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(54) BODY CANAL TREATMENT DEVICE

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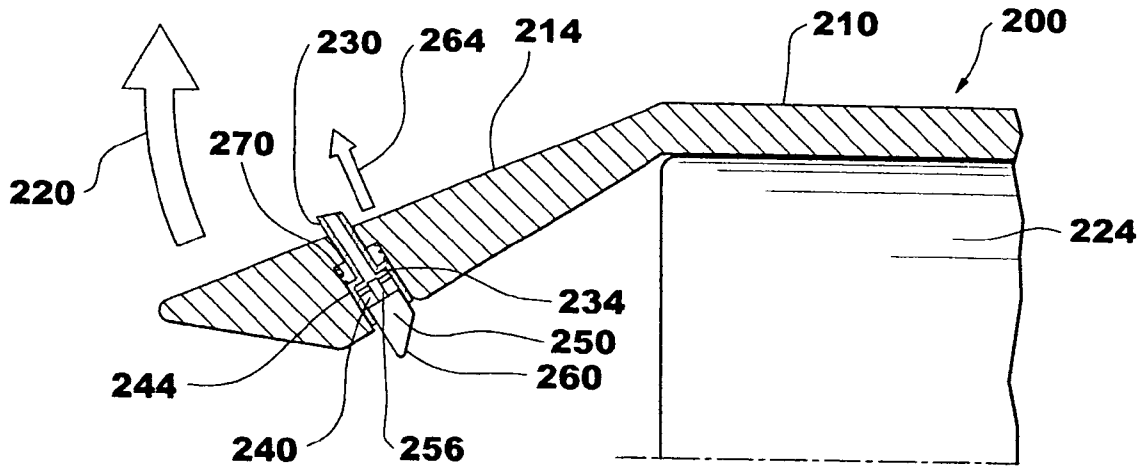
(52) **U.S. Cl.** **604/107**

(57) **ABSTRACT**

A device for applying a medicament to a tissue such as the interior wall of a body canal includes a housing having a treatment end for insertion into the body canal. At least one treatment arm is movably connected to the housing and has thereon at least one applicator for applying the medicament to the canal wall. At least one actuator is provided for moving the treatment arm outward relative to the housing and toward the canal wall, and for operating the applicator to apply the medicament to the canal wall. A method for applying a medicament to a tissue such as an interior wall of a body canal is also disclosed.



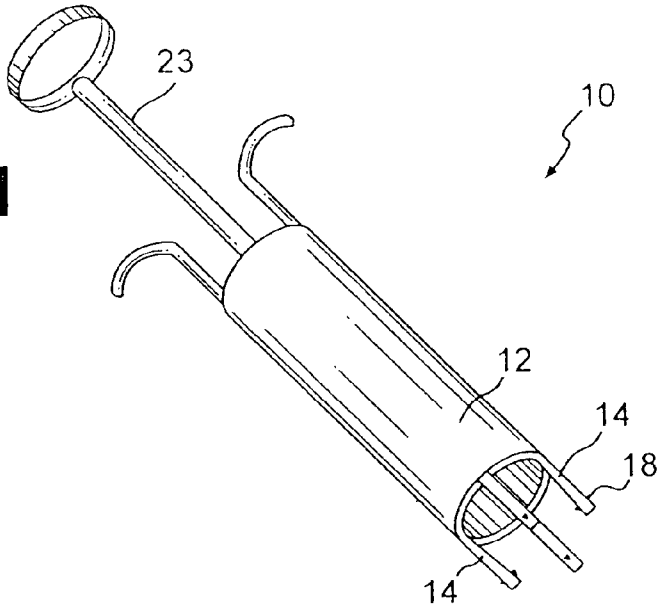


FIG. 1

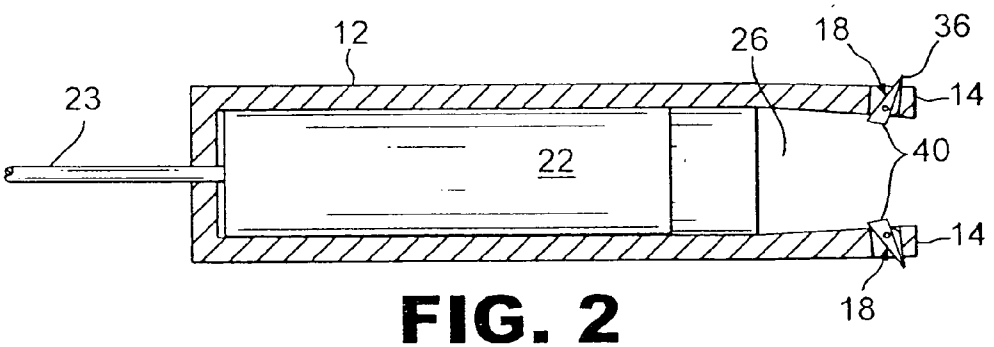


FIG. 2

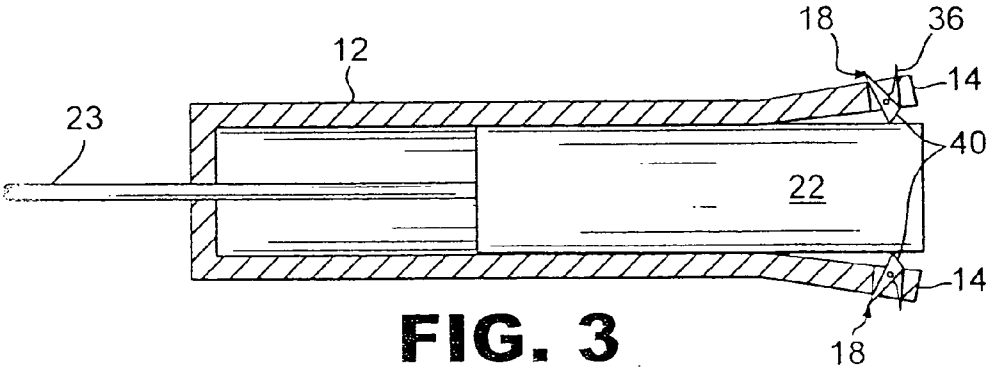


FIG. 3

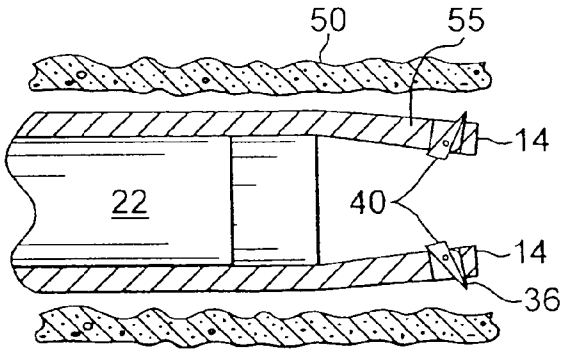


FIG. 4(a)

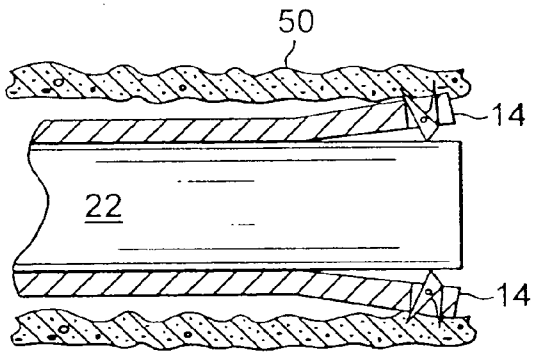


FIG. 4(b)

