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(54) **ENDOSCOPIC APPLICATOR WITH  
REAGENT BALL CUTTER**

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**Publication Classification**

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(52) **U.S. Cl.**

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(57)

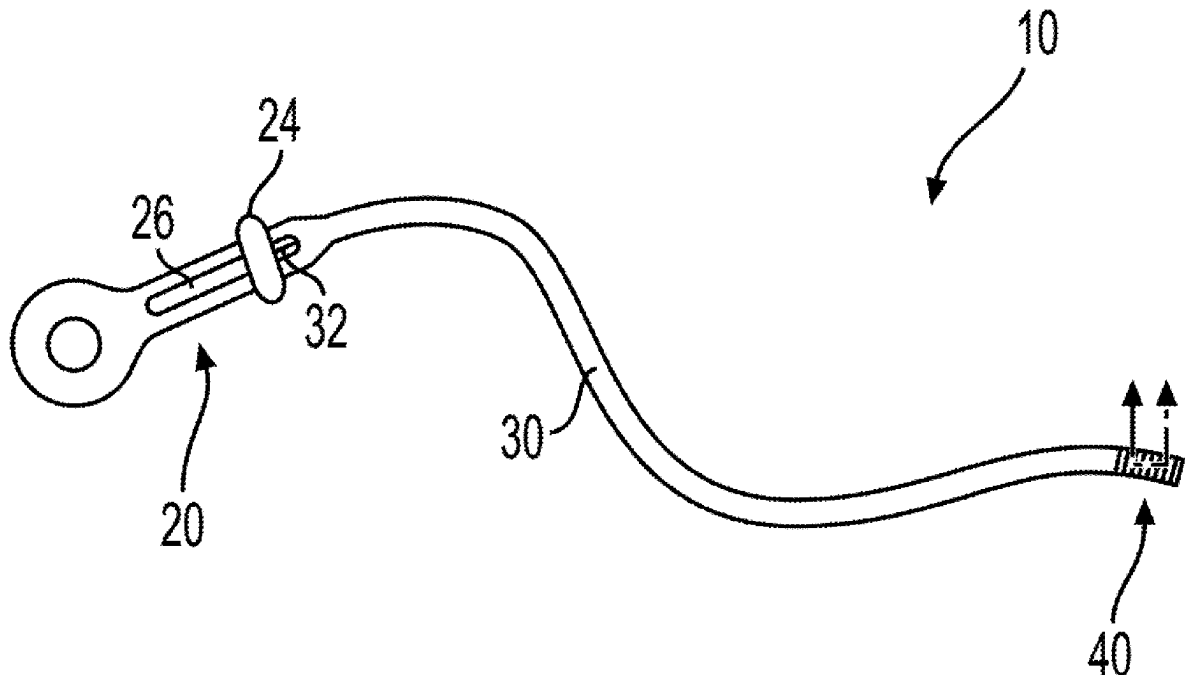
**ABSTRACT**

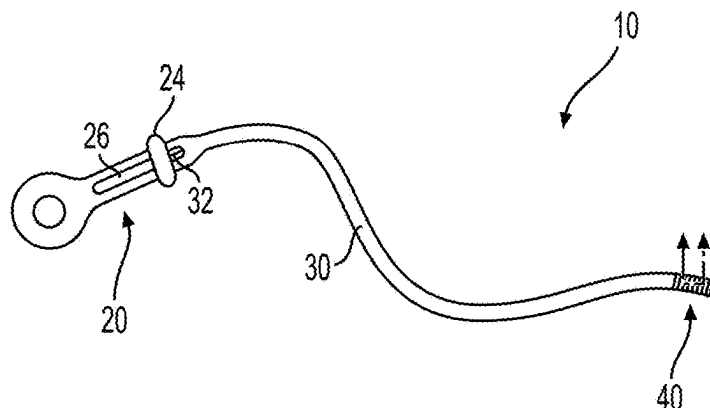
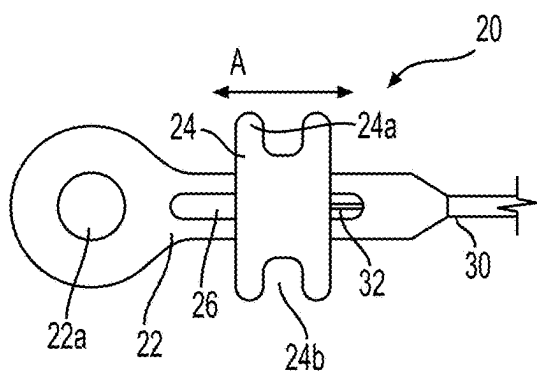
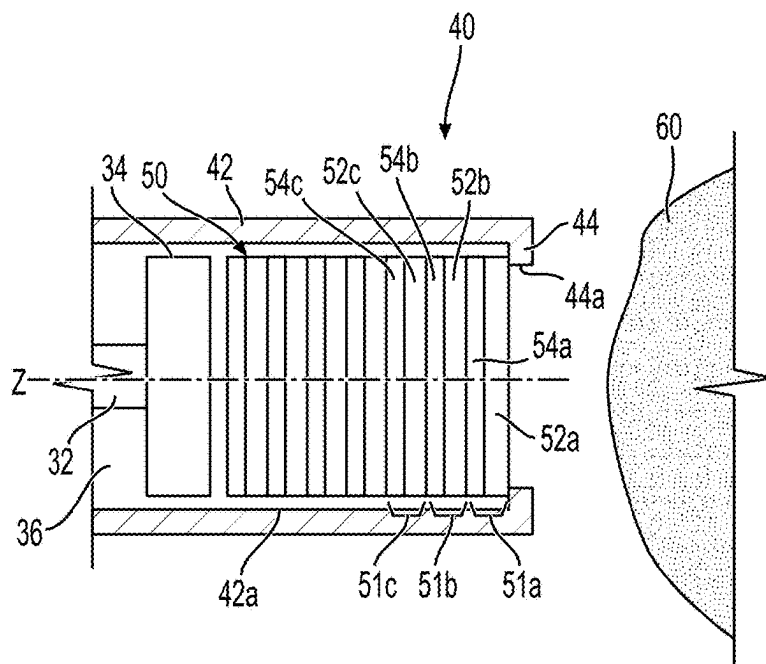
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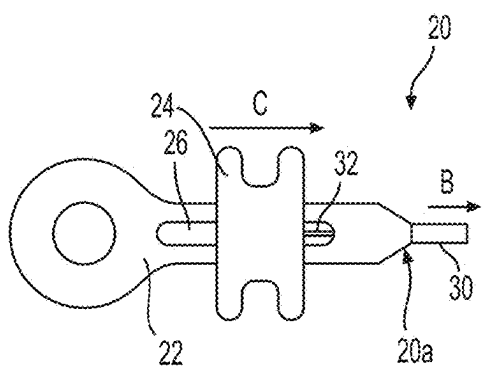
(63) Continuation of application No. 18/396,021, filed on Dec. 26, 2023, now Pat. No. 12,303,654, which is a continuation of application No. 18/067,324, filed on Dec. 16, 2022, now Pat. No. 11,890,430, which is a continuation of application No. 16/860,252, filed on Apr. 28, 2020, now Pat. No. 11,554,251.

A medical dispensing device which includes a catheter, an applicator tip at a distal end of the catheter, the catheter and the applicator tip defining a lumen having a longitudinal axis and a distal opening, a plunger in the lumen and movable along the longitudinal axis, and a plurality of elements in the lumen proximal to the distal opening and distal to the plunger, the plurality of elements stacked along the longitudinal axis for dispersement of one element at a time through the distal opening via a force applied by the plunger.

