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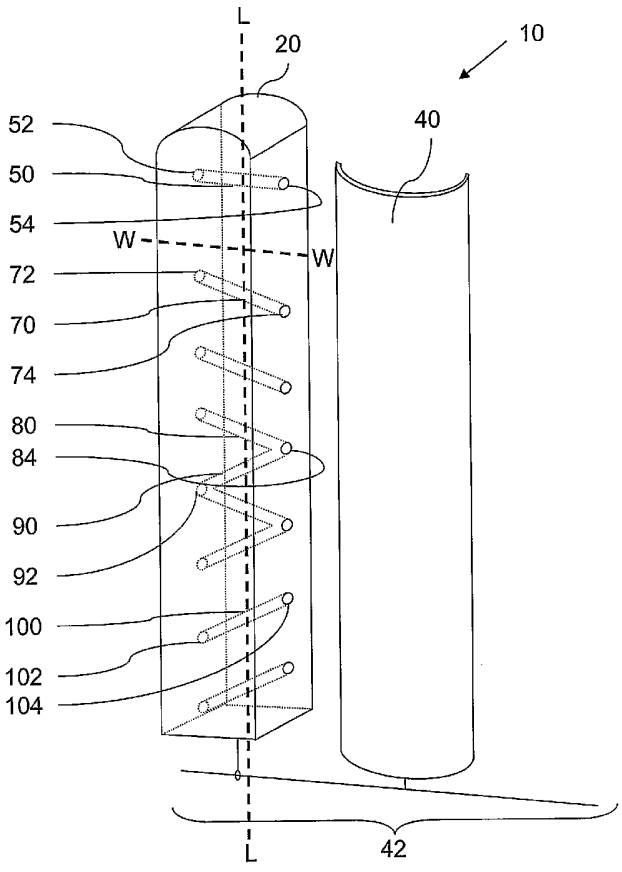
(54) Title: SUTURE GUIDE



(57) Abstract: A suture guide may include a tissue guard and a flanking post disposed to one side of the tissue guard. The flanking post may define a plurality of channels passing through its width. The channels may be so oriented that they define suture needle guide paths in one or more planes that do not intersect the tissue guard.

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SUTURE GUIDE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application No. 60/621,720, filed October 25, 2004, the entire content of which is hereby incorporated herein by reference.

BACKGROUND

[0002] Tendon rupture is a debilitating event that limits motion and can cause pain. Rupture can result from overexertion, trauma, and age-related degeneration, among other causes. Surgical repair of the ruptured tendon is typically required; tendinous tissue has poor wound-healing properties, and the torn ends of the tendon separate from one other due to contraction of the unrestrained muscle attached to one tendon end.

[0003] Surgical repair of a ruptured tendon is typically performed by putting one or more sutures through each torn end and then sewing the complementing sutures to one another, thereby winching the torn ends together and restoring the connected muscle to its normal resting length. Two risks of tendon repair include inadequate strength of the repair and potential soft tissue problems from surgical exposure. Accordingly, it would be best if a tendon could be repaired through a small incision but with a strong repair. With a small incision, the needles used to advance the sutures through the tendon may be advanced manually, without any guides, but this practice risks placing the sutures unevenly, so that the tendon's natural geometry and strength are not restored, and the repair is weak. One approach, described in U.S. Pat. No. 6,200,327 to Assal, provides a two-piece guide member with aligned channels in each piece. The aligned channels allow a user to advance a loaded needle horizontally through the tendon in a precise and repeatable fashion. However, the structure of the Assal device necessarily limits each suture to just one pass through the tendon; this results in a potentially weak stitch that provides a minimum of surface area for the suture to engage the tendon.

SUMMARY

[0004] The present disclosure describes the structure and use of various suture guides that facilitate the precise and reproducible placement of multiple passes of a suture through a tissue.

[0005] In an embodiment, a suture guide may include a tissue guard and a flanking post disposed to one side of the tissue guard. The flanking post may define a plurality of channels passing through its width. The channels may be so oriented that they define suture needle guide paths in one or more planes that do not intersect the tissue guard.

[0006] In an embodiment, a suture guide may include a tissue guard and a flanking post disposed to one side of the tissue guard. The flanking post may define a plurality of channels passing through its width. The channels may be so oriented that they define suture needle guide paths in one or more planes that do not intersect the tissue guard, and so that at least one channel is not perpendicular to the long axis of the flanking post, so that it defines an oblique suture needle guide path.

[0007] In an embodiment, a method of suturing a tissue may include positioning a suture guide disclosed herein against a tissue to be sutured, so that the tissue guard overlies or supports the tissue and the flanking post flanks a first side of the tissue. A first needle, with a first suture attached, may be advanced through a needle guide path in the post and then the tissue, so that ends of the first suture emerge from the first side and a second side of the tissue. A second needle, with a second suture attached, may be advanced through a needle guide path in the post and then the tissue, forming a needle track, so that ends of the second suture emerge from the first side and the second side of the tissue. The sutures may be detached from their respective needles. The first suture may be attached to the end of the second suture that is on the second side of the tissue. The second suture may be retracted through the needle track, thereby pulling the first suture through the needle track and disposing its end on the first side of the tissue.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] **FIGS. 1-5, 11-13,** and **16** show perspective views of various exemplary embodiments of suture guides.