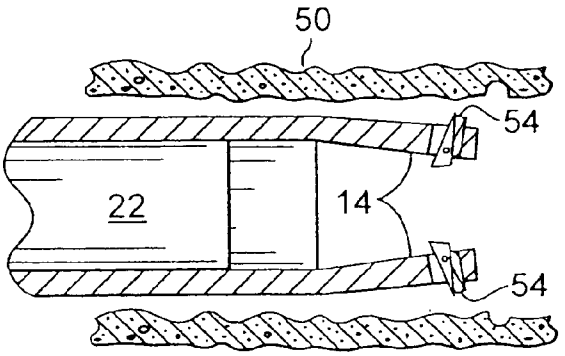


FIG. 4(c)

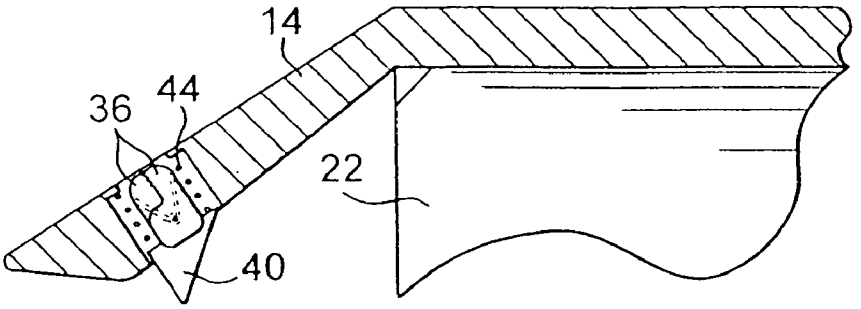


FIG. 5(a)

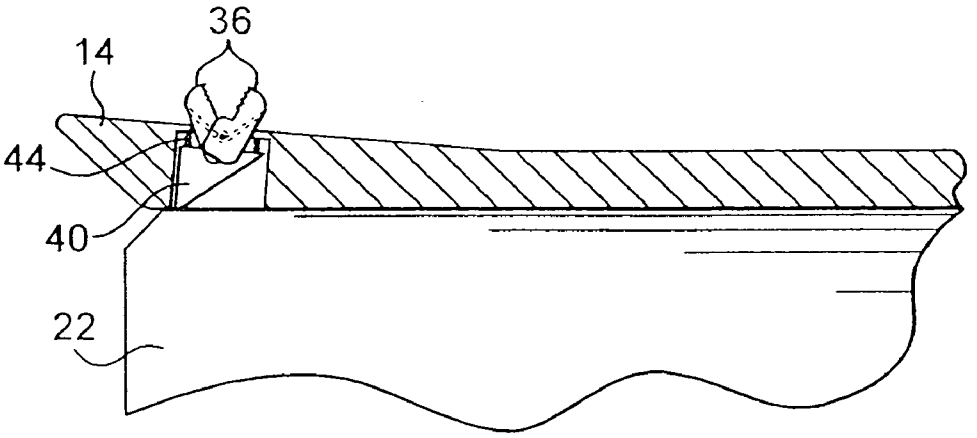


FIG. 5(b)

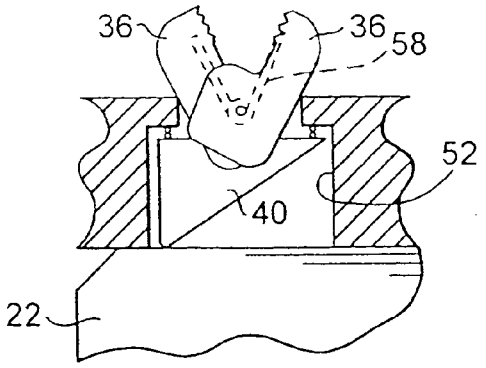


FIG. 6(a)

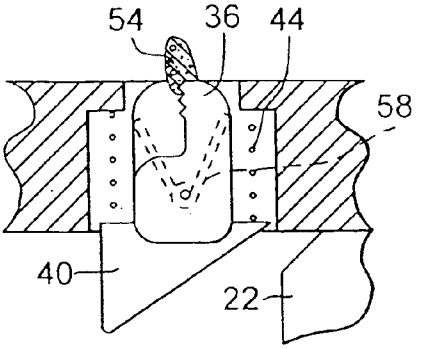


FIG. 6(b)

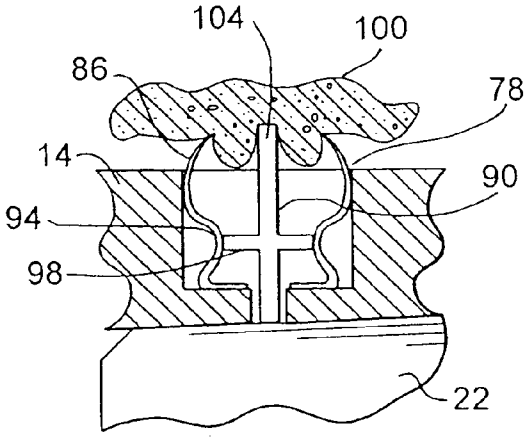


FIG. 8(a)

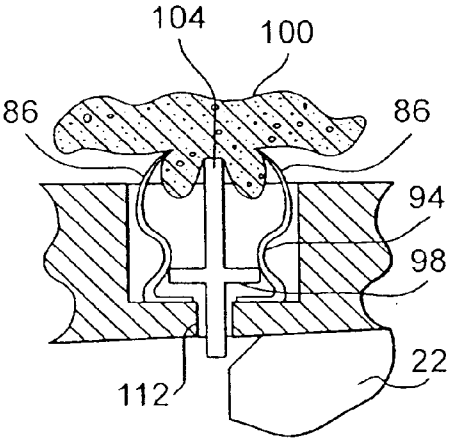


FIG. 8(b)

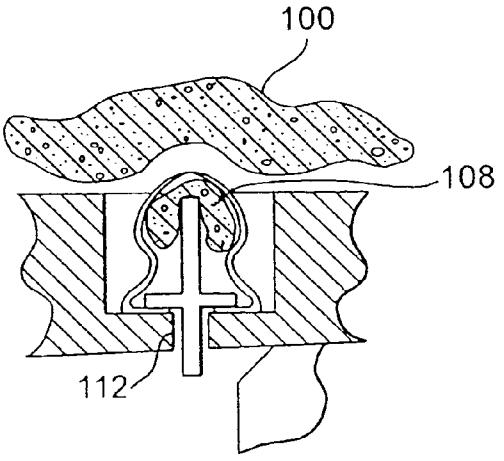


FIG. 8(c)

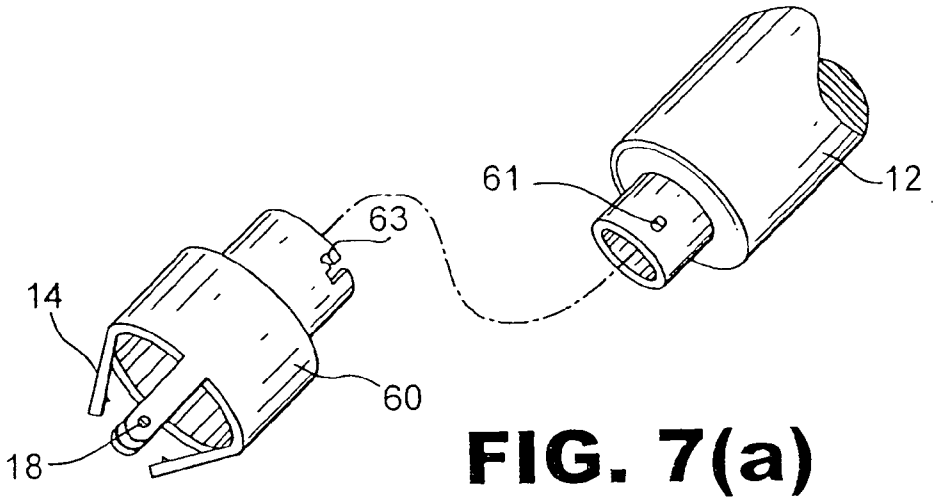


FIG. 7(a)

