen Elementes (910) erstreckt sich ein zweites Anti-Roll-Element (938) auswärts von einem Bereich des zweiten zylindrischen Elementes (930) erstreckt und sich ein drittes Anti-Roll-Element (958) von dem zweiten Ende

(962) des dritten zylindrischen Elementes (950) erstreckt.

2. Radiopharmazeutischer Behälter (900) nach Anspruch 1, wobei:

das erste zylindrische Element (910) eine erste äußere Hülse (914) aus nicht rostenden Stahl, die einen Bereich des ersten zylindrischen Elementes bedeckt, mit einer Greifoberfläche (902) umfasst, die in die erste äußere Hülse aus nicht rostenden Stahl geschnitten ist; und
das dritte zylindrische Element (950) eine dritte äußere Hülse (954) aus nicht rostendem Stahl umfasst, die einen Bereich des dritten zylindrischen Elementes (950) mit einer Greifoberfläche umfasst, die in die dritte äußere Hülse aus nicht rostendem Stahl geschnitten ist.

3. Radiopharmazeutischer Behälter (900) nach Anspruch 1 oder 2, wobei das zweite zylindrische Element (930) vom ersten zylindrischen Element (910) und vom dritten zylindrischen Element (950) gelöst werden kann und wobei das zweite zylindrische Element Abmessungen hat, die ermöglichen, dass das zweite zylindrische Element dazu verwendet werden kann, die Spritze (10) abzuschirmen, während die Spritze dazu verwendet wird, den radiopharmazeutischen Stoff in einen Behälter abzugeben.

4. Radiopharmazeutischer Behälter (900) nach Anspruch 1 oder 2, wobei die Greifoberfläche (902) eine rautenförmig gemusterte aufgeraute Oberfläche aufweist.

5. Radiopharmazeutischer Behälter (900) nach Anspruch 1 oder 2, wobei das erste Anti-Roll-Element (918) und das zweite Anti-Roll-Element (938) je einen Block aufweisen, der sich auswärts von dem Wolframkörper erstreckt, wobei der Block zumindest drei im Wesentlichen flache Seiten aufweist.

6. Radiopharmazeutischer Behälter (900) nach Anspruch 5, wobei der Block 4 im Wesentlichen flache Seiten aufweist.

Revendications

1. Etui pour radiopharmaceutique (900) pour transporter une seringue contenant un radiopharmaceutique, comprenant:

a. un premier élément cylindrique (910) comprenant un premier corps en tungstène (912) définissant une première cavité (916) à l'intérieur de ce dernier s'ouvrant sur une première extrémité (922);

b. un deuxième élément cylindrique (930) comprenant un deuxième corps en tungstène (932) définissant une deuxième cavité (936) à travers ce dernier, comprenant une extrémité proximale (940) et une extrémité distale (942) opposée, l'extrémité proximale pouvant se mettre en prise avec la première extrémité (922) du premier élément cylindrique (910) de sorte que la première cavité (916) est sensiblement alignée avec la deuxième cavité (936), le deuxième élément cylindrique (930) comprenant également un manchon en acier inoxydable externe (934) recouvrant une partie du deuxième élément cylindrique avec une surface de préhension (902) découpée dans le deuxième manchon en acier inoxydable externe;
c. un troisième élément cylindrique (950) comprenant un troisième corps en tungstène (952) définissant une troisième cavité (956) s'ouvrant sur une extrémité principale (960), l'extrémité principale pouvant se mettre en prise avec l'extrémité distale (942) du deuxième élément cylindrique (930) de sorte que la troisième cavité (956) est sensiblement alignée avec la deuxième cavité (936),
dans lequel la première cavité (916), la deuxième cavité (936) et la troisième cavité (956) sont formées afin d'être complémentaires du point de vue de la forme de la seringue (10),
dans lequel un premier élément antiroulis (918) s'étend vers l'extérieur à partir de la deuxième extrémité (920) du premier élément cylindrique (910), un deuxième élément antiroulis (938) s'étend vers l'extérieur à partir d'une partie du deuxième élément cylindrique (930) et un troisième élément antiroulis (958) s'étend vers l'extérieur à partir de l'extrémité secondaire (962) du troisième élément cylindrique (950).

2. Etui pour radiopharmaceutique (900) selon la revendication 1, dans lequel:

le premier élément cylindrique (910) comprend un premier manchon en acier inoxydable externe (914) recouvrant une partie du premier élément cylindrique avec une surface de préhension (902) découpée dans le premier manchon en acier inoxydable externe; et
le troisième élément cylindrique (950) comprend un troisième manchon en acier inoxydable externe (954) recouvrant une partie du troisième élément cylindrique (950) avec une surface de préhension découpée dans le troisième manchon en acier inoxydable externe.