[0009] **FIGS. 6-8** show top plan views of exemplary embodiments of suture guides.

[0010] **FIGS. 9-10** and **14-15** show side elevation views of exemplary embodiments of suture guides.

[0011] **FIGS. 17-17A** show perspective and elevation views, respectively, of another exemplary embodiment of a suture guide.

[0012] **FIGS. 18-32** depict exemplary uses of an embodiment of a suture guide.

DETAILED DESCRIPTION

[0013] The suture guides disclosed herein provide suture needle guide paths that assist a surgeon or other user in positioning stitches in a precise and reproducible way. In particular, the disclosed suture guides include needle guide paths that allow the user to create multiple passes of a stitch through a tissue, which are stronger than a single pass.

[0014] **FIG. 1** shows one exemplary embodiment of a suture guide **10**. In this embodiment, the suture guide includes a tissue guard **40** and a flanking post **20**. In the depicted embodiment, the tissue guard has a concave shape, and the concavity faces toward the back of the device. This shape can facilitate a snug contact between the guard and an underlying convex tissue. The guard may various degrees of concavity, from, for example, about 120 degrees of arc to about 180 degrees of arc. The guard may also have other shapes, including a flat plate, rounded corners, squared-off corners, v-shaped, and others. The free end of the guard (the tip) may be curved, tapered, rounded, and/or thinned, akin to the blades of a vaginal speculum, to facilitate sliding along tissue.

[0015] The flanking post is disposed to one side of the tissue guard. The post defines a plurality of channels **50, 70, 80**, etc. that extend through the post's width, from external orifices **52, 72, 92**, etc. to internal orifices **54, 74, 84**, etc. The channels are positioned so that a needle passing through one of the channels will move in a plane that does not intersect the tissue guard. This detail is shown more clearly in **FIGS. 6-10**. When the device is positioned on a tissue, the needles will then pass through the tissue behind (**FIG. 4**) or in front (**FIG. 5**) of the guard without being obstructed by the guard. "Behind" and "front" in this sense refer to the guard as viewed in the figures. When a suture guide is positioned for an Achilles tendon repair, for example, the needles will pass anterior or posterior to the tissue guard, where "anterior" and "posterior" are defined with respect to the patient's anatomy.

[0016] One or more of the channels may be parallel to the width of the flanking post, *i.e.*, parallel to an axis **W** through the width of the post, to ensure that a needle passing through them will not intersect the tissue guard. However, one or more channels can be oriented non-parallel so that sutures passing through the tissue are in different planes and do not interfere with one another. The non-parallel channel should be so angled that its axis does not intersect the tissue guard. **FIG. 7** shows one exemplary embodiment having non-parallel channels **56, 58**.

[0017] One or more of the channels, exemplified here as channel **50**, may be perpendicular to the long axis **L** of the flanking post in addition to being parallel to the post's width. This

channel can define a horizontal suture needle guide path. (The path does not appear horizontal in the drawing due to the perspective.) At least one other channel, such as channel **70**, is not perpendicular to the post's long axis, although it is still parallel to the width. This channel defines an oblique suture needle guide path. Some of the oblique channels may run in a first non-perpendicular direction, such as channels **70** and **80**, while other oblique channel may run in a second non-perpendicular direction different fro the first direction, such as channels **90** and **100**. Adjacent oblique channels running in different directions can share a common orifice, such as orifice **84** shared by channels **80** and **90**. It should be noted that the depicted post embodiment defines nine channels, but alternative embodiments may have more or fewer channels in accordance with particular applications.

[0018] In this embodiment, the post and the tissue guard are connected to one another by a rod **42**. The guard can be affixed to the connector, while the post can be clampable and repositionable. For example, the post could be clamped in the illustrated position during part of a suturing procedure, then moved to the other side of the rod during another part of the procedure. A sliding arrangement can also allow the post to be positioned an appropriate distance from the tissue guard for a given tissue size or to accommodate the local anatomy.

[0019] FIG. 2 shows another embodiment of a suture guide similar to the embodiment of **FIG. 1**, except that instead of a connecting rod, the guide has a shaft **44** to which the post is rotatably mounted by arm **46**. The post can rotate about the shaft and thereby swing from one side of the guard to the other side. The post and/or shaft can include a mechanism to help ensure that the post is rotated into an appropriate position, *i.e.*, one in which the tissue guard will not obstruct needles passing through the channels. Examples of appropriate mechanisms include a paired notch and detent, a stop, a clasp, a clamp, and alignment markings on the post and/or shaft to guide the user. The tissue guard may also be rotatable about the shaft, so that it can be swiveled between an anterior position and a posterior position.

[0020] FIG. 3 shows yet another embodiment of a suture guide which includes a second flanking post **30** disposed to the side of the guard opposite from that of the first flanking post. The second flanking post, as illustrated, is a mirror image of the first post and includes a plurality of channels that complement the channels of the first post. It is preferred that the channels are so aligned that a needle passing through a channel in the first post will glide smoothly into a similarly-directed channel in the second post. An example

of this is shown in **FIGS. 20-21**. In the embodiment depicted in **FIG. 3**, the posts are connected to the guard by a base **45**. The base, guard, and post or posts can be of unitary construction. Alternatively, the parts could be connected by an adjustable connecter as described earlier, such as a rod/clamp, or a bolt/screw arrangement, so that the posts may be positioned on either side of the guard in the optimal positions for a given use.