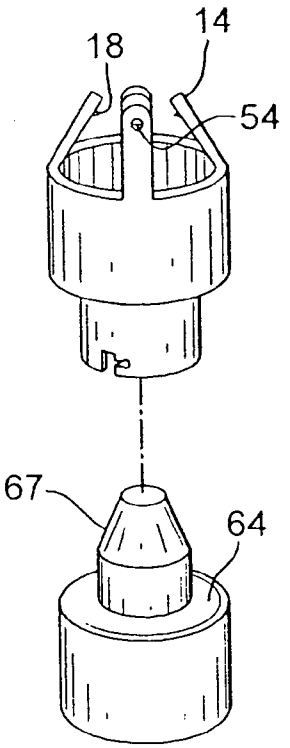


FIG. 7(b)

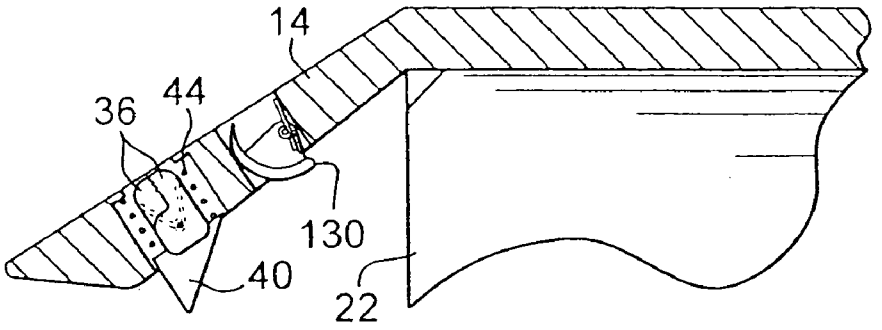


FIG. 9(a)

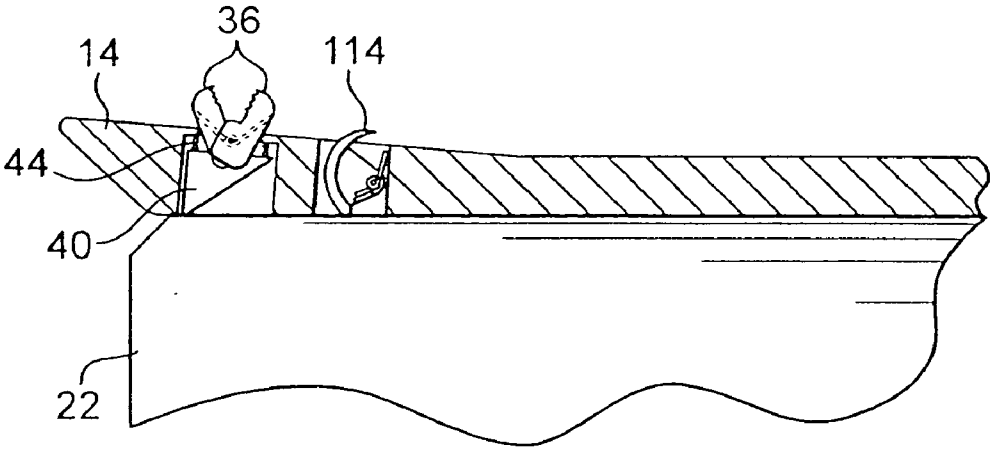


FIG. 9(b)

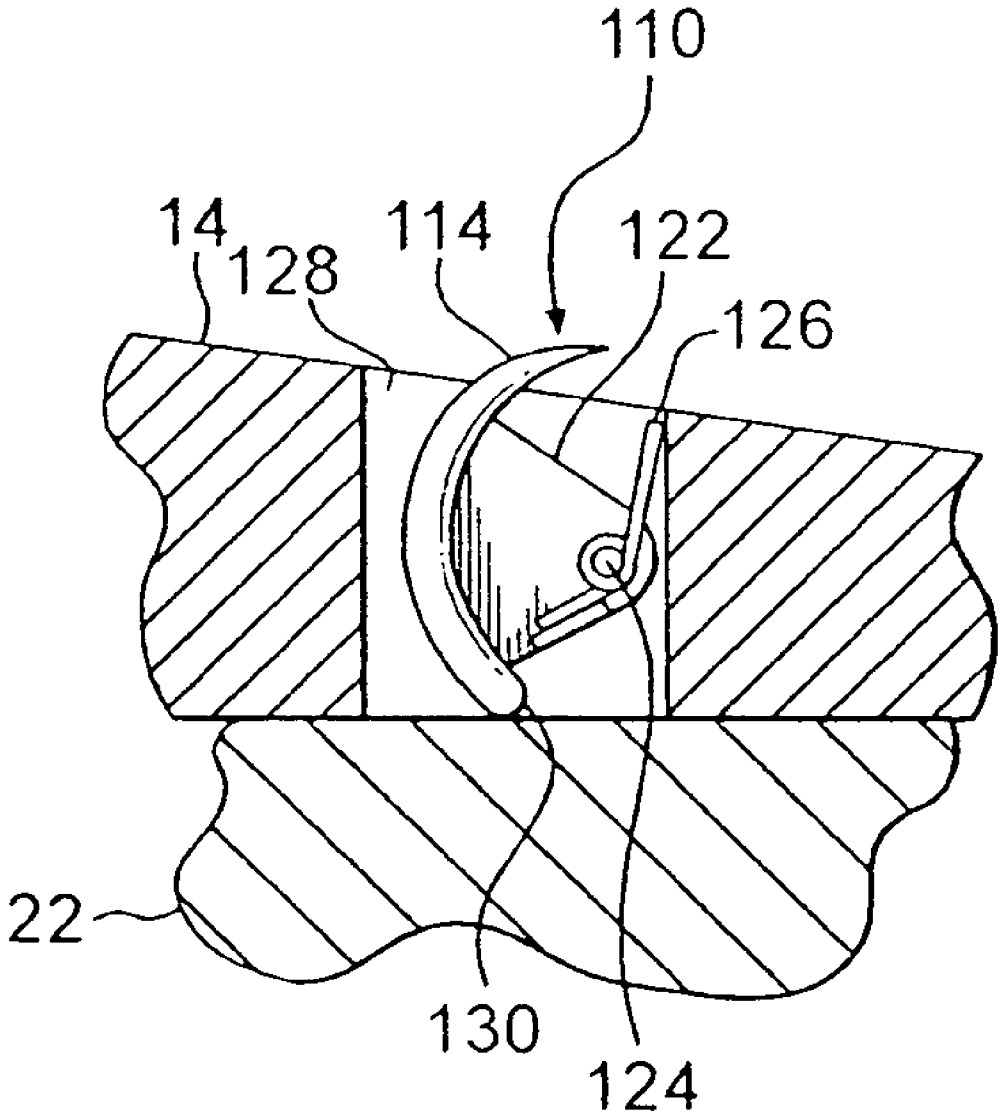
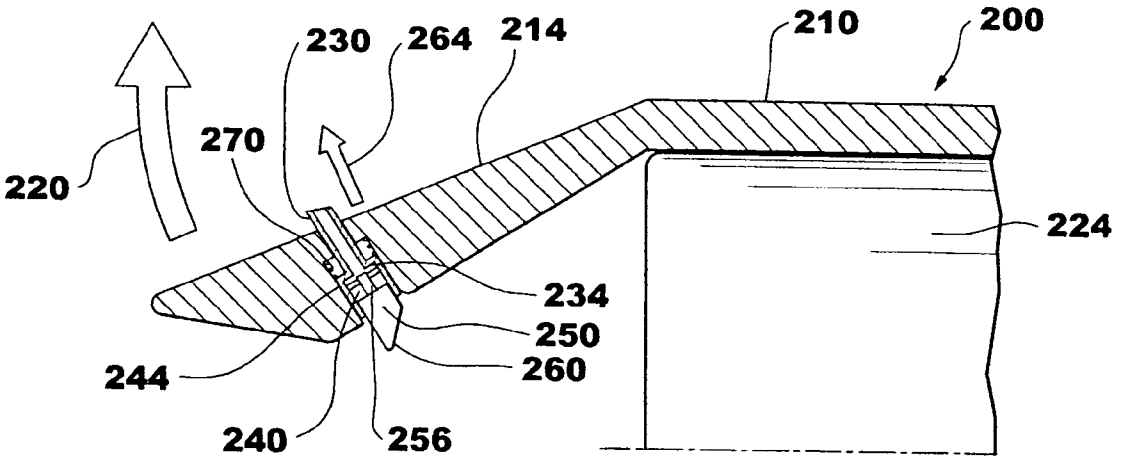