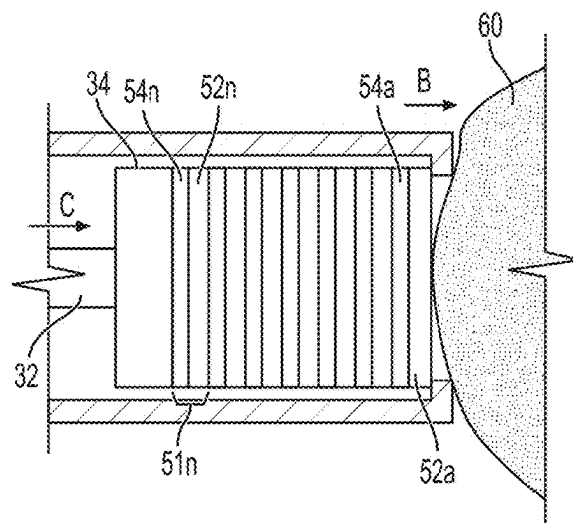


**FIG. 1****FIG. 2**

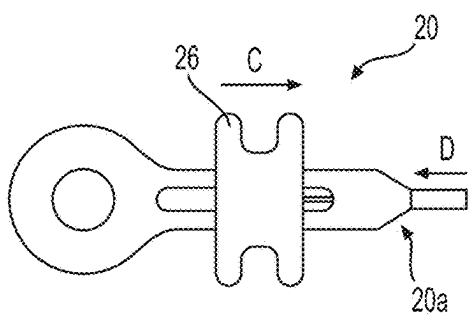
**FIG. 3**



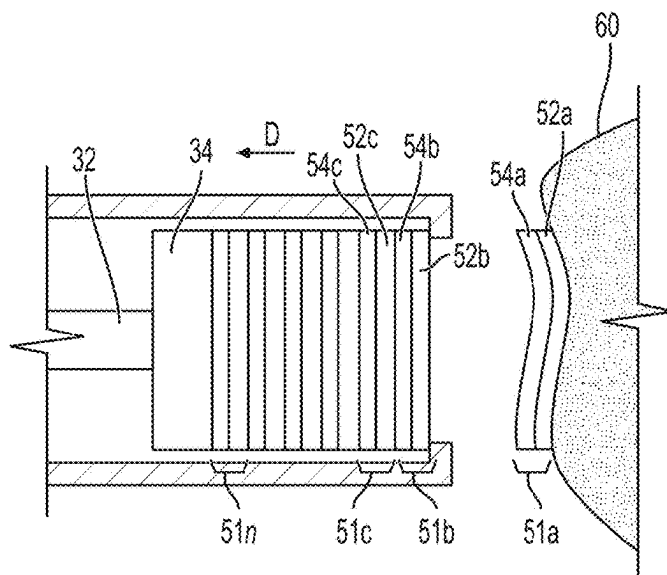
**FIG. 4A**



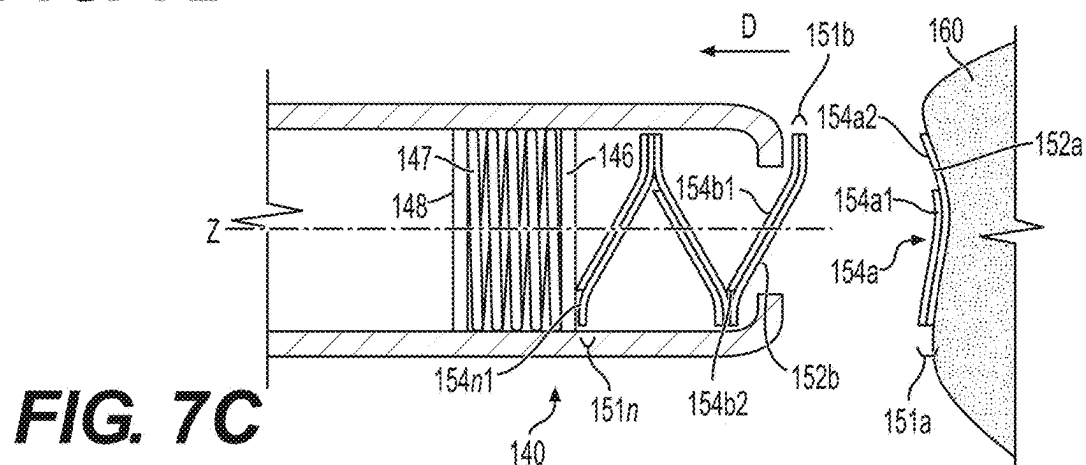
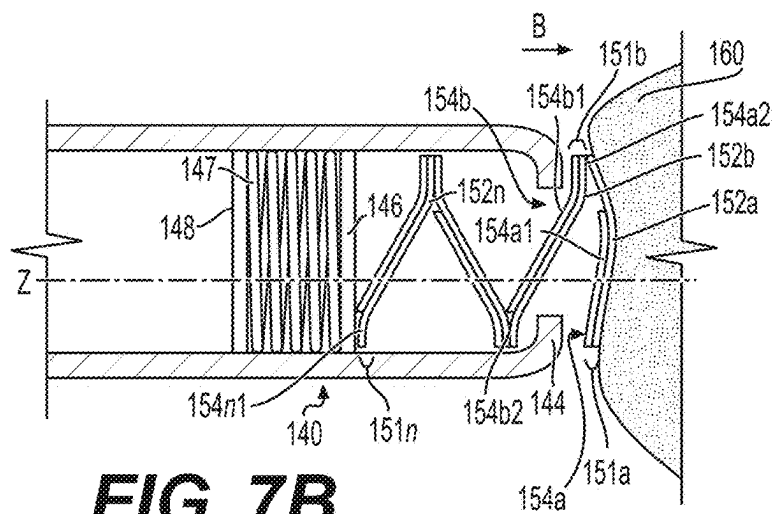
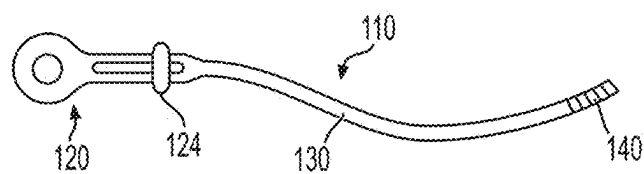
**FIG. 4B**