[0021] The disclosed suture guides can also be so positioned that the tissue guard supports tissue rather than covers it. This can be done by turning the device over and slipping the guard behind the tissue to be sutured. The guard would help hold the tissue to be sutured away from surrounding tissue and would also protect tissue deep to the tissue to be sutured.

[0022] FIGS. 6-10 show additional views of various suture guide embodiments to depict certain features more clearly. **FIG. 6** is a transverse cross section of the **FIG. 3** embodiment taken at the level of channel **50** and projected upward. Width axis **W** and long axis **L** are depicted. Tissue guard **40** is positioned so that the suture needle guide paths are situated in one or more planes behind the guard, so that needles advanced through those paths will enter tissue held behind the guard during use. The guard does not extend so far back as to block the needle path planes, as this would interfere with suturing. However, as shown in **FIG. 8**, the guard may extend backward just up to the foremost guide plane, so that the edge of the guard may further assist needle **N** guidance. **FIG. 8** also shows an alternative embodiment of guard **40**, in which the edges of the guard define grooves **48** that may be used to slide suture catches up and down the guard. This feature will be described in more detail with reference to **FIG. 19**. **FIGS. 9-10** show side view of suture guides. **FIG. 10**, in particular, shows a suture guide with handle **110** to simplify the grip and positioning of the device.

[0023] FIGS. 11-15 show alternative embodiments of suture guides that include additional protuberances on the guard. The guard depicted in **FIG. 11** includes catch receptacles **120** and **130**. These protuberances prevent suture catches that are slid along the guard from advancing beyond the guard and potentially damaging tissue beyond the guard. In some embodiments, a guard may include a protuberance **140** disposed along the guard. A complementary guard on the other side of the guard is not visible in this perspective view, but is better seen as protuberance **150** in **FIG. 15**. The protuberances **140** and **150** help hold away body structures that are deeper than the tissue being sutured, to prevent the suture catch from inadvertently contacting the deep structure, and also to keep the deep structure away from the suture needle guide paths.

[0024] It is preferred that the mid-guard protuberances be so positioned that they do not cross the suture needle guide paths, so that they do not interfere with use of the device. It is also preferred that the mid-guard protuberances do not interfere with the movement of suture catches along the tissue guard. In some cases, as shown in **FIG. 12**, the protuberance **140′** can be shaped so that its body is clear of the guard and suture catch **180** (discussed in more detail with reference to **FIG. 19**) can pass unimpeded. **FIG. 13** shows detail of an alternate embodiment, in which the catch receptacles **120′** and **130′** are larger than the previous embodiment. The receptacles should be blunt, not sharp, so that they do not poke surrounding tissue. **FIGS. 14** and **15** show side views of embodiments that include catch receptacles and/or mid-guard protuberances. (Note that, as shown in **FIGS. 14-15**, the sides of the tissue guard need not extend into the space between the posts as they do in **FIGS. 6-7**.)

[0025] **FIG. 16** shows another embodiment in which the guard **40′** is tapered along its length. The guard may gradually narrow as it approaches the guide base. This tapered shape may be preferred when the device is used to suture a tendon or other tissue which itself has a tapered shape.

[0026] The suture guide can be formed from a variety of materials, including metals and plastics. A disposable, single-use device can be made from plastic and have a unitary design, so that it could be made by injection molding. A sterilizable, reusable device can be made from metal, such as stainless steel or other metals typically used in surgical applications.

[0027] **FIGS, 17-17A** depict another embodiment of a suture guide, which includes a second tissue guard **41** pivotably coupled to the other tissue guard by hinges **42**. The hinges may be lockable by, for example, a ratchet or a screw (not shown). The tips of the blades may be adapted for sliding along tissue, as disclosed above. The two guards permit simultaneous protection of tissues above and below the tissue being sutured using the suture guide. To position the double-guard device, the guards are swung to an open position, and the device is slid over the tissue like a sleeve. The guards can then be swung against the tissue and tightened, if desired.

EXAMPLES

[0028] **FIGS. 18-32** describe, step-by-step, exemplary uses of suture guides. These examples depict the use of a suture guide having two posts, but the depicted uses can also be accomplished using a one-post suture guide, in which the device is flipped over, or the

post repositioned, when maneuvers involving the second post are called for. These figures are schematic representations and are not necessarily depicted to scale; rather, they illustrate the principles of use. The end result of the exemplary uses is to have a suture threaded through the tissue in a crisscross pattern.

[0029] **FIG. 18** shows the starting condition for an exemplary suturing procedure. The suture guide is placed over a tissue **T** to be sutured so that the guard covers the tissue and the flanking posts lie on either side of the tissue. (In another embodiment, a device could be turned over, so that the tissue guard supports the tissue.) A first needle **160** is advanced through the horizontal channel **50**, emerges into the space between the posts, and then enters the tissue. The horizontal channel positions the needle for a horizontal trajectory through the tissue. The needle may have a sharp tip **162** to facilitate clean entry of the needle into the tissue. As the needle passes through the tissue, it forms a horizontal needle track. The needle **160** is loaded with a first suture **170**; the suture is drawn through the horizontal track. Once the needle emerges on the far side of the tissue, the first suture is accessible on the second side of the tissue. (In alternate embodiments, the horizontal channel might not be used or might be omitted from the device.)