FIG. 10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264
214
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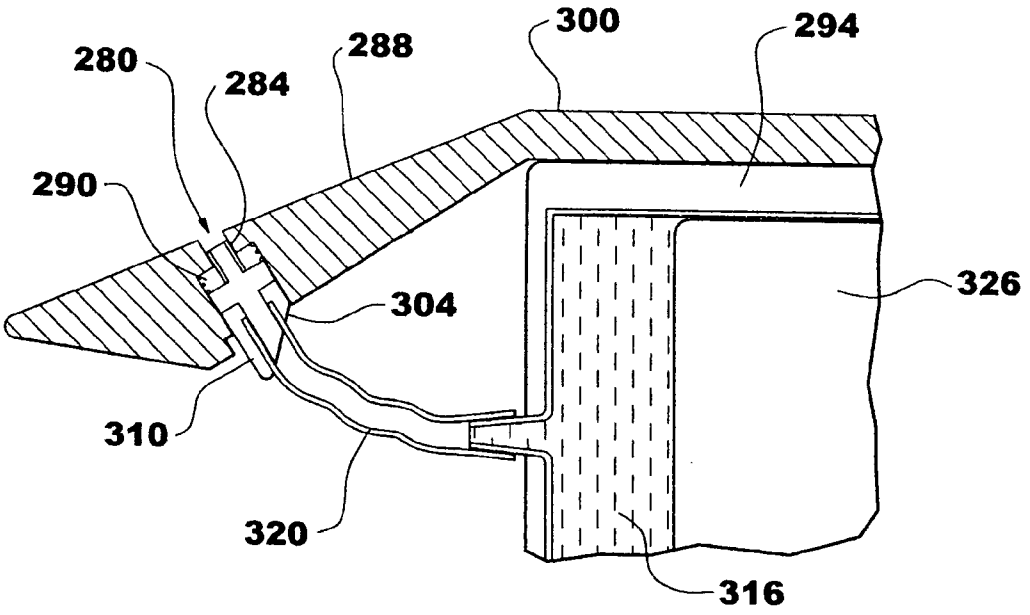
256

FIG. 11


300
294
280
284
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316

FIG. 12

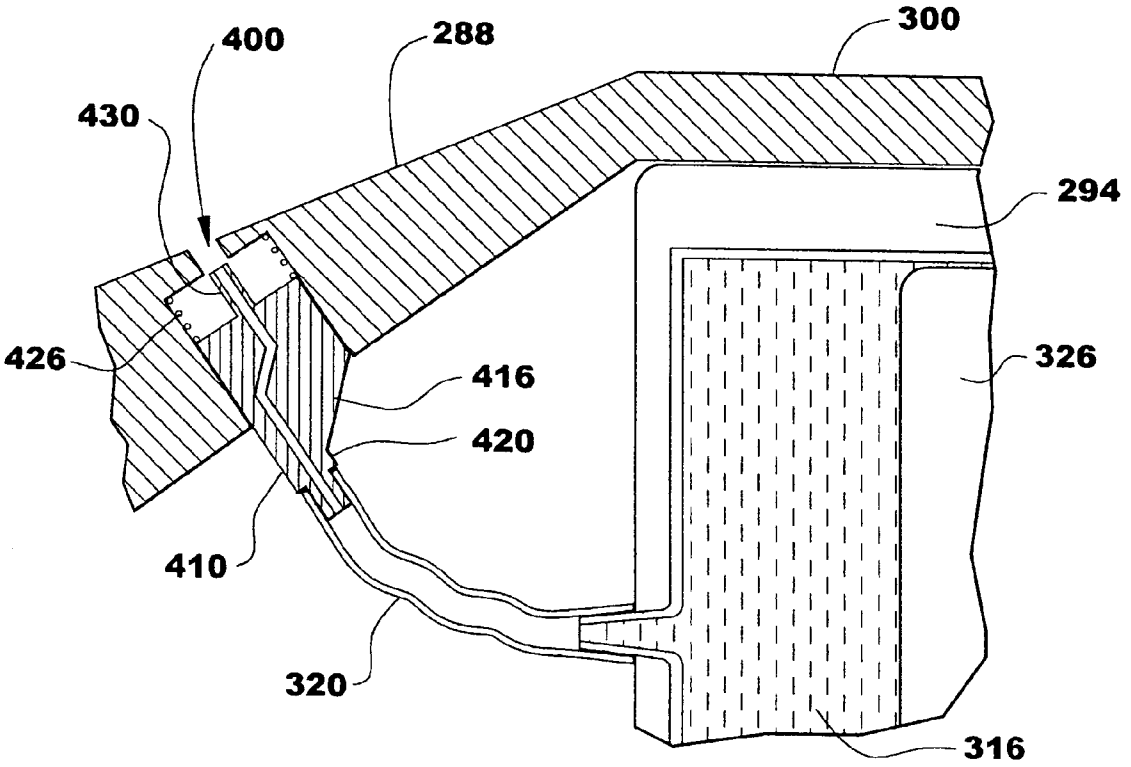
400
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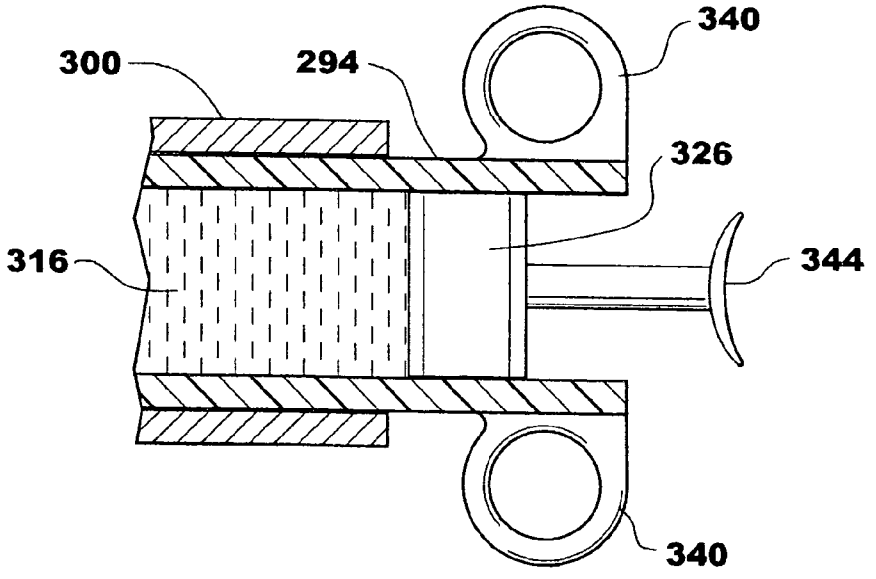
FIG. 13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326
316
344
340

FIG. 14

BODY CANAL TREATMENT DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 10/187,564, filed on Jul. 2, 2002, which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] This invention relates generally to medical instrumentation, and more particularly to medical devices for treating body canals.