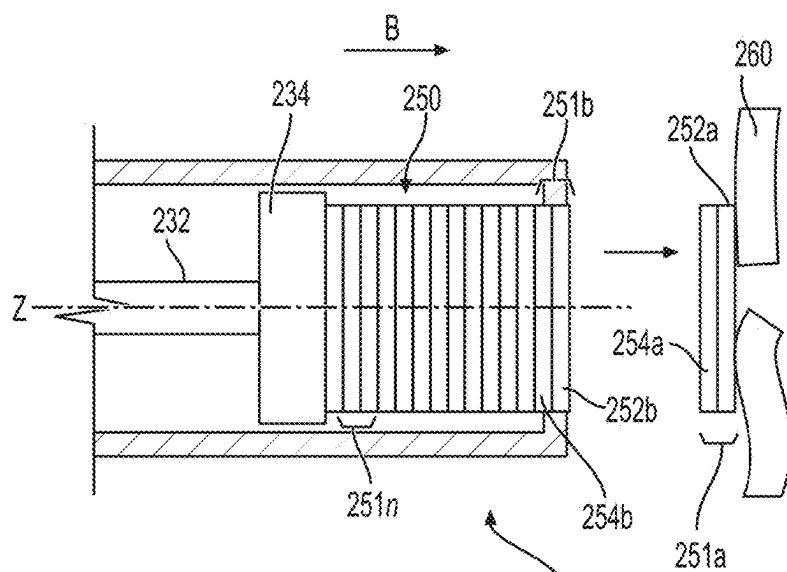


**FIG. 5A**

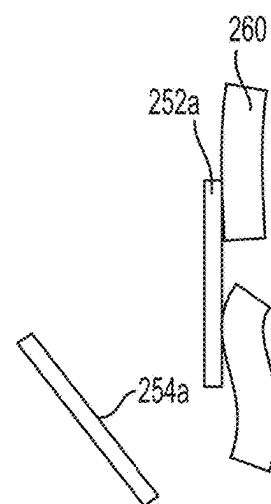


**FIG. 5B**

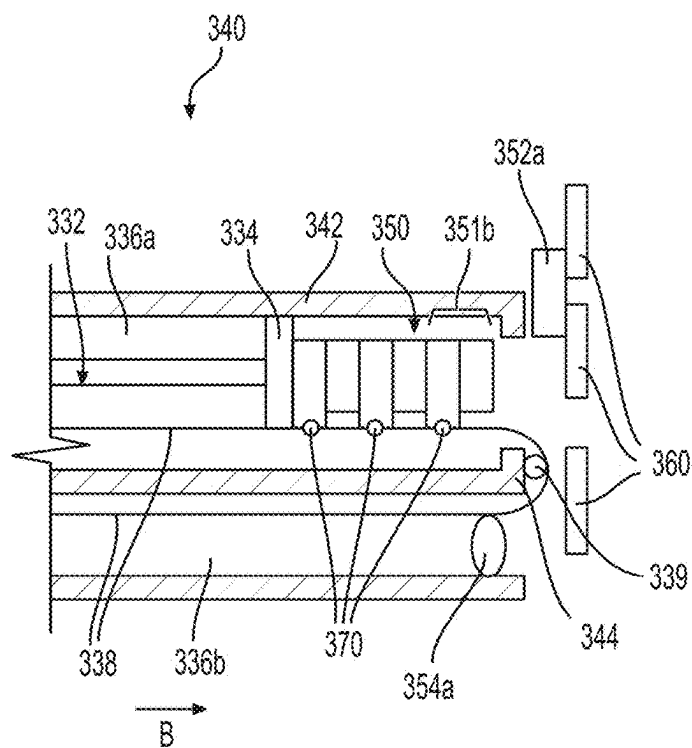




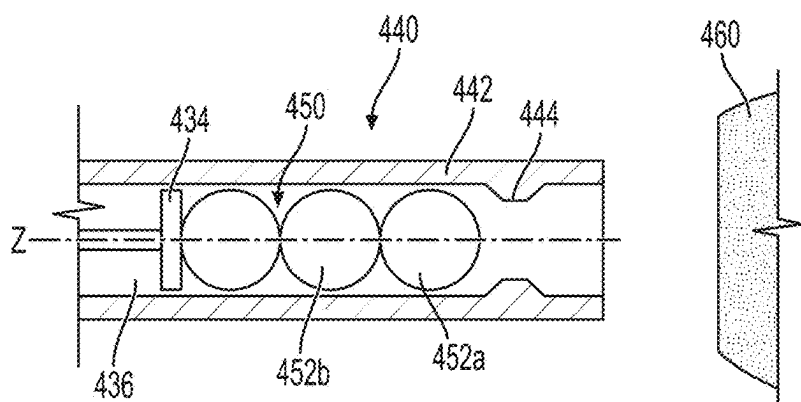
**FIG. 8A**



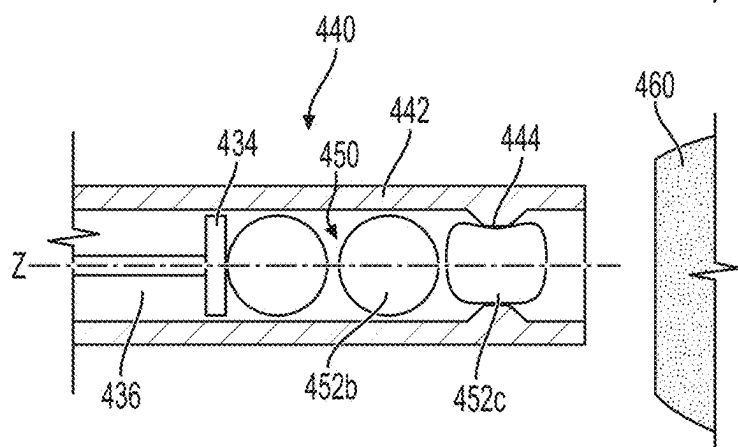
**FIG. 8B**



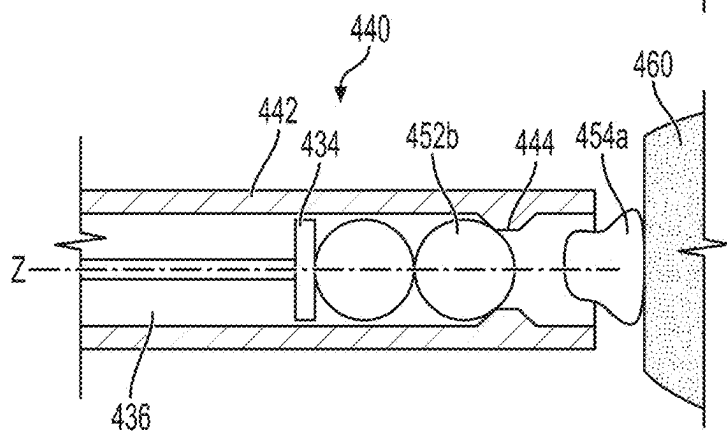
**FIG. 9**



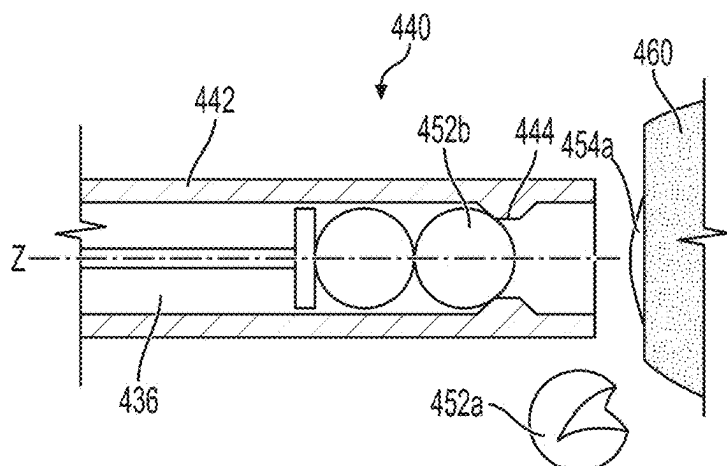
**FIG. 10A**



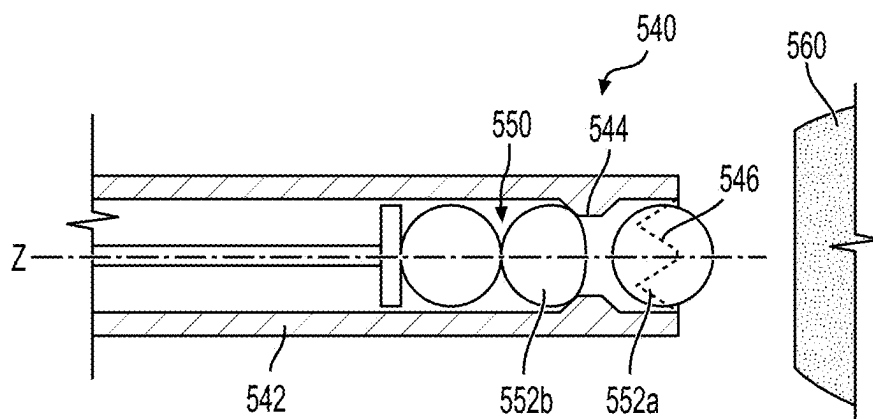
**FIG. 10B**



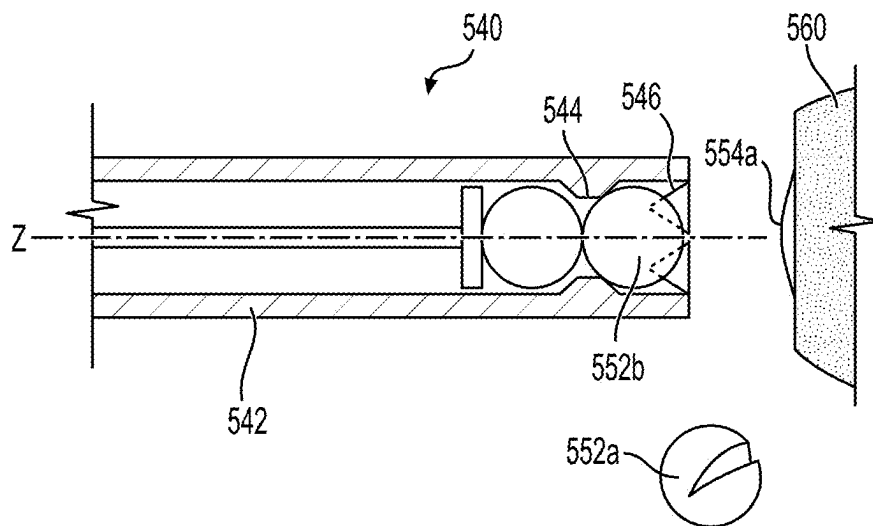
**FIG. 10C**



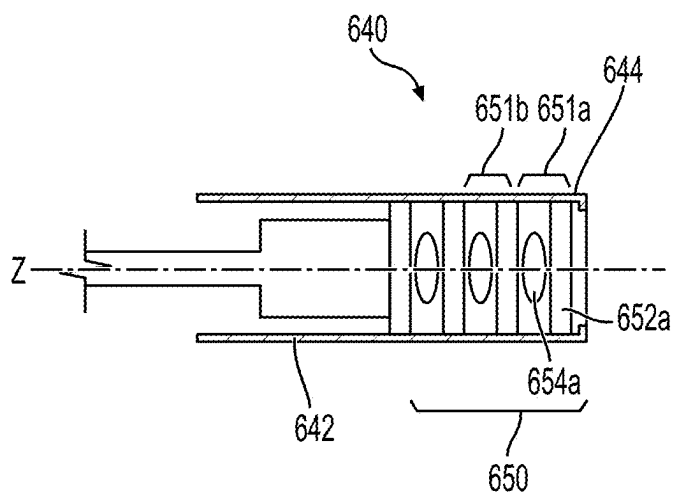
**FIG. 10D**



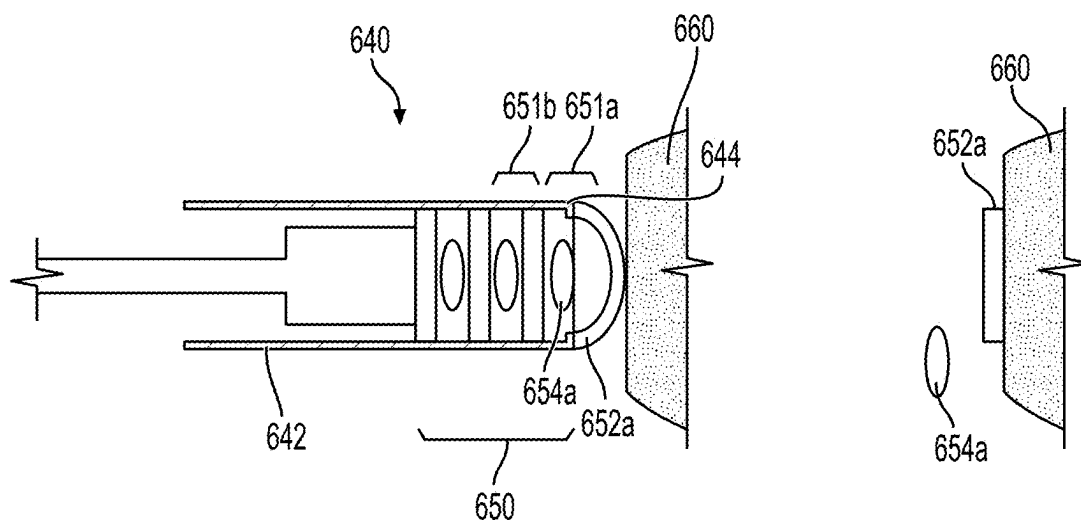
**FIG. 11A**



**FIG. 11B**



**FIG. 12A**



**FIG. 12B**



## ENDOSCOPIC APPLICATOR WITH REAGENT BALL CUTTER

### CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. application Ser. No. 18/396,021, filed Dec. 26, 2023, which is a continuation of U.S. application Ser. No. 18/067,324, filed Dec. 16, 2022, now U.S. Pat. No. 11,890,430, which is a continuation of U.S. application Ser. No. 16/860,252, filed Apr. 28, 2020, now U.S. Pat. No. 11,554,251, which claims the benefit of priority from U.S. Provisional Application No. 62/840,734, filed Apr. 30, 2019, each of which is incorporated by reference herein in its entirety.

### TECHNICAL FIELD

[0002] The present disclosure relates generally to medical systems and devices for delivering protective barriers to the gastrointestinal (GI) region, and more particularly, to methods and tools for delivering and deploying patches or other tissue barriers to the gastrointestinal system.

### BACKGROUND

[0003] Conventional endoscopic procedures, such as endomucosal resection (EMR), endosubmucosal dissection (ESD), and anastomosis, as well as diseases, such as inflammatory bowel disease (IBD) and IBD subsidiary diseases, result in damage to GI tissues. These procedures and diseases cause very thin layers in the GI tract wall, leaving the GI tract wall vulnerable to GI perforation or other trauma.

[0004] Current procedures for repairing the GI tract require surgical procedures, including clipping or endoscopic suturing, to appose tissue and allow time for healing. These conventional techniques and associated technologies are not suitable for large defects, or for repair of friable or fibrotic tissue. Yet, failure to provide a protective barrier between the damaged GI tract lining and the GI cavity can cause perforation, infection, and/or sepsis. The present disclosure may solve one or more of these problems or other problems in the art. The scope of the disclosure, however, is defined by the attached claims and not the ability to solve a specific problem.

### SUMMARY OF THE DISCLOSURE

[0005] According to an embodiment, a medical dispensing device comprises a catheter defining a lumen having a longitudinal axis and a distal opening, a plunger disposed in the lumen and movable along the longitudinal axis, and a plurality of elements disposed in the lumen proximal to the distal opening and distal to the plunger, the plurality of elements being stacked along the longitudinal axis for dispersement one element at a time through the distal opening via a force applied by the plunger.