[0030] Next, shown in **FIG. 19**, a suture catch **180** may be advanced up through the guard. The catch may be guided up the suture through a groove, such as groove **48** (**FIG. 8**). The catch may have a hook **182** or similar structure to catch a suture. The hook may be curved to various extents. The hooks shown are curved through about 180 degrees, but hooks may be curved less, such as about 120 degrees, or may be curved more, such as through about 270 degrees, about 300 degrees, about 330 degrees, about 350 degrees, or about 360 degrees, so that the hook more resembles an eye or a loop. The hook is maneuvered to catch the suture (or may have been already placed in position before the passage of the first suture in **FIG. 18**), and then the catch is pulled down through the guard, taking the first suture with it. The catch may then be advanced again up through the guard to be in position for the next suture.

[0031] In **FIG. 20**, a second needle **190** is advanced through one of the oblique guide paths of the first post, into the tissue, out the far side of the tissue, and, optionally, into the corresponding channel in the second post. This motion forms an oblique track through the tissue. As shown in **FIG. 21**, a second suture **200** is attached to the back of the second needle. The second suture has a catch on its front end, such as a loop **202**, and the second suture may be attached to the second needle by another loop **194** attached to the back of the

needle. Once the front end of the second suture **200** emerges on the far side of the tissue, it is detached from the second needle, hooked by the suture catch **180** (**FIG. 19**), and brought down through the guard. The back end of the second suture protrudes from the first side of the tissue so that it can be grasped later. Next, shown in **FIG. 22**, the first suture **170** is threaded through the catch **202** on the second suture. In some embodiments, the catch could be tightened like a noose to grasp the first suture. Alternatively, the first and second sutures could be knotted or otherwise bonded. The back end of the second suture is then pulled so that the second suture is retracted back through the oblique track and pulls the first suture along with it. **FIG. 23** shows the end of this step, with the first suture now making one horizontal pass through the tissue and one oblique pass. The distance between the exit point of the horizontal pass and the entry point of the oblique pass may vary; it is exaggerated in the drawing to show detail. In practice, such as during a repair of the Achilles tendon, the separation between the exit and entry points may be in the range of about 6 millimeters to about 26 millimeters. The separation can vary depending on factors such as the size or consistency of the tissue to be sutured (for example, other tendons or other tissue types), the location or extent of the rupture, or the particular anatomy of the subject. The separation distance can be controlled, for example, by providing several suture needle guide paths from among which the user can select, or by instructing the user to reposition the suture guide.

[0032] **FIG. 24** shows the next step. The second needle is reloaded with the second suture or another suture. Alternatively, a third needle, with its own suture is provided. This needle **190′** is advanced in an oblique channel from the other side of the tissue. If the suture guide has two posts, this channel would be in the second post. If the guide has one post, that post would be moved to the other side. This needle is advanced all the way through the tissue (**FIG. 25**), thereby forming a second oblique needle track, and brings its suture **200′** out to the first side of the tissue. The suture **200′** is detached from the needle by cutting link **194′**. A suture catch is advanced along the guard to hook the suture and bring its catch **202′** down, and, as shown in **FIG. 26**, the first suture **170** is threaded through it, as before. The suture **200′** is then backed out through the second oblique needle track, pulling the first suture **170** with it. **FIG. 27** shows the state of the procedure at this point: the first suture **170** has now made three passes through the tissue.

[0033] The process may be repeated one or more times to give the suture additional oblique passes through the tissue. **FIG. 28** shows the conditional after one additional oblique pass is

formed. The dangling end of the first suture **170** may be pulled into the space between the first post and the guard using a catch **180**, and the entire procedure repeated, so that both ends of the first suture are stitched through the tissue in a crisscross pattern. The end result of this procedure is shown in **FIG. 29**. Alternatively, or in addition, a second suture **210**, shown in **FIG. 30**, can be introduced through a channel in the second post (or relocated single post) and stitched through the tissue in mirror image to the first suture **170**. As many additional sutures as desired can be placed in the tissue in this manner.

[0034] The entire process may then performed on the other end of the ruptured tissue, as shown in **FIG. 31**. In some embodiments, sutures could be passed through the other ruptured tissue end using conventional techniques. The free ends of sutures placed in each tissue end are pulled together and tied, as shown in **FIG. 32**, thereby completing the tissue repair.

[0035] Exemplary uses of the disclosed suture guides include Achilles tendon repair, anterior tibial tendon repair, repair of extensor tendons, flexor tendons to the fingers, tendons of the arm as well as other tendons and other tissue types.

I claim:

1. A suture guide, comprising:

a tissue guard; and

a flanking post disposed to one side of the tissue guard, the flanking post defining a plurality of channels passing through its width, the channels so oriented that:

a) the channels define suture needle guide paths in one or more planes that do not intersect the tissue guard; and

b) at least one channel is not perpendicular to a long axis of the flanking post, so that it defines an oblique suture needle guide path.