BACKGROUND OF THE INVENTION

[0003] Biopsy devices are used to obtain tissue samples, usually for purposes of performing testing on these samples. In order to obtain a biopsy sample, the biopsy device must be inserted into the body to reach the tissue for which the biopsy is to be taken. The device must be positioned next to the tissue, the sample taken, and the device removed. Some biopsy protocols require multiple samples to be taken. In the case of a body canal, samples from different positions on the circumference of the canal are sometimes required for each axial position along the canal length. This can require multiple devices if sterility and sample integrity are to be maintained, or multiple procedures if more than one biopsy site is required to be sampled.

[0004] It is difficult to maintain the stability and position of a biopsy device upon insertion into the body. Biopsy procedures usually involve small incisions such that manipulation of the device at the point of the biopsy is not directly possible. It is possible for the biopsy sample to become dislodged from the biopsy device during removal of the device from the body. Secure retention of the sample is necessary to avoid repeating the process.

[0005] The treatment of body canals is complicated by the enclosed location that is remote from the user. The confined space and necessity of applying treatment at some or all of a surface that surrounds the instrument at 360° produces challenges to deliver effective treatments to such canals. For example, it has recently been discovered that the implantation of a non-resorbable biocompatible polymer in the distal esophagus and proximal gastric cardia is a promising treatment for Gastro Esophageal Reflux Disease (GERD). GERD is associated with heartburn, regurgitation, or both, and is a chronic disorder with substantial morbidity and a major adverse impact on patient quality of life. D. Johnson, the American Journal of Gastroinurology, Vol. 98, No. 9, 2003, 1921-1930. The treatment requires the implantation of antericS (Boston Scientific, Natick, Mass.) into the canal through a small gage needle. The treatment requires several injections around the circumference of the canal, and through a length of the esophageal canal. These injections are time consuming if done individually, and can result in imprecise dosing through a given area of the canal.

SUMMARY OF THE INVENTION

[0006] A biopsy device includes a housing and at least one biopsy mechanism connected to the housing. The biopsy mechanism can be provided on a biopsy arm that is connected to the housing. An actuator is provided for moving the biopsy arm and operating the biopsy mechanism.

[0007] The biopsy mechanism can comprise jaws adapted to engage and remove a biopsy sample. The jaws can be biased to an open position. The actuator can contact the jaws, a cam, or other structure connected to the jaws, such that movement of the actuator opens the jaws.

[0008] The actuator can comprise a moveable plunger. The housing can include an open interior and the plunger can be provided in the open interior. Movement of the plunger contacts the cam or other structure to operate the biopsy mechanism. Movement of the plunger can also move the biopsy arm radially outward relative to the housing. This movement will position the biopsy mechanism against the tissue to be sampled. Thus, a single stroke of the actuator can move the biopsy mechanism into position and operate the biopsy mechanism to take the sample. Gripping structure can be provided on the housing and the plunger so as to facilitate relative movement of the plunger within the housing.

[0009] Movement of the actuator in a first direction can force the biopsy arm radially outward and causes the biopsy mechanism to open. Movement of the actuator in a second direction causes the biopsy arm to move radially inward and the biopsy mechanism to close. Alternatively, the actuator can be constructed such that movement in one direction will in one position open the biopsy mechanism, and movement to another position, but in the same direction, will close the biopsy mechanism.

[0010] The biopsy mechanism can be biased to an open position or a closed position. A cam can be operatively connected to the biopsy mechanism. Contact between the actuator and the cam causes the biopsy mechanism to open or close against the biasing. The biopsy mechanism should be in the closed position prior to the biopsy arm moving radially inward such that the sample will be securely retained.

[0011] In a preferred embodiment, a plurality of biopsy arms are provided. A plurality of radially disposed biopsy arms can be spaced about an end of the housing. A first end of each arm can be connected to the housing. Each biopsy arm has a biopsy mechanism such that movement of the actuator actuates each of the biopsy arms and the respective biopsy mechanism. The biopsy mechanism can be provided at or near an opposing end of the biopsy arm. Two or more arms are preferred. Four or more radially disposed arms permit sampling about the circumference of a canal or orifice, such as the esophagus.

[0012] The biopsy arms can be provided on a head that is removably attached to the housing. In this manner, the head can be removed after the biopsy is performed and the housing and related actuator mechanism can be refitted with another head for taking another sample. The removed head with the biopsy samples is then processed to remove the samples for laboratory analysis.

[0013] A biopsy method includes the steps of providing a biopsy device with a housing and at least one biopsy mechanism connected to the housing. Structure is provided for moving the biopsy mechanism and actuating the biopsy mechanism. The biopsy mechanism can be provided on a biopsy arm that is connected to the housing. The device is inserted adjacent to tissue and the actuator is manipulated in order to move the biopsy mechanism into position and to operate the biopsy mechanism to obtain a sample.

[0014] A device for applying a medicament to an interior wall of a body canal includes a housing have a treatment end for insertion into the body canal. At least one treatment arm is movably connected to the housing and has thereon at least one applicator for applying the medicament to the canal wall. At least one actuator is provided for moving the treatment arm outward relative to the housing and toward the canal wall, and for operating the applicator to apply the medicament to the canal wall.

[0015] The applicator can comprise any suitable structure for applying the medicament to the canal wall. In one aspect, the applicator is a syringe and injects the medicament into the canal wall. In another aspect, the applicator comprises a cannula which applies the medicament to a surface of the canal wall.

[0016] The treatment arm can be biased to an inward position. The actuator can contact the treatment arm and moves the treatment arm outward toward the canal wall against the biasing. Movement of the actuator causes the applicator to release the medicament.

[0017] The actuator can comprise a plunger. Movement of the plunger contacts the treatment arm to move the treatment arm outward toward the canal wall. The housing can comprise an open interior portion and the plunger can be provided in the interior portion. The housing and the plunger can comprise gripping structure for moving the plunger.

[0018] A plurality of radially spaced treatment arms can be spaced about an end of the housing. A first end of each treatment arm can be connected to the housing. The applicator can be provided substantially at an opposing end of each treatment arm. In one aspect, at least four treatment arms are provided and radially spaced about the end of the housing.

[0019] The applicator can comprise a container with a reservoir for containing the medicament. The container can be connected to the treatment arms. The actuator can contact the container to cause the release of the medicament through the treatment arms. The actuator can comprise a plunger for contacting the container in the treatment arm. The housing can comprise an open interior portion and the plunger can be movable within the open interior. The plunger can contact the treatment arm to move the treatment arm outward, and can then contact the container to force the medicament from the reservoir. The container can comprise a seal and a piston movable in the container to break the seal. Movement of the piston causes the piston to break the seal and release the medicament to flow from the container and the applicator.

[0020] The container can be movable in the treatment arms between a retracted position and an extended position. Biasing structure can bias the container toward the retracted position. The plunger is operable to move the container to the extended position.

[0021] The plunger can include a reservoir for medicament. Means are provided for forcing the medicament from the reservoir and through the applicator. At least one connection channel can be provided for transferring the medicament from the reservoir of the plunger to the applicator. A piston can be movable within the reservoir for forcing the medicament to the applicator and the body canal.