[0006] The device may include a wire or a cable disposed in the lumen and connected to a proximal end of the plunger, and the wire or the cable may be configured to move the plunger axially along the longitudinal axis.

[0007] The plurality of elements may include a plurality of stacked patches, and each of the plurality of stacked patches may have an adhesive layer and a non-adhesive layer proximal to the adhesive layer.

[0008] The non-adhesive layer may be configured to remain attached to the adhesive layer after dispensing the respective patch from the device.

[0009] The non-adhesive layer may not extend across an entire proximal surface of the adhesive layer, exposing a portion of the proximal surface of the adhesive layer, and the exposed portion of the proximal surface may be attached to (1) a distal surface of the adhesive layer of an adjacent and proximal patch from the plurality of stacked patches, or (2) the plunger.

[0010] A proximal surface of the non-adhesive layer of a distalmost patch of the plurality of stacked patches may be configured to contact a distalmost surface of the catheter outside of the lumen.

[0011] The device may include a second wire or a second cable extending from a proximal end to a distal end of the catheter and may be attached to each of the non-adhesive layers, and may be configured to remove each separate non-adhesive layer from a corresponding adhesive layer.

[0012] The device may include a second lumen defined by the catheter, the second wire or the second cable may extend through the second lumen, and the second lumen may receive each of the non-adhesive layers separate from the corresponding adhesive layer.

[0013] Each of the adhesive layers may include one or more therapeutic agents.

[0014] The distal end of the catheter may include an annular ring at a distalmost portion of the catheter and extending from a sidewall of the catheter toward the distal opening, wherein a distance between an innermost surface of the annular ring and the longitudinal axis may be less than a distance between an innermost surface of the sidewall of the catheter and the longitudinal axis.

[0015] A distal surface of a distalmost element of the plurality of elements may be configured to contact a proximal surface of the annular ring, and the force applied by the plunger may push the distalmost element out the distal opening.

[0016] The device may include a wall disposed in the lumen, transverse to the longitudinal axis, and fixed to a sidewall of the lumen at a location proximal to the plurality of elements, and may include a biasing element attached at a first end to the wall, and at a second end to the plunger, such that a force provided by the biasing element may push the plunger against the plurality of elements and toward the distal opening.

[0017] The plurality of elements may include a plurality of deformable spheres, an outer surface of each of the deformable spheres including a first material and surrounding and containing therein a second material, different from the first material.

[0018] A protrusion may extend from a sidewall defining the lumen toward the longitudinal axis, and distal to a distalmost one of the plurality of deformable spheres.