2. The suture guide of claim 1, further comprising a base from which the flanking post and the tissue guard extend, so that the post and guard are fixed in relation to one another.

3. The suture guide of claim 1, further comprising a shaft to which the guard and post are so coupled as to make the post and the guard rotatable with respect to one another.

4. The suture guide of claim 1, wherein the post and the guard are attached to one another through a connecter so adjustable as to control the spacing between the post and the guard.

5. The suture guide of claim 1, 2, 3, or 4, wherein the guard has a concave shape, and the concavity faces the suture needle guide paths.

6. The suture guide of claim 5, wherein the edges of the guard concavity extend backward to, but not into, the forward-most suture needle guide plane.

7. The suture guide of claim 1, 2, 3, 4, or 6, wherein the guard has a cylindrical arc shape.

8. The suture guide of claim 1, 2, 3, 4, or 6, wherein the guard tapers along its length.

9. The suture guide of claim 1, 2, 3, 4, or 6, wherein the flanking post defines at least two non-perpendicular channels that share a common orifice.

10. The suture guide of claim 1, 2, 3, 4, or 6, wherein the flanking post defines at least one channel oriented in a first direction not perpendicular to the long axis of the flanking post, and at least one additional channel oriented in a second direction, different from the first direction, not perpendicular to the long axis of the flanking post.

11. The suture guide of claim 1, 2, 3, 4, or 6, wherein at least one channel of the flanking post is perpendicular to the long axis of the flanking post so that it defines a horizontal suture needle guide path.

12. The suture guide of claim 11, wherein the flanking post defines at most one perpendicular channel.

13. The suture guide of claim 1, 2, 3, 4, or 6, wherein the flanking post defines at least three non-perpendicular channels.

14. The suture guide of claim 1, 2, 3, 4, or 6, wherein all channels defined by the flanking post are not perpendicular to the long axis of the flanking post.

15. The suture guide of claim 1, 2, 3, 4, or 6, wherein at least one channel of the flanking post is parallel to the width of the flanking post.

16. The suture guide of claim 1, 2, 3, 4, or 6, wherein the channels of the flanking post are parallel to the width of the flanking post.

17. The suture guide of claim 1, 2, 3, 4, or 6, wherein the at least one channel of the flanking post is non-parallel to the width of the flanking post.

18. The suture guide of claim 1, 2, 3, 4, or 6, further comprising a second flanking post disposed to the side of the guard opposite from that of the first flanking post, each flanking post defining a plurality of channels passing through its width, the channels so oriented that:

a) the channels define suture needle guide paths in one or more planes that do not intersect the tissue guard; and

b) at least one channel is not perpendicular to the long axis of the flanking post so that it defines an oblique suture needle guide path.

19. The suture guide of claim 18, wherein the channels of the two flanking posts are so aligned that one non-perpendicular channel from each of the first and second flanking posts are coaxial and together define an oblique suture needle guide path through the first post and the second post.

20. The suture guide of claim 18, wherein at least one channel of each flanking post is perpendicular to the long axis of the flanking post so that it defines a horizontal suture needle guide path.

21. The suture guide of claim 20, wherein each post defines at most one perpendicular channel.

22. The suture guide of claim 21, wherein each post defines at least two non-perpendicular channels.

23. The suture guide of claim 18, wherein each post defines at least two non-perpendicular channels.

24. The suture guide of claim 18, further comprising a base from which the two flanking posts and the tissue guard extend, so that the two posts and the guard are fixed in relation to one another.

25. A suture guide, comprising:

a tissue guard; and

two flanking posts disposed to opposite sides of the tissue guard, each flanking post defining a plurality of channels passing through its width, the channels so oriented that they define suture needle guide paths in one or more planes that do not intersect the tissue guard.

26. A suture guide, comprising:

a tissue guard; and

a flanking post disposed to one side of the tissue guard, the flanking post defining a plurality of channels passing through its width, the channels so oriented that the channels define suture needle guide paths in one or more planes that do not intersect the tissue guard.

27. A suture guide, comprising:

a tissue guard; and

a flanking post disposed to one side of the tissue guard, the flanking post defining a plurality of channels passing through its width, the channels so oriented that:

a) the channels define suture needle guide paths in one or more planes that do not intersect the tissue guard; and

b) at least one channel is perpendicular to the long axis of the flanking post, so that it defines a horizontal suture needle guide path.

28. The suture guide of claim 27, wherein all channels defined by the flanking post are perpendicular to the long axis of the flanking post.

29. The suture guide of claim 1, further comprising a second tissue guard attached by a hinge to the first tissue guard.

30. A method of suturing a tissue, comprising:

positioning a suture guide as defined by claim 1 against a tissue to be sutured, so that the tissue guard overlies or supports the tissue and the flanking post flanks a first side of the tissue;

advancing a first needle, with a first suture connected thereto, through a needle guide path in the post and then the tissue, so that ends of the first suture emerge from the first side and a second side of the tissue;

advancing a second needle, with a second suture connected thereto, through a needle guide path in the post and then the tissue, forming a needle track, so that ends of the second suture emerge from the first side and the second side of the tissue;

detaching the sutures from their respective needles;

attaching the first suture to the end of the second suture that is on the second side of the tissue; and

retracting the second suture through the needle track, thereby pulling the first suture through the needle track and disposing its end on the first side of the tissue.