[0022] A treatment device can include a housing with a movable actuator and at least one movable treatment arm. The treatment arm comprises a treatment mechanism. Movement of the actuator moves the treatment arm radially outward relative to the housing and operates the treatment mechanism to cause the treatment mechanism to apply a medicament to surrounding tissue. The treatment mechanism can comprise an applicator. Movement of the actuator causes the applicator to open and close.

[0023] The housing can be elongated with an open interior. The actuator is movable within the open interior. The treatment arm is connected to an end of the housing. Movement of the actuator in a first direction causes the treatment arm to move radially outward and causes the treatment mechanism to open. Movement of the actuator in a second direction causes the treatment arm to move radially inward and the treatment mechanism to close. The actuator can cause the treatment arm to move outward prior to causing the treatment mechanism to open. The actuator can cause the treatment mechanism to close prior to causing the treatment arm to move radially inward. A plurality of treatment arms can be provided. Each can have a treatment mechanism such that movement of the actuator actuates each of the treatment arms and treatment mechanisms. The treatment mechanisms can be biased to a closed position.

[0024] A method for applying a medicament to an interior wall of a body canal includes the steps of providing a device having a treatment end for insertion into the body canal, at least one treatment arm movably connected to the housing and having thereon at least one applicator for applying the medicament to the canal wall. At least one actuator is provided for moving the treatment arm outward relative to the housing and toward the canal wall, and for operating the applicator to apply the medicament to the canal wall. The device is inserted at least in part into the body canal. The actuator is operated to apply the medicament to an interior wall of the body canal.

[0025] An injection device is provided for injecting a medicament into a tissue. The injection device comprises a housing having an injection end. At least one injection arm is movably connected to the injection end of the housing and has thereon at least one syringe for injecting the medicament into the tissue. At least one actuator is provided for moving the injection arm relative to the housing and toward the tissue and for operating the syringe to inject the medicament into the tissue.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] There are shown in the drawings embodiments which are presently preferred, it being understood however, that the invention is not limited to the precise arrangements and instrumentalities shown, wherein:

[0027] **FIG. 1** is a perspective view of a biopsy device according to the invention.

[0028] **FIG. 2** is a cross section of a biopsy device according to the invention, and in a first mode of operation.

[0029] **FIG. 3** is a cross section depicting a second mode of operation.

[0030] FIGS. **4**(*a*)-(*c*) are cross sections depicting successive steps in a biopsy procedure according to the invention.

[0031] FIGS. **5**(*a*)-(*b*) are cross sections depicting the operation of a biopsy mechanism according to the invention.

[0032] FIGS. **6**(*a*)-(*b*) are enlarged cross sections of the biopsy mechanism of **FIG. 5** as used during a biopsy procedure.

[0033] FIGS. **7**(*a*)-(*b*) are exploded perspective views illustrating an alternative embodiment of the invention.

[0034] FIGS. **8**(*a*)-(*c*) are cross sections illustrating a biopsy procedure utilizing an alternative biopsy mechanism according to the invention.

[0035] FIGS. **9**(*a*)-(*b*) are cross sections illustrating the operation of an alternative embodiment.

[0036] **FIG. 10** is a cross section illustrating a gripping device of the alternative embodiment of **FIG. 9**.

[0037] **FIG. 11** is a cross section of a device for applying a medicament to a tissue.

[0038] **FIG. 12** is a cross section of an alternative embodiment.

[0039] **FIG. 13** is a cross section of another alternative embodiment.

[0040] **FIG. 14** is a cross section illustrating an actuator assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0041] A biopsy device **10** according to the invention is shown in **FIG. 1**. The biopsy device **10** includes a housing **12** and at least one biopsy mechanism **18**. The housing **12** can be of any suitable construction. The biopsy mechanism **18** can be provided on a biopsy arm **14**. Any number of biopsy arms **14** can be provided, however, at least two and preferably at least four biopsy arms **14** are preferred.

[0042] An actuator is provided for moving the biopsy mechanism outward relative to the housing **12** and operating the biopsy mechanism **18**. The actuator can be a single mechanism or multiple mechanisms. Any suitable actuator mechanism(s) can be utilized. In one embodiment, the actuator comprises a plunger **22** which is moveable within an open interior **26** of the housing **12**. Suitable structure such as handle **23** can be provided for manipulating the plunger **22**. Movement of the actuator operates the biopsy mechanism **18** as shown in FIGS. **2-3**. In one embodiment, the plunger **22** is operable to contact the biopsy mechanism **18** in such a manner as to operate the biopsy mechanism **18**. A cam **40** can be associated with the biopsy mechanism **18**. The movement of the plunger **22** contacts the cam **40** (**FIG. 3**) to operate the biopsy mechanism **18**.

[0043] The biopsy mechanism **18** can be of any design that is suitable to remove a biopsy sample when actuated. The biopsy mechanism **18** is provided by suitable structure such that the biopsy mechanism is moved into position and operated to take the sample, preferably in a single action. In one design, the biopsy mechanism **18** comprises forceps **36**. As shown in FIGS. **4-6**, the forceps **36** are associated with suitable structure, such as cam **40**, to operate the forceps **36**. Biasing, such as spring **44**, can be provided to bias the forceps **36** to a normally-closed position. Movement of the plunger **22** from a position within the housing **12** as shown in **FIG. 5**(*a*) to the position shown in **FIG. 5**(*b*) causes the plunger **22** to contact the cam **40**. The cam **40** is moved within the cam seat **52** from the position shown in **FIG. 5**(*a*) to the position shown in **FIG. 5**(*b*) against the action of the spring **44**. The forceps **36** are moved outward from the biopsy arm **14** and open through the operation of suitable structure such as spring **58** as shown in **FIG. 6**(*a*). The biopsy arms **14** can be provided with a substantially wedge-shaped portion **55** as shown in **FIG. 4**(*a*). Movement of the plunger **22** causes the plunger **22** to contact the wedge portion **55** to cause the biopsy arms **14** to move outward as shown in FIGS. **4**(*a*)-(*c*). Retraction of the plunger **22** causes the return of the forceps **36** from the open position shown in **FIG. 4**(*b*) to the closed position and inward movement of the biopsy arms **14**, as shown in **FIG. 4**(*c*). Other structure for moving the biopsy arms **14** and biopsy mechanisms **18** outward and inward are alternatively possible.

[0044] In operation, the biopsy device **10** is positioned in a portion of the body such as canal **50**, although it will be appreciated that the biopsy device **10** of the invention can be utilized to biopsy tissues throughout the body. The plunger **22** is initially in the retracted position. When the biopsy device **10** has been properly positioned, movement of the plunger **22** causes the plunger **22** to contact wedge portions **55** of the biopsy arms **14** to move the biopsy arms **14** radially outward toward the walls of the canal **50** as shown in **FIG. 4**(*b*). The plunger **22** also contacts the cam **40** to cause the forceps **36** to move from the normally-closed position to the open position. Thus, the biopsy mechanisms **18** are centered and forced toward the walls of the canal **50** and are opened for taking a sample. The biopsy device **10** of the invention permits, in one action, the outward movement of the biopsy arms **14** and the operation of the biopsy mechanism **18**. Upon retraction of the plunger **22**, the plunger **22** is removed from contact with the cam **40** which causes the forceps **36** to close under the action of the biasing spring **44**. A tissue sample **54** is removed by the forceps **36**. Also, retraction of the plunger **22** permits the biopsy arms **14** to move radially inward and away from the walls of the canal **50**, as shown in **FIG. 4**(*c*). This will permit retraction of the biopsy device **10** whereupon the biopsy device **10** can be removed and the sample **54** can be obtained. The retraction of the plunger **22** closes the forceps **36** before the retraction of the plunger **22** causes significant inward movement of the biopsy arms **14**, such that the sample **54** is removed before the biopsy mechanism **18** is moved away from the tissue.