3. Etui pour radiopharmaceutique (900) selon la revendication 1 ou 2, dans lequel le deuxième élément cylindrique (930) peut être dégagé du premier élé-

ment cylindrique (910) et du troisième élément cylindrique (950) et dans lequel le deuxième élément cylindrique a des dimensions qui permettent au deuxième élément cylindrique d'être utilisé pour protéger la seringue (10) alors que la seringue est utilisée pour délivrer le radiopharmaceutique à un réceptacle.

4. Etui pour radiopharmaceutique (900) selon la revendication 1 ou 2, dans lequel la surface de préhension (902) comprend une surface striée selon un modèle de diamant.

5. Etui pour radiopharmaceutique (900) selon la revendication 1 ou 2, dans lequel le premier élément antiroulis (918) et le deuxième élément antiroulis (938) comprennent chacun un bloc qui s'étend vers l'extérieur à partir du corps en tungstène, le bloc ayant au moins trois côtés sensiblement plats.

6. Etui pour radiopharmaceutique (900) selon la revendication 5, dans lequel le bloc a quatre côtés sensiblement plats.

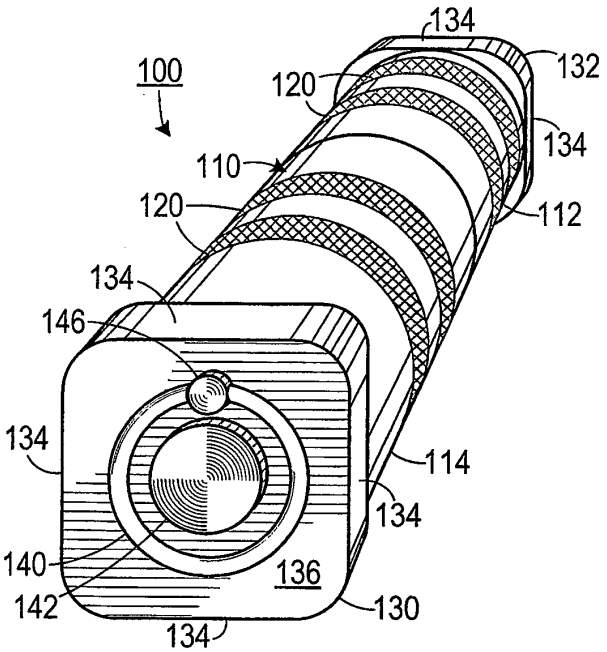


FIG. 1

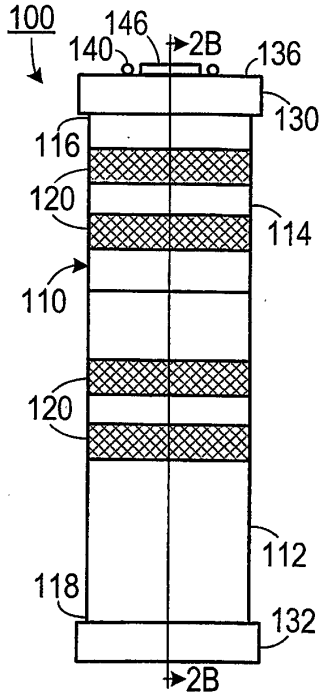


FIG. 2A

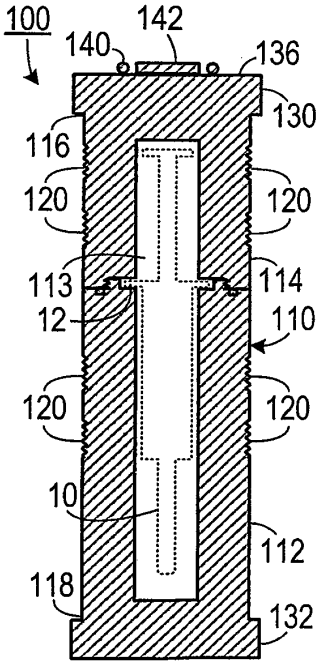


FIG. 2B

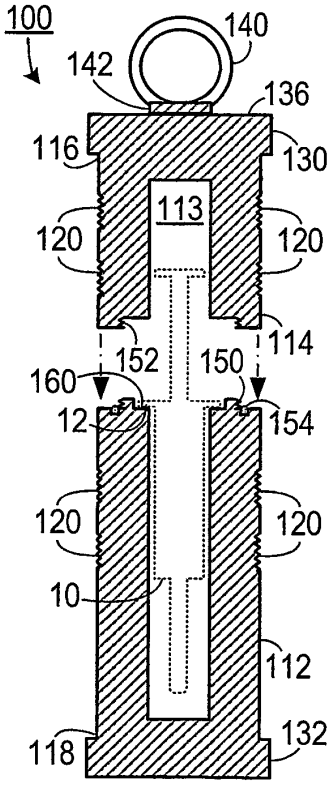


FIG. 2C

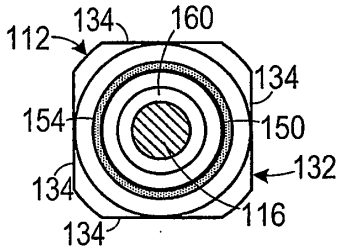


FIG. 2D

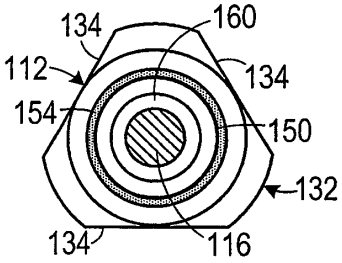


FIG. 2E

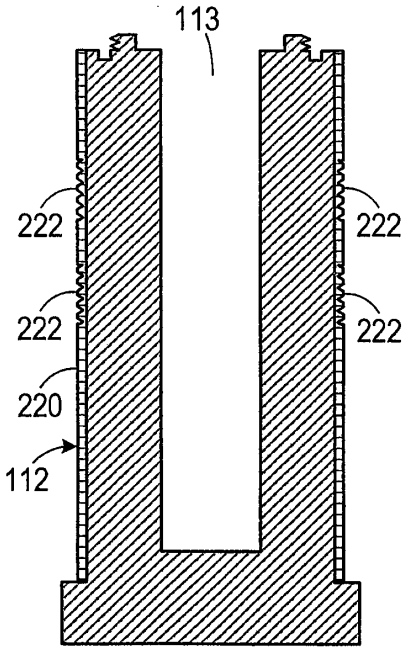