31. The method of claim 30, further comprising repeating the steps using a second set of first and second needles with respective sutures attached thereto.

32. A method of suturing a tissue, comprising:

positioning a suture guide as defined by claim 1 on a tissue to be sutured, so that the tissue guard overlies or supports the tissue and the flanking post flanks a first side of the tissue;

advancing a first needle, with a first suture connected thereto, through the horizontal needle guide path and then the tissue, forming a horizontal track, so that an end of the first suture emerges on a second side of the tissue;

advancing a second needle, with a second suture connected thereto, through the oblique needle guide path and then the tissue, forming an oblique needle track, so that ends of the second suture emerge from the first side and the second side of the tissue;

detaching the sutures from their respective needles;

attaching the first suture to the end of the second suture that is on the second side of the tissue; and

retracting the second suture through the oblique needle track, thereby pulling the first suture through the oblique needle track and disposing its end on the first side of the tissue.

33. The method of claim 32, wherein the suture guide further comprises a shaft to which the guard and post are so coupled as to make the post rotatable about the long axis of the guard, and the method further comprises:

rotating the flanking post so that it lies on the side of the guard opposite from its original position; and

advancing the second needle or a third needle, with the second suture or a third suture connected thereto, through an oblique needle guide in the flanking post and then the tissue, thereby creating a second oblique track, so that ends of the second suture emerge from the first side and the second side of the tissue;

attaching the first suture to the end of the second or third suture that is on the first side of the tissue; and

retracting the second or third suture through the second oblique needle track, thereby pulling the first suture through the second oblique needle track and disposing its end on the second side of the tissue.

34. The method of claim 32, wherein the suture guide further comprises a second flanking post as set forth in claim 18, and the method further comprises:

positioning the second flanking post so that it flanks the second side of the tissue;

advancing the second needle or a third needle, with the second suture or a third suture connected thereto, through an oblique needle guide in the second flanking post and then the tissue, thereby creating a second oblique track, so that ends of the second suture emerge from the first side and the second side of the tissue;

attaching the first suture to the end of the second or third suture that is on the first side of the tissue; and

retracting the second or third suture through the second oblique needle track, thereby pulling the first suture through the second oblique needle track and disposing its end on the second side of the tissue.

35. The method of claim 32, further comprising:

advancing the first needle or a third needle, with a third suture connected thereto, through the horizontal needle guide path and then the tissue, forming a horizontal track, so that an end of the third suture emerges on the first side of the tissue;

advancing the second needle or a fourth needle, with the second suture or a fourth suture connected thereto, through an oblique needle guide path and then the tissue, forming an oblique needle track, so that ends of the second suture emerge from the first side and the second side of the tissue;

detaching the sutures from their respective needles;

attaching the third suture to the end of the second suture that is on the first side of the tissue; and

retracting the second suture through the oblique needle track, thereby pulling the third suture through the oblique needle track and disposing its end on the second side of the tissue.

36. The method of claim 32, further comprising repeating the steps using a second set of first and second needles with respective sutures attached thereto.