[0045] In some biopsy protocols, it is necessary to repeatedly biopsy in incremental lengths. For example, in a biopsy for Barretts Metaplasia (cancer of the esophagus), the protocol requires that a biopsy be taken every 5-20 mm. The repetition of the sampling can be tedious and time consuming. The biopsy device **10** according to the invention permits the sampling of the esophageal tissue about the circumference of the esophagus in a single action. Further, according to another embodiment of the invention, the removal of the biopsy sample **54** can be readily obtained. In this embodiment, shown in FIGS. **7**(*a*)-(*b*), the biopsy arms **14** and biopsy mechanisms **18** are provided on a head **60**. The head **60** is removably connected to the housing **12**. The connection can be made by any suitable structure, such as the interlocking tongue **61** and groove **63** structure that is shown. Upon the taking of a biopsy sample **54**, the biopsy device **10** is removed from the body and the head **60** is disconnected from the housing **12**. The biopsy sample **54** can then be removed by manipulating the head **60** on a removal device **64**. The removal device **64** can have a plunger **67** which is inserted into the head **60** to contact the

biopsy mechanisms **18** to cause the mechanisms to open and release the samples **54**. The head **60** can then be discarded or cleaned and sterilized for further use.

[**0046**] The operation of an alternative embodiment of a biopsy mechanism according to the invention is shown in FIGS. **8**(*a*)-(*c*). The biopsy mechanism **78** is provided in a suitable seat in the biopsy arm **14**. Spring arms **86** are held open by contact with a piston **90**. Inward protruding portions **94** are contacted by a cross-piece **98** of the piston **90** to retain the spring arms **86** in the open position shown in **FIG. 8**(*a*). The biopsy arm **14** is then forced against the tissue **100**, as by movement of the plunger **22** which wedges the biopsy arms **14** outward. Outward movement of the biopsy arms **14** causes end **104** of piston **90** to contact the tissue **100**, which forces the cross-piece **98** of the piston **90** away from the inward protruding portions **94** of the spring arms **86**, as shown in **FIG. 8**(*b*). The spring arms **86** then spring closed, and a sample **108** is removed from tissue **100**. Retraction of the plunger **22** causes the piston **90** to retract through an opening **112**, the spring arms **86** to close securely, and the sample **108** to be secured between the spring arms **86**. This position is shown in **FIG. 8**(*c*). The device can then be removed from the body to retrieve and process the biopsy samples.

[**0047**] There is shown in FIGS. **9-10** an alternative embodiment comprising a gripping device **110** for securing the biopsy arms **14** to the surrounding tissue so as to facilitate the taking of a sample. The gripping device **110** includes suitable structure for gripping the tissue such as a projection **114** having a sharp end. The projection **114** is movable in an opening **128**. In one embodiment, the projection **114** is mounted on a carrier **122** which is pivotally mounted to biopsy arm **14** by pin **124**. Suitable biasing such as spring **126** can bias the projection **114** to a retracted position. Movement of the plunger **22** contacts end **130** of projection **114** as the plunger moves from the retracted position shown in **FIG. 9**(*a*) to the extended position shown in **FIG. 9**(*b*). As the biopsy arm **14** is thereby moved outward, the projection **114** is extended and the sharp end enters the surrounding tissue to secure the biopsy arm **14** in position while the biopsy is taken. The biopsy mechanism can be as previously described including forceps **36**, cam **40** and spring **44**, or can be of an alternative construction. Upon retraction of the plunger **22**, the forceps **36** will close prior to retraction of the projection **114** such that the biopsy sample will be removed before the surrounding tissue is released.

[**0048**] In an alternative embodiment, the biopsy device **10** permits the outward movement of the biopsy arms **14**, operation of the biopsy mechanisms **18**, followed by the closing of the biopsy mechanisms **18** and radially inward movement of the biopsy arms **14**, in a single action, that is, without retraction of the plunger **22**. Such a device could be provided with suitable grooves or openings on the sides of the plunger **22** to permit the biopsy mechanisms **18** and biopsy arms **14** to retract into the sides of the plunger **22** when the plunger **22** has been moved forward a given distance.

[**0049**] Although the invention has been described with reference to a device with biopsy arms **14**, the invention is not limited in this regard. The biopsy mechanisms **18** can be provided on other structure or on the housing **12**, so long as suitable structure is provided to cause the outward movement of the biopsy mechanisms **18** upon actuation of the device.

[**0050**] The biopsy device **10** according to the invention can be made from any suitable material.

[**0051**] Various treatment devices can be constructed according to the invention. There is shown in **FIG. 11 a** device **200** for applying a medicament to a tissue, particularly to an interior surface of a body canal. The device **200** has a housing **210** to which is connected one or more treatment arms **214**. The treatment arms are movable radially outward in the direction indicated by arrow **220**. An actuator **224** is provided to cause the treatment arms **214** to move radially outward toward the tissue of the body canal.

[**0052**] An applicator is provided for applying the medicament to the tissue. The applicator can have any suitable construction. In one aspect, the applicator comprises a syringe **230** which is connected to a container **234** having a reservoir **240** for containing the medicament. Suitable structure is provided for operation by the actuator to release the medicament. One such structure comprises frangible seal **244** which contains the medicament in reservoir **240**. A piston **250** can be provided and is movable within the container **234**. Movement of the piston breaks the seal **244** to permit the medicament to flow outward through syringe **230**. Structure such as projection **256** can be provided to facilitate the breaking of the seal **244**.

[**0053**] The manner in which the actuator causes operation of the applicator can vary. In one aspect, the actuator **224** is movable within the housing **210**. The piston **250** can have a contact surface such as incline surface **260**. Movement of the actuator **224** will cause the actuator to contact surface **260** and thereby cause the piston **250** to move, whereby projection **256** will break seal **244** to release medicament from reservoir **240**. Continued movement of the actuator **224** will cause syringe **230** to move outward in the direction of arrow **264** relative to the arm **214**.

[**0054**] The syringe **230** can be biased between an extended position and a retracted position. Suitable biasing such as spring **270** biases the syringe **230** to the retracted position. In this manner, the actuator **224** will move the syringe to the extended position, and movement of the actuator **224** to a retracted position permits the syringe **230** to also move to the retracted position under the influence of the biasing **270**. The arms **214** and syringe **230** will thereby be in a retracted position for insertion into and movement through the body canal. Movement of the actuator **224** will first move the treatment arms **214** outward, and then cause movement of the syringe **230** and release of the medicament for injection into the tissue. Other structure is possible.

[**0055**] There is shown in **FIG. 12** an applicator **280** with a cannula **284** suitable for applying the medicament to an outside surface of the tissue. A biasing such as spring **290** is provided to retract cannula **284** to a retracted position. A plunger **294** is movable within housing **300** to contact inclined surface **304** of piston **310** to move the cannula **284** to an extended position for application of the medicament. The medicament can be stored at the applicator **280**, however, in an alternative embodiment, the plunger **294** comprises a reservoir **316** for containing the medicament. Suitable connecting structure such as a channel or conduit **320**

is provided for transferring the medicament from the reservoir **316** to the applicator **280**. Suitable structure is provided for forcing the medicament from the reservoir **316** to the applicator **280**. Any suitable structure can be provided. In one aspect, a piston **326** is movable in reservoir **316** to apply pressure to the medicament and force the medicament through the conduit **320** to the applicator **280**. Suitable structure such as grooves or recesses can be provided in the plunger **294** to permit the conduit **320** to fold into these grooves as the plunger **294** is advanced. Alternative structure such as pumps of various kinds can be provided for releasing the medicament. Other applicator structures are also possible.