[0019] The device may include one or more cutters distal to the protrusion and extending from the sidewall defining the lumen toward the longitudinal axis, wherein the one or more cutters may be configured to cut the outer surface of each of the plurality of deformable spheres and expose the second material as each of the plurality of deformable spheres is dispensed from the device.

[0020] According to another embodiment, a medical dispensing device includes a handle, a catheter extending distally from the handle, an applicator tip at a distal end of

the catheter, the catheter and the applicator tip defining a lumen having a longitudinal axis and a distal opening, a plunger disposed in the lumen and movable along the longitudinal axis, and a plurality of elements disposed in the lumen proximal to the distal opening and distal to the plunger, the plurality of elements being stacked along the longitudinal axis for dispersement one element at a time through the distal opening.

**[0021]** The plurality of elements may include a plurality of deformable spheres, an outer surface of each of the deformable spheres including a first material and surrounding and containing therein a second, flowable material, different from the first material.

**[0022]** The plurality of elements may include a plurality of stacked patches, each of the plurality of stacked patches may have an adhesive layer and a non-adhesive layer proximal to the adhesive layer.

**[0023]** According to yet another embodiment, a method for applying a medical patch to tissue includes pushing a stack of patches toward a distal opening of a catheter, moving the catheter toward a target, such that a distalmost patch from the stack of patches contacts the target, and moving the catheter in a proximal direction, away from the target, thereby releasing the distalmost patch from the catheter.

**[0024]** The method may include, after releasing the distalmost patch from the catheter, pushing the remaining patches of the stack of patches toward the distal opening, moving the catheter toward a second target, such that a second distalmost patch contacts the second target, and moving the catheter in a proximal direction, away from the second target, thereby releasing the second distalmost patch from the catheter

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0025]** The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate various exemplary embodiments and together with the description, serve to explain the principles of the disclosed embodiments.

**[0026]** FIG. 1 is a schematic of an endoscopic applicator system according to an embodiment;

**[0027]** FIG. 2 is a perspective view of a handle for an endoscopic applicator system according to an embodiment;

**[0028]** FIG. 3 is a cross-section of an applicator tip according to an embodiment;

**[0029]** FIG. 4A is a perspective view of a handle for an endoscopic applicator system according to an embodiment;

**[0030]** FIG. 4B is a cross-section of an applicator tip according to an embodiment;

**[0031]** FIG. 5A is a perspective view of a handle for an endoscopic applicator system according to an embodiment;

**[0032]** FIG. 5B is a cross-section of an applicator tip according to an embodiment;

**[0033]** FIG. 6 is a schematic of an endoscopic applicator system according to another embodiment;

**[0034]** FIGS. 7A-7C are cross-sections of an applicator tip according to another embodiment;

**[0035]** FIG. 8A is a cross-section of an applicator tip according to yet another embodiment;

**[0036]** FIG. 8B is a cross-section of a regenerative patch according to an embodiment;

**[0037]** FIG. 9 is a cross-section of an applicator tip according to yet another embodiment;

**[0038]** FIGS. 10A-10D are cross-sections of an applicator tip according to another embodiment;

**[0039]** FIGS. 11A-11B are cross-sections of an applicator tip according to yet another embodiment; and

**[0040]** FIGS. 12A-12B are cross-sections of an applicator tip according to yet another embodiment.

#### DETAILED DESCRIPTION

**[0041]** Both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the features, as claimed. As used herein, the terms “comprises,” “comprising,” “having,” “including,” or other variations thereof, are intended to cover a non-exclusive inclusion such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements, but may include other elements not expressly listed or inherent to such a process, method, article, or apparatus. In this disclosure, relative terms, such as, for example, “about,” “substantially,” “generally,” and “approximately” are used to indicate a possible variation of  $\pm 10\%$  in a stated value or characteristic.

**[0042]** Referring to FIG. 1, an endoscopic applicator **10** according to an embodiment is shown. Endoscopic applicator **10** includes a handle **20**, a catheter **30** connected to handle **20**, and an applicator tip **40** at a distal end of catheter **30**, opposite handle **20**.

**[0043]** FIG. 2 illustrates handle **20** according to an exemplary embodiment. Handle **20** includes a body **22** defining a hole **22a** in body **22** at a proximal end thereof. Catheter **30** is attached at an opposite, distal end of body **22**. A slot **26** extends through body **22** in a direction parallel to a direction of extension of catheter **30**. A spool **24** is disposed in slot **26** and moves within and along slot **26** in a direction parallel to the direction of extension, as shown by arrow A. As further shown in FIG. 2, spool **24** includes two annular protrusions **24a** at a distal end and a proximal end thereof and extending from spool **24** in a direction perpendicular to the direction of extension of catheter **30**. Annular protrusions **24a** define an annular grip **24b**, which is grasped by a user as will be described in greater detail herein. It will be understood that handle **20** may be made of any material known in the art, including, but not limited to, a medical grade plastic or rubber, a ceramic, a metal, or a combination thereof.

**[0044]** As further shown in FIG. 2, a wire **32** (or a cable) extends distally from the distal end of spool **24**. Wire **32** extends through a hole (not shown) in handle **20** and into a lumen **36** (FIG. 3) of catheter **30**. As will be described in greater detail herein, actuation of wire **32** dispenses a regenerative patch. As will be understood, catheter **30** is a generally circular sheath extending from handle **20** to applicator tip **40**. While catheter **30** is described as including lumen **36** (FIG. 3), catheter **30** may include multiple lumens to incorporate other tools and/or elements (e.g., lighting, imaging, etc.) at applicator tip **40**. Additionally, or alternatively, catheter **30** may be placed in another, larger catheter or endoscope (not shown), if use of tools, suction, light-emitting elements, or the like associated with the larger catheter are so desired. It will be understood that wire **32** may include any material known in the art, including, but not limited to, medical grade plastic, metal, or other resin suitable to be used to push and/or pull a plunger **34** (FIG. 3), as described herein, during application of a regenerative patch or agent. It will be understood that while examples discuss a regenerative agent applied to a patch, the patch

may include an adhesive without a regenerative agent. Further, it will be understood that catheter 30 may be formed of any medical grade plastic, rubber, resin, or the like that is suitable for use in medical applications.

**[0045]** Referring to FIG. 3, which shows a cross-section of applicator tip 40, as indicated by the cross-sectional lines shown in FIG. 1, applicator tip 40 is disposed at the distal end of catheter 30. Applicator tip 40 includes an outer wall 42 having a generally circular cross-section. As shown in FIG. 3, applicator tip 40 is the distalmost portion of catheter 30, as applicator tip 40 may be integrally formed with catheter 30. Applicator tip 40 further includes an annular ring 44 provided at a distalmost portion of applicator tip 40. Annular ring 44 extends annularly from an outermost part of outer wall 42 toward a central longitudinal axis Z (e.g., central axis Z) of lumen 36, has a uniform thickness, and forms a radially-inward directed flange at the distalmost end of endoscopic applicator 10. The flange assists in retaining patches within applicator tip 40. A distance from central axis Z to an innermost portion 44a of annular ring 44 is less than a distance from central axis Z to an innermost portion 42a of outer wall 42. Alternatively, or additionally, applicator tip 40, including outer wall 42, may be a separate element from catheter 30, such as an add on device attached via screw threads, adhesive, snap fit, or the like. Applicator tip 40 may be any material known in the art, including, but not limited to, a medical grade plastic, resin, or rubber. Alternatively, any other mechanism for retaining patches 50, e.g., tabs, may be provided at the distalmost portion of applicator tip 40.

**[0046]** As shown in FIG. 3, a stack of patches 50, for example patches having a regenerative agent, are disposed in applicator tip 40 for application to a target 60, as explained herein. Plunger 34, connected to a distalmost portion of wire 32, is disposed in applicator tip 40 at a position proximal to the stack of patches 50. Plunger 34 may be any material known in the art, including, but not limited to a medical grade metal alloy, a plastic, a resin, or a rubber, suitable for being used to place pressure against the stack of patches 50.

**[0047]** With continued reference to FIG. 3, the stack of patches 50 may include a first patch 51a having a first layer 52a including an adhesive substance and a second layer 54a including a non-adhesive backing, so that adjacent patches 50 do not adhere to one another. As described herein, first layer 52a may include a regenerative agent, an adhesive regenerative agent, or any other therapeutic or diagnostic agent and/or attachment mechanism for attaching first patch 51a to target 60.