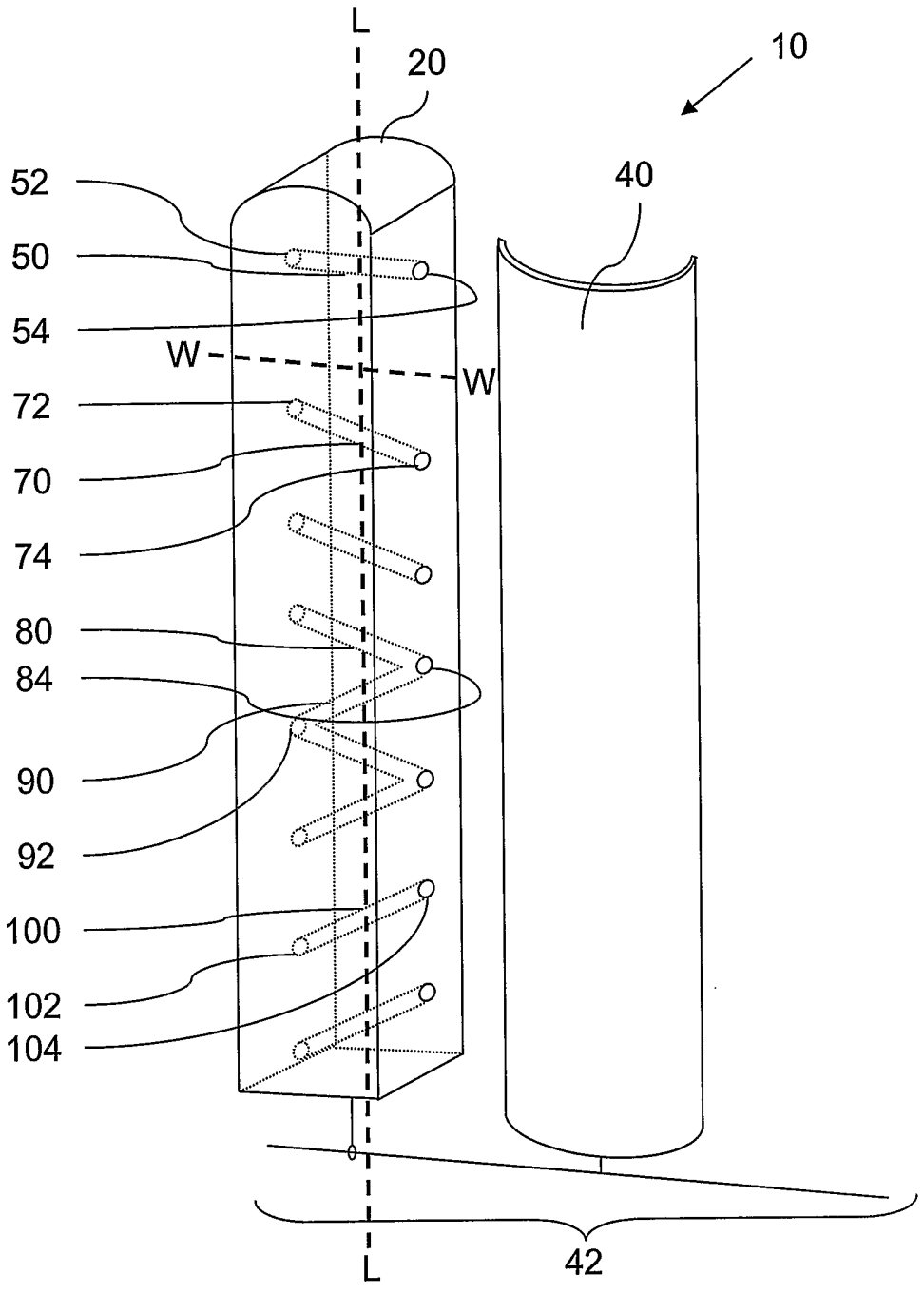

FIG. 1

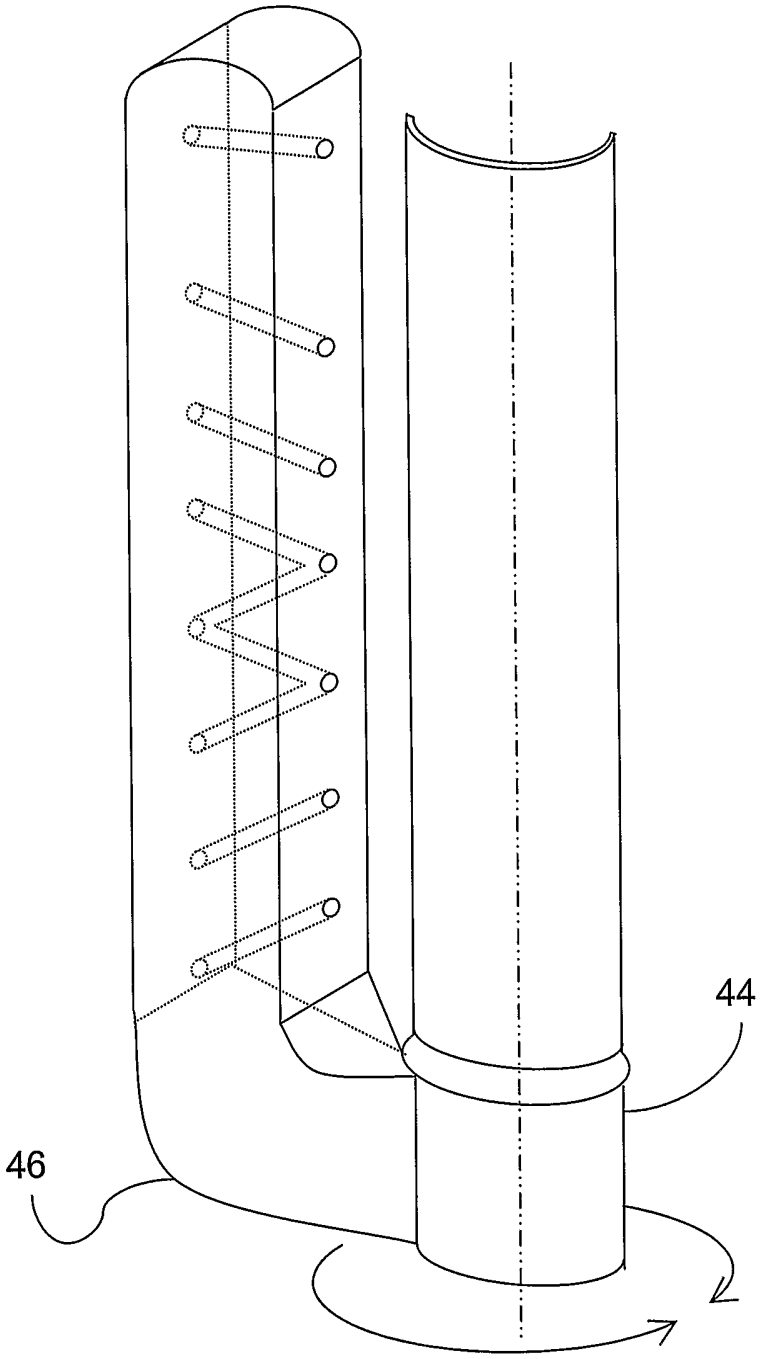

FIG. 2