[**0056**] An alternative structure is shown in **FIG. 13**. In this structure, the applicator **400** includes a movable piston **410** with an inclined surface **416**. A stop **420** can be provided on the piston **410**. The plunger **294** will advance and contact the inclined surface **416** to move the applicator **400** from a retracted position that is shown to an extended position against biasing **426**. Medicament can be released through cannula **430**. The plunger **294** will contact the stop **420** to prevent the plunger **294** from advancing to such a distance that the conduit **320** is disconnected, damaged, or squeezed by the plunger **294**.

[**0057**] Any suitable structure can be provided for forcing the medicament from the reservoir **316** to the applicator. One suitable structure is shown in **FIG. 14**. A piston **326** is movable through the plunger **294** and suitable gripping structure is provided for manual manipulation of the piston **326**. Finger grips **340** can be provided on the plunger **294** to facilitate the user's moving the plunger **294** through the housing **300** to actuate the arms and applicators. Another finger grip **344** can be provided to facilitate the movement of the piston **326** within the plunger **294**.

[**0058**] According to a method of the invention, the treatment device is inserted into the body canal through an appropriate point of entry. In one embodiment, the body canal is the esophagus. The actuator is operated to extend the treatment arms radially outward toward the interior surface of the body canal. The actuator is then operated to release the medicament. The actuator can then be operated to retract the applicator and the arms to facilitate further movement of the device in the body canal. The actuator can then again be operated to extend the treatment arms and cause the applicators to again release the medicament.

[**0059**] Any suitable medicament can be applied using the invention. In one aspect, the medicament is an implant material for the treatment of Gastro Esophageal Reflux Disease (GERD). The implant material can be a non-resorbable biocompatible polymer such as ethylene vinylalcohol which can be applied in a solution with dimethyl sulfoxide. A radio-opaque material such as micronized tantulum powder can also be provided to allow fluoroscopic visualization. The dimethyl sulfoxide solvent diffuses away from the implant site such that the polymer and tantulum form a spongy, non-resorbable solid in situ.

[**0060**] The device of the subject invention can be made in a variety of different dimensions and designs without departing from the spirit or essential attributes of the invention. Accordingly, reference should be had to the following claims, rather than to the foregoing specification, as defining the scope of the invention.

We claim:

1. A device for applying a medicament to an interior wall of a body canal, comprising:

a housing having a treatment end for insertion into said body canal;

at least one treatment arm moveably connected to said housing and having thereon at least one applicator for applying said medicament to said canal wall; and

at least one actuator for moving said treatment arm outward relative to said housing and toward said canal wall, and for operating said applicator to apply said medicament to said canal wall.

2. The device of claim 1, wherein said applicator comprises a syringe.

3. The device of claim 1, wherein said applicator comprises a cannula.

4. The device of claim 1, wherein said treatment arm is biased to an inward position.

5. The device of claim 4, wherein said actuator contacts said treatment arm and moves said treatment arm outward toward said canal wall.

6. The device of claim 5, wherein movement of said actuator causes said applicator to release said medicament.

7. The device of claim 5, wherein said actuator comprises a plunger, movement of said plunger contacting said treatment arm to move said treatment arm outward toward said canal wall.

8. The device of claim 1, wherein said housing comprises an open interior portion and said actuator comprises a plunger provided in said open interior.

9. The device of claim 8, wherein at least one of said housing and said plunger comprise gripping structure for moving the plunger.

10. The device of claim 1, wherein a plurality of radially spaced treatment arms are spaced about an end of said housing, a first end of each treatment arm being connected to said housing, said applicator being provided substantially at an opposing end of each treatment arm.

11. The device of claim 10, wherein four treatment arms are provided and radially spaced about said end of said housing.

12. The device of claim 1, wherein said applicator comprises a container with a reservoir for containing said medicament, said container of said applicator being connected to said treatment arms, said actuator contacting said container to cause the release of said medicament through said treatment arms.

13. The device of claim 12, wherein said plunger contacts said treatment arm to move said treatment arm outward, and then contacts said container to force said medicament from said reservoir.

14. The device of claim 12, wherein said actuator comprises a plunger for contacting said container in said treatment arm, said housing comprising an open interior portion and said plunger being movable within said open interior.

15. The device of claim 14, wherein said container of said treatment arms comprises a seal and a piston movable in said container to break said seal, movement of said piston causing said piston to break said seal and release said medicament to flow from said container and said applicator.

16. The device of claim 12, wherein said applicator comprises a syringe, whereby said medicament will be injected into said canal wall.

17. The device of claim 12, wherein said container is movable in said treatment arms between a retracted position and an extended position, and further comprising biasing structure for biasing said container toward said retracted position, said actuator being operable to move said container to said extended position.

18. The device of claim 1, wherein said actuator comprises a plunger, said plunger having a reservoir for said medicament, and means for forcing said medicament from said reservoir and through said applicator.

19. The device of claim 19, further comprising connection channel means for transferring said medicament from said reservoir of said plunger to said applicator.

20. The device of claim 18, wherein said means for forcing said medicament from said reservoir comprises a piston movable within said reservoir for forcing said medicament to said applicator.

21. A treatment device comprising a housing with a moveable actuator and at least one moveable treatment arm, said treatment arm comprising a treatment mechanism, movement of said actuator moving said treatment arm radially outward relative to said housing and operating said treatment mechanism to cause said treatment mechanism to apply a medicament to tissue.

22. The treatment device of claim 21, wherein said treatment mechanism comprises an applicator, movement of said actuator causing said applicator to release said medicant.

23. The treatment device of claim 21, wherein said housing is elongated with an open interior, said actuator is moveable within said open interior, and said treatment arm is connected to an end of said housing, movement of said actuator in a first direction causing said treatment arm to move radially outward and causing said treatment mechanism to release said medicant, and movement of said actuator in a second direction causing said treatment arm to move radially inward and said treatment mechanism to cease releasing said medicant.

24. The treatment device of claim 21, wherein said actuator causes said treatment arm to move outward prior to causing said treatment mechanism to release said medicant.

25. The treatment device of claim 24, wherein said actuator causes said treatment mechanism to cease releasing said medicant prior to causing said treatment arm to move radially inward.

26. The treatment device of claim 21, further comprising a plurality of treatment arms, each having a treatment mechanism, movement of said actuator actuating each of said treatment arms and treatment mechanisms.

27. The treatment device of claim 21, wherein said treatment mechanism is biased to a closed position.

28. The treatment device of claim 21, wherein said treatment arm is provided on a head, said head being detachable from said housing.

29 An injection device for injecting a medicament into a tissue, comprising:

a housing having an injection end;

at least one injection arm moveably connected to said injection end of said housing and having thereon at least one syringe for injecting said medicament into said tissue;

at least one actuator for moving said injection arm outward relative to said housing and toward said tissue and for operating said syringe to inject said medicament into said tissue.

30. A method for applying a medicament to an interior tissue of a body canal wall, comprising the steps of:

providing a device for applying a medicament to said tissue, comprising a housing having a treatment end for placement adjacent to said tissue, at least one treatment arm moveably connected to said housing and having thereon at least one applicator for applying said medicament to said tissue, and at least one actuator for moving said treatment arm outward relative to said housing and toward said tissue, and for operating said applicator to apply said medicament to said tissue;

inserting said treatment arm into said body canal: and,

operating said actuator to apply said medicament to said interior tissue of said body canal.

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