**[0048]** First layer 52a is provided at a distalmost position of lumen 36 and is adjacent to and in contact with annular ring 44 of applicator tip 40. First layer 52a is applied to target 60, e.g., tissue, or another suitable target site, as will be described herein. A second patch 51b having a first layer 52b including an adhesive agent (and/or a regenerative agent) and a second layer 54b including a non-adhesive backing is disposed proximal to and adjacent second layer 54a of first patch 51a. A third patch 51c having a first layer 52c and a second layer 54c is disposed proximal to and adjacent second layer 54b of second patch 51b, and so on and so forth for n number of patches (an n patch 51n is illustrated in FIG. 4B and has a first layer 52n and a second layer 54n). It will be understood that target 60 may be any

tissue known in the art, including but not limited to endomucosal tissue, gastrointestinal tissue, bone tissue, cartilage, etc.

**[0049]** An operation of endoscopic applicator 10 illustrated in FIGS. 1-3 will now be described.

**[0050]** Endoscopic applicator 10 is introduced to the body through an opening, such as through the mouth or nose, or through an opening formed by an incision, e.g., during a surgical procedure. Applicator tip 40 is inserted into the body through the opening and advanced to the desired deployment site, e.g., the GI tract. According to an embodiment, applicator tip 40 and catheter 30 are advanced along a guidewire (not shown). It will be understood that applicator tip 40 and catheter 30 may be advanced along a pre-positioned sheath, catheter, endoscope, bronchoscope, colonoscope, or the like, e.g., a catheter with multiple lumens to provide light emission, suction, tools, or the like, or may be positioned in any other manner or using any other device known in the art.

**[0051]** After positioning applicator tip 40 at the desired location, e.g., at target 60, deployment and placement of the stack of patches 50, one-by-one in a serial fashion, is performed. Referring to FIGS. 4A and 4B, handle 20 is maneuvered to push the distalmost portion of applicator tip 40, including annular ring 44, in a direction indicated by arrows B, such that annular ring 44 abuts target 60. At a same time, or subsequently, spool 24 (grasped by an index finger and a middle finger of the user's hand, while a thumb is in hole 22a, for example) is advanced longitudinally along handle 20 in a direction indicated by arrow C toward a distal end 20a of handle 20, thereby pushing wire 32 and plunger 34 in the direction indicated by arrow C in FIG. 4B. Plunger 34 pushes against the proximalmost patch 51n (n is a number of patches in the stack of patches 50, and may be a maximum number of patches in the stack of patches 50 that can be disposed in applicator tip 40), thereby forcing the stack of patches 50 against target 60, and causing first layer 52a of first patch 51a to contact and adhere to target 60. Subsequently, while continuing to push spool 24 toward distal end 20a of handle 20, or maintaining a position of spool 24 relative to handle 20, endoscopic applicator 10, including applicator tip 40, is pulled in a proximal direction, as indicated by arrow D in FIGS. 5A and 5B. As shown in FIG. 5B, first patch 51a adheres to target 60 via first layer 52a, and second layer 54a remains attached to a side of first layer 52a opposite target 60. After application of first patch 51a, applicator tip 40 is moved to another application location, e.g., a position adjacent first patch 51a, and the application of second patch 52a is performed. In this manner, one or more patches from the stack of patches 50 is applied to target 60.

**[0052]** Referring to FIG. 6, an endoscope applicator 110 according to another embodiment is disclosed. Like reference numerals will be used to describe like elements.

**[0053]** Endoscope applicator 110 includes a handle 120, a catheter 130 attached to handle 120, and an applicator tip 140 attached to catheter 130 at a distal end opposite handle 120. Spool 124 is shown in FIG. 6; however, since a spool is unnecessary in the operation of endoscope applicator 110 according to the embodiment in FIGS. 6-7C as described herein, handle 120 may be formed without spool 124. With continued reference to FIG. 6, catheter 130 is a generally

circular sheath extending from handle 120 to applicator tip 140 and defining a lumen 136, similar to catheter 30 described above.

[0054] Referring to FIG. 7A, applicator tip 140 according to an embodiment will be described. Applicator tip 140 is disposed at a distal end of catheter 130. Applicator tip 140 includes an outer wall 142 and an annular ring 144, similar to applicator tip 40. As shown in FIG. 7A, a stack of patches 150 is disposed in applicator tip 140 for application to a target 160, as explained herein. A plunger 146 is connected to a fixed plate 148 via a spring 147, all of which are disposed in applicator tip 140 at a position proximal to the stack of patches 150. Fixed plate 148 may have an area equal to or smaller than a cross-section area of lumen 136 and may be fixed to a sidewall of lumen 136 via an adhesive, sonic welding, or the like. Plunger 146, spring 147, and fixed plate 148 may be any material known in the art, including but not limited to a medical grade metal alloy, a plastic, a resin, or a rubber, suitable for being used to place pressure against the stack of regenerative patches 150 and push the stack of patches 150 toward a distal opening of applicator tip 140.

[0055] With continued reference to FIG. 7A, the stack of patches 150 may include a first patch 151a having a first layer 152a including an adhesive substance and a second layer 154a, including a non-adhesive surface 154a1, so that adjacent patches 150 do not adhere to one another, and an adhesive surface 154a2, which may include the same material as first layer 152a. As described herein, first layer 152a may include a regenerative agent, an adhesive regenerative agent, or any other agent and/or attachment mechanism for attaching first patch 151a to target 160.

[0056] Prior to a first application, first patch 151a is partially exposed from applicator tip 140, outside of the distal opening of the applicator tip 140 such that non-adhesive surface 154a1 is adjacent to and/or contacts an outer surface of annular ring 144, thereby exposing first layer 152a outside applicator tip 140, as will be described in greater detail herein. Adhesive surface 154a2 is attached to a first layer 152b of a second patch 151b, as shown in FIG. 7A. Second patch 151b also includes a second layer 154b having a non-adhesive layer 154b1 and an adhesive surface 154b2. A patch 151n, which is a proximalmost patch, has an adhesive surface 154n1, which attaches to plunger 146 (n is a number of patches in the stack of patches 150, and may be a maximum number of patches in the stack of patches 150 that can be disposed in applicator tip 140). First layer 152a is applied to target 160, e.g., a tissue or another suitable target site, as will be described herein. It will be understood that target 160 may be any tissue known in the art, including but not limited to endomucosal tissue, gastrointestinal tissue, bone tissue, cartilage, etc.

[0057] An operation of endoscopic applicator 110 illustrated in FIGS. 7B and 7C will now be described. Endoscopic applicator 110 is introduced to the body in a same manner an endoscopic applicator 10 in FIGS. 1-3, as described above. After positioning applicator tip 140 at the desired location, e.g., at target 160, placement of one or more of the stack of patches 150 is performed. Handle 120 is maneuvered to push the distalmost portion of applicator tip 140 in FIG. 7B, including annular ring 144, in a direction indicated by arrow B and against target 160. Pushing applicator tip 140 against target 160 causes a surface of first layer 152a, opposite a surface of second layer 154a contacting annular ring 144, to contact and adhere to target 160.

Subsequently, as shown in FIG. 7C, applicator tip 140 is pulled in a direction indicated by arrow D, via handle 120, which causes the remainder of patch 151a to exit applicator tip 140. If necessary to completely deploy all of patch 151a against target 160, handle 120 and applicator tip 140 are again moved in the direction indicated by arrow B in FIG. 7B, such that annular ring 144 presses against a surface 154b1 of second layer 154b of second patch 151b, as shown in FIG. 7B, causing first patch 151a to adhere to target 160. Applicator tip 140 is again moved in a direction indicated by arrow D in FIG. 7C, which pulls first layer 152b of second patch 151b from surface 154a2 of first patch 151a. Spring 147 forces plunger 146 against patch 151n, thereby forcing the stack of regenerative patches 150 toward the distal end of applicator tip 140, allowing second patch 151b to be applied to the same target 160 or a different target. As shown in FIG. 7C, second patch 151b is set to be applied to another location on target 160. As further shown in FIG. 7C, second layer 154a remains attached to first layer 152a, but the embodiment is not limited to this configuration, since second layer 154a may be released from first layer 152a during and/or subsequent to application of first patch 151a to target 160.