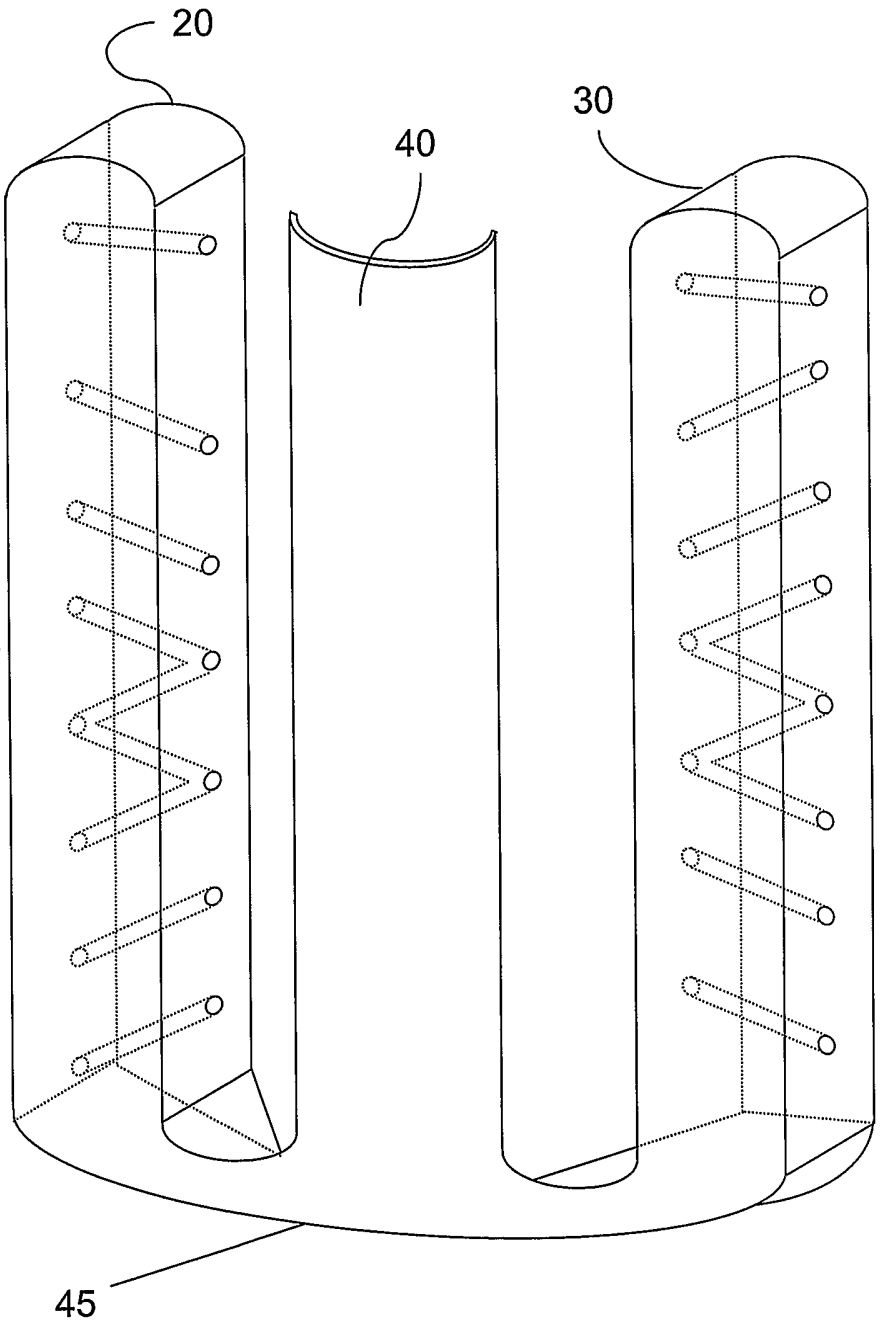

FIG. 3

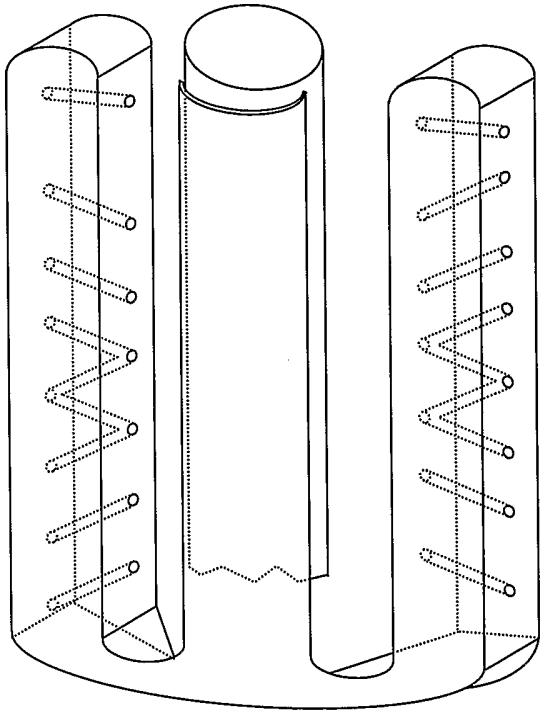

FIG. 4