FIG. 2F

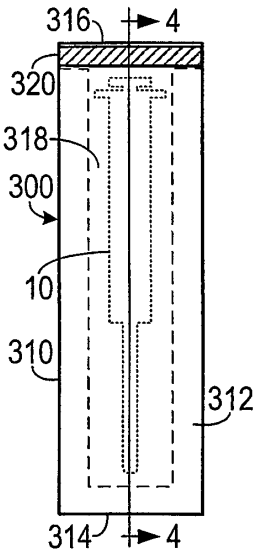


FIG. 3

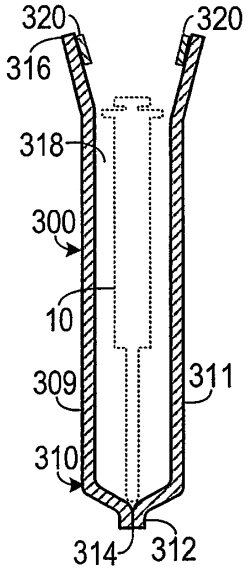


FIG. 4A

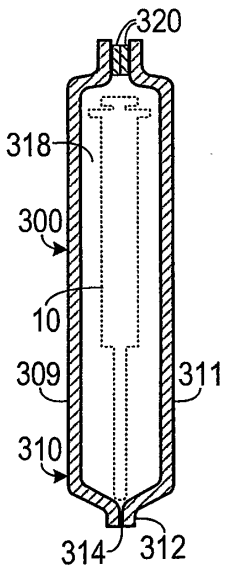


FIG. 4B

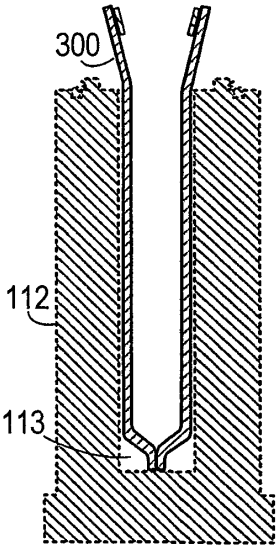


FIG. 5

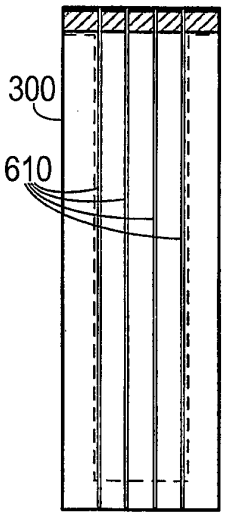


FIG. 6

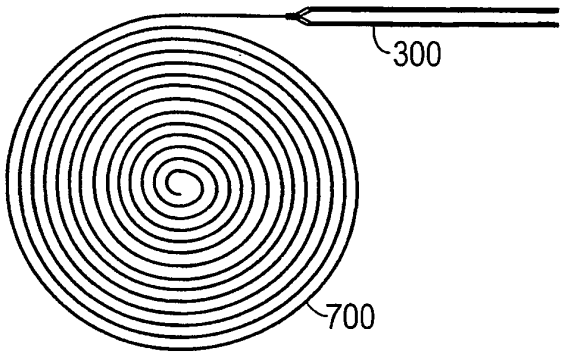


FIG. 7

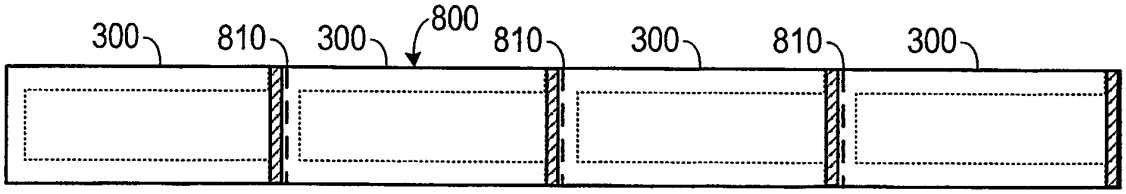


FIG. 8

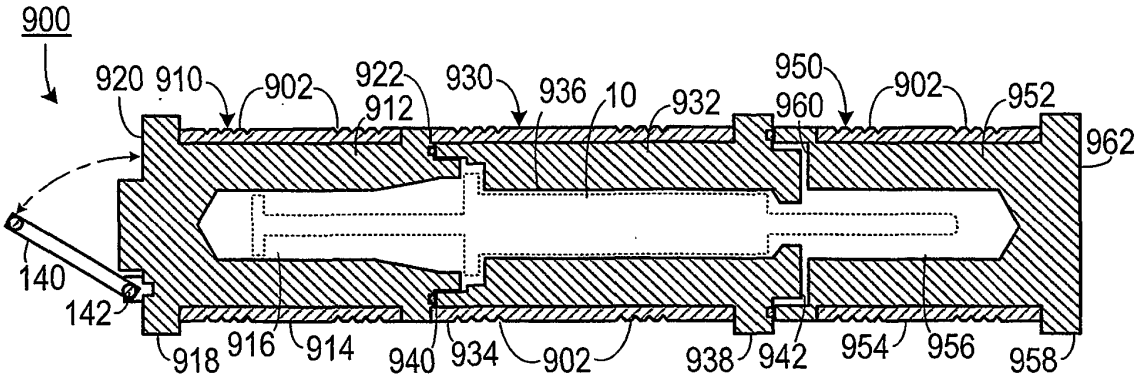


FIG. 9

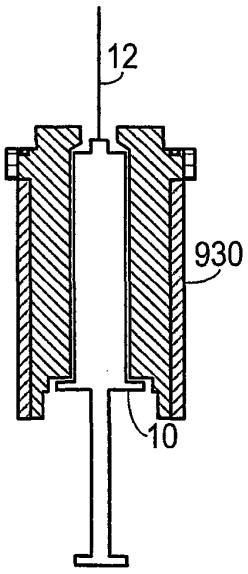


FIG. 10

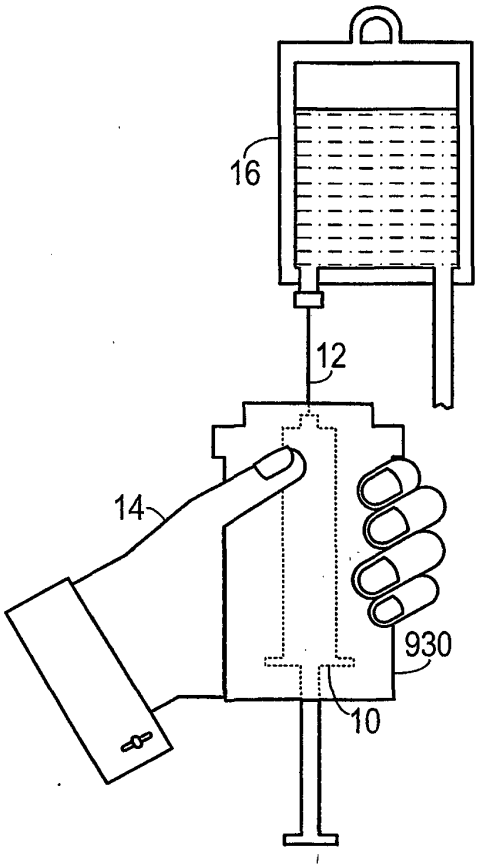


FIG. 11

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4869299 A **[0006]**
- US 5828073 A **[0006]**
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