[0058] According to another embodiment, an applicator tip 240 is illustrated in FIG. 8A, and has similar features as applicator tip 40, described above. As shown in FIG. 8A, a stack of patches 250 is disposed in applicator tip 240 for application to a target 260, as explained herein. The stack of patches 250, including first patch 251a having a first layer 252a and a second layer 254a, and including second patch 251b having a first layer 252b and a second layer 254b, are applied to target 260 using a plunger 234 attached to a wire 232 in a manner as described above with reference to FIGS. 4A-5B. Applicator tip 240 according to an embodiment is used with, e.g., handle 20 shown in FIG. 2.

[0059] An operation of an endoscopic applicator, such as endoscopic applicator 10 in FIG. 1, having an applicator tip 240 will now be described. Applicator tip 240 is inserted into the body through the opening and advanced to the desired deployment site, e.g., the GI tract, as in the previous embodiments. After positioning applicator tip 240 at the desired location, deployment and placement of the stack of patches 250 is performed, in any manner described above.

[0060] As shown in FIG. 8A, first patch 251a adheres to target 260 via first layer 252a. As shown in FIG. 8B, after first patch 251a is attached to target 260, second layer 254a disengages or disconnects from, or otherwise falls off of, a back side (e.g., a side opposite target 260) and is passed from the body via normal excretion, is retrieved by another tool, and/or is biodegradable. After application of first patch 251a, applicator tip 240 is moved to another application location, e.g., a position adjacent first patch 251a, and the application of second patch 251b is performed. In this manner, one or more patches 251n from the stack of patches 250 is applied to the same target 260, or a different target. While handle 20, including spool 24, is described in the operation of applicator tip 240, the application device (e.g., spring 147, fixed plate 148, and plunger 146) illustrated in FIG. 7A may alternatively be used with applicator tip 240 to advance patches 250 along applicator tip 240 during application.

[0061] According to another embodiment, an applicator tip 340 is illustrated in FIG. 9. Like reference numerals will be used to describe like elements.

[0062] Applicator tip 340 is disposed at a distal end of a catheter (such as catheter 30 shown in FIG. 1). Applicator tip 340 includes an outer wall 342 and an annular ring 344, like those in prior embodiments.

[0063] The stack of patches 350 includes a plurality of patches as described herein. Each of the plurality of patches has a first layer, e.g., 352a, and a second layer, e.g., 354a. As shown in FIG. 9, each second layer, e.g., 354a, is attached to a pulley system, as will be described herein.

[0064] As shown in FIG. 9, a stack of patches 350 are disposed in applicator tip 340 for application to a target 360. One or more of patches 350 are applied to target 360 using a plunger 334 attached to a wire 332 disposed in a first lumen 336a in a manner as described above with reference to FIGS. 4A-5B. First lumen 336a and a second lumen 336b may include a pulley system, as shown in FIG. 9. The pulley system may include a wire or cable 338 that may extend around a pulley 339 at a distalmost end of applicator tip 340 and into a second lumen 336b, adjacent first lumen 336a, and which extends to a proximal end of a catheter, e.g., catheter 30 described herein. Cable 338 may attach to each of the second layers (e.g., second layer 354a) at connection points 370. Alternatively, applicator tip 340 may be formed without second lumen 336b, and cable 338 may extend on an outer side of applicator tip 340. As a further alternative, pulley 339 may be located within one or more lumens of the catheter so no parts of the pulley system are outside of the catheter. Cable 338 extends to a handle, e.g., handle 20, to allow a user to manipulate cable 338, as will be described herein. Applicator tip 340 according to an embodiment is used with handle 20 shown in FIG. 2.

[0065] An operation of an endoscopic applicator, such as endoscopic applicator 10 in FIG. 1, having an applicator tip 340 will now be described. Applicator tip 340 is inserted into the body through the opening and advanced to the desired deployment site, e.g., the GI tract, in any of the manners described above. After positioning applicator tip 340 at the desired location, deployment and placement of the stack of patches 350 is performed, in any manner described above. As shown in FIG. 9, first layer 352a was previously adhered to target 360. Subsequently, while continuing to push spool 24 toward distal end 20a of handle 20, an endoscopic applicator (including handle 20, catheter 30, and applicator tip 340) is pulled in a proximal direction, as indicated by arrow D in FIG. 5A. As shown in FIG. 9, first layer 352a adheres to target 360. After first layer 352a is attached to target 360, second layer 354a, which is attached to cable 338, is detached from first layer 352a and pulled proximally inside second lumen 336b. Cable 338 may be operated in any manner known in the art, for example by a user or by a motor (not shown). Alternatively, or additionally, cable 338 may pull second layer 354a on an external side of applicator tip 340.

[0066] After application of first layer 352a, applicator tip 340 is moved to another application location, e.g., a position adjacent first layer 352a, and the application of a first layer of second patch 351b is performed. In this manner, one or more patches from the stack of patches 350 is applied to target 360. While handle 20, including spool 24, is described in the operation of applicator tip 340, the application device (e.g., spring 147, fixed plate 148, and plunger 146) illustrated in FIG. 7A may alternatively be used with applicator tip 340 to advance patches 350 along applicator tip 340 during.

[0067] According to another embodiment, applicator tips 440 and 540 will be described with reference to FIGS. 10A-11B.

[0068] As shown in FIG. 10A, an applicator tip 440 is disposed at a distal end of a catheter (such as catheter 30 shown in FIG. 1). Applicator tip 440 includes an outer wall 442 having a generally circular cross-section. Applicator tip 440 is the distalmost portion of the catheter. Applicator tip 440 further includes a protrusion 444 extending into a lumen 436 of applicator tip 440. Protrusion 444 may be an annular protrusion, or one or more protrusions, that extends over less than a full circumference of lumen 436. A distance from central axis Z to an innermost portion of protrusion 444 is less than a distance from central axis Z to an innermost surface of outer wall 442. Protrusion 444 secures a plurality of spheres 450 in applicator tip 440 until a force applied to the plurality of spheres 450, e.g., provided by a plunger 434, forces the distalmost ball past protrusion 444.

[0069] A stack of spheres 450 includes a plurality of spheres 452a, 452b, etc. as described herein. Each of the plurality of spheres, e.g., 452a, 452b, has a reagent, e.g., 454a (see FIG. 10D), provided within for application to a target 460. One or more of the stack of spheres 450 are applied to target 460 using a plunger 434 in a manner as described above with reference to FIGS. 4A-5B. Applicator tip 440 according to an embodiment is used with handle 20 shown in FIG. 2.

[0070] With reference to FIG. 11A, an applicator tip 540, similar to applicator tip 440, will be described. Applicator tip 540 is disposed at a distal end of a catheter (such as catheter 30 shown in FIG. 1). Applicator tip 540 includes an outer wall 542 and a protrusion 544, like those in prior embodiments. Applicator tip further includes one or more blades 546 (or other cutting elements) distal of annular protrusion 544. Blades 546 are used to cut through an outer shell, which may be a rigid or deformable shell containing a substance container therein, of each of the plurality of spheres 550 during application to target 560, as described herein.

[0071] The plurality of spheres 550 include, e.g., spheres 552a, 552b, etc., and including a reagent, e.g., 554a, as described herein with reference to applicator tip 440.

[0072] An operation of applicator tip 440 and 540 will now be described with reference to FIGS. 10A-10D and 11A-11B. Applicator tips 440 or 540 are inserted into the body through the opening and advanced to the desired deployment site, e.g., the GI tract, in any of the manners described above. After positioning applicator tips 440 and 540 at the desired location, deployment and placement of the plurality of spheres 450 or 550 is performed in any manner described above.

[0073] With reference to FIG. 10C, a first sphere 452a is forced from applicator tip 440 and against target 460. The pressure between first sphere 452a and target 460 and/or applicator tip 440 causes first sphere 452a to rupture, thereby releasing a first reagent 454a, which coats target 460. First reagent 454a may be hydrophilic and or otherwise designed to be attracted to target 460.

[0074] Dispensing the plurality of spheres 550 using applicator tip 540 may be performed, as shown in FIGS. 11A and 11B. A first sphere 552a is forced past annular protrusion 544 and out a distal end of applicator tip 540. As first sphere 552a is dispensed, an outer layer of first sphere 552a is cut by one or more blades 546, thereby releasing a first reagent

**554a**, which coats target **560**. After application of first reagents **454a**, **554a**, applicator tips **440** or **540** are moved to another application location, e.g., a position adjacent the application area or another target area, and the application of another reagent using second spheres **452b**, **552b** is performed. In this manner, reagents from one or more spheres from the stack of spheres **450**, **550** are applied to targets **460**, **560**, respectively.

[0075] According to another embodiment, an applicator tip **640** is illustrated in FIGS. **12A** and **12B**. Like reference numerals will be used to describe like elements.

[0076] Applicator tip **640** is disposed at a distal end of a catheter (such as catheter **30** shown in FIG. **1**). Applicator tip **640** includes an outer wall **642** having a generally circular cross-section and an annular ring **644**, similar to applicator tip **40**.

[0077] The stack of patches **650** includes a plurality of patches **651a**, **651b**, etc. as described herein. Each of the plurality of patches has a first layer, e.g., **652a**, and a spacer, e.g., **654a**. As shown in FIG. **12B**, each spacer, e.g., **654a**, separates from each first layer e.g., **652a**, after application to target **660**, as will be described herein.

[0078] As shown in FIG. **12A**, a stack of patches **650** are disposed in applicator tip **640** for application to a target **660**, as explained herein. The stack of patches **650** are applied to target **660** in any manner described above. For example, applicator tip **640** according to an embodiment is used with handle **20** shown in FIG. **2**.

[0079] An application of the stack of patches **650** will be described with reference to FIGS. **12A** and **12B**. Applicator tip **640** is inserted into the body through the opening and advanced to the desired deployment site, e.g., the GI tract, in any manner described herein. After positioning applicator tip **640** at the desired location, deployment and placement of the stack of patches **650** is performed, similar to the manner described with respect to the embodiments above. After patch **651a** is attached to target **660**, first separator **654a** is detached from first layer **652a**. Separator **654a** may be biodegradable. Alternatively, or additionally, separator **654a** may be small enough to pass through the body and be excreted during normal bowel movements by a patient, or may be removed by a tool.

[0080] After application of first patch **651a**, applicator tip **640** is moved to another application location, e.g., a position adjacent first patch **651a** or another target site, and the application of second patch **651b** is performed. In this manner, one or more patches from the stack of regenerative **650** is applied to target **660**.

[0081] It will be understood that, unless specifically set forth herein, any material known in the art may be used for the various elements. For example, features may include a medical grade plastic or rubber, a ceramic, a metal, or a combination thereof. Spacers and/or separation layers may be may include a material that is biodegradable and/or may include one or more of a medical grade plastic or rubber, a ceramic, a metal, or a combination thereof, such as polyvinyl acetate (PVA), polyhydroxyethylmethacrylate (PHEMA), polytetrafluoroethylene (PTFE), HDPE (high-density polyethylene), polydimethylsiloxane (PDMS), polyurethane (PU), and/or poly (methyl methacrylate) (PMMA). The attachment agent(s) may be one or more biocompatible materials and may be adhesive prior to introduction into a body lumen and/or may be activated by moisture. Further, the regenerative agent may include an adhesive agent as

described above, and/or may be any agent now known or later developed for the treatment of the inner walls of a human body, such as the GI tract.

[0082] It will be apparent to those skilled in the art that various modifications and variations can be made to the disclosed device without departing from the scope of the disclosure. Other embodiments of the disclosure will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.

1. A medical dispensing device, comprising:

a catheter defining a lumen having a longitudinal axis and a distal opening; and

a plurality of patches disposed in the lumen, the plurality of patches being stacked along the longitudinal axis for dispersement, wherein each of the plurality of stacked patches comprises:

an adhesive layer; and

a non-adhesive layer proximal to the adhesive layer, wherein the non-adhesive layer extends across only a first portion of a proximal surface of the adhesive layer, exposing a second portion of the proximal surface of the adhesive layer.

2. The medical dispensing device of claim 1, wherein the exposed second portion of the proximal surface of each adhesive layer is attached to a distal surface of the adhesive layer of an adjacent, proximal patch from the plurality of stacked patches.

3. The medical dispensing device of claim 1, wherein the non-adhesive layer is configured to remain attached to the adhesive layer after the patch is dispensed from the catheter.

4. The medical dispensing device of claim 1, wherein a proximal surface of the non-adhesive layer of a distalmost patch is configured to contact a distal surface of the catheter external to the lumen.

5. The medical dispensing device of claim 1, further comprising a plunger disposed in the lumen and movable along the longitudinal axis to dispense the patches through the distal opening.

6. The medical dispensing device of claim 5, wherein the plunger is configured to dispense the patches one at a time by applying a distal force along the longitudinal axis.

7. The medical dispensing device of claim 6, wherein a proximalmost patch of the plurality of patches is attached to a distal surface of the plunger via the exposed second portion of its adhesive layer.

8. The medical dispensing device of claim 1, wherein a distal end of the catheter comprises an annular ring extending from a sidewall of the catheter toward the longitudinal axis, wherein a radial distance between an innermost surface of the annular ring and the longitudinal axis is less than a radial distance between the sidewall of the catheter and the longitudinal axis.

9. The medical dispensing device of claim 8, wherein a distal surface of a distalmost patch is configured to contact a proximal surface of the annular ring.

10. The medical dispensing device of claim 1, further comprising a plurality of spacers disposed between adjacent patches of the plurality of patches.

**11.** The medical dispensing device of claim **10**, wherein each spacer of the plurality of spacers is biodegradable or dimensioned for removal or natural excretion from a patient after patch deployment.

**12.** The medical dispensing device of claim **1**, wherein at least one adhesive layer of the plurality of patches comprises a therapeutic agent.

**13.** A medical dispensing device, comprising:

- a handle;
- a catheter extending distally from the handle;
- an applicator tip at a distal end of the catheter, the catheter and the applicator tip defining a lumen having a longitudinal axis and a distal opening; and
- a plurality of patches disposed in the lumen, the plurality of patches being stacked along the longitudinal axis for dispersement through the distal opening, wherein an adhesive layer of each patch is attached to the adhesive layer of an adjacent, distal patch of the plurality of stacked patches.

**14.** The medical dispensing device of claim **13**, wherein the adhesive layer of a proximalmost patch of the plurality of patches is attached to a plunger disposed in the lumen.

**15.** The medical dispensing device of claim **14**, further comprising a wire or a cable disposed in the lumen and connected to a proximal end of the plunger, the wire or the cable configured to move the plunger axially along the longitudinal axis.

**16.** The medical dispensing device of claim **13**, wherein a distal end of the catheter comprises an annular ring extending from a sidewall of the catheter toward the longitudinal axis, wherein a radial distance between an innermost surface of the annular ring and the longitudinal axis is less than a radial distance between the sidewall of the catheter and the longitudinal axis.

**17.** The medical dispensing device of claim **16**, wherein a distal surface of a distalmost patch of the plurality of patches is configured to contact a proximal surface of the annular ring until a force applied by a plunger of the medical dispensing device pushes the distalmost patch out of the distal opening.

**18.** The medical dispensing device of claim **13**, further comprising a plurality of spacers disposed between adjacent patches of the plurality of patches.

**19.** A medical dispensing device comprising:

- a catheter defining a lumen having a longitudinal axis and a distal opening; and
- a plurality of patches disposed in the lumen, the plurality of patches being stacked along the longitudinal axis for dispersement, wherein each of the plurality of stacked patches comprises an adhesive layer; and

a plurality of spacers disposed between adjacent patches of the plurality of patches.

**20.** The medical dispensing device of claim **19**, further comprising a plunger disposed in the lumen and movable along the longitudinal axis to dispense the patches through the distal opening, wherein the plunger is configured to dispense the patches one at a time by applying a distal force along the longitudinal axis.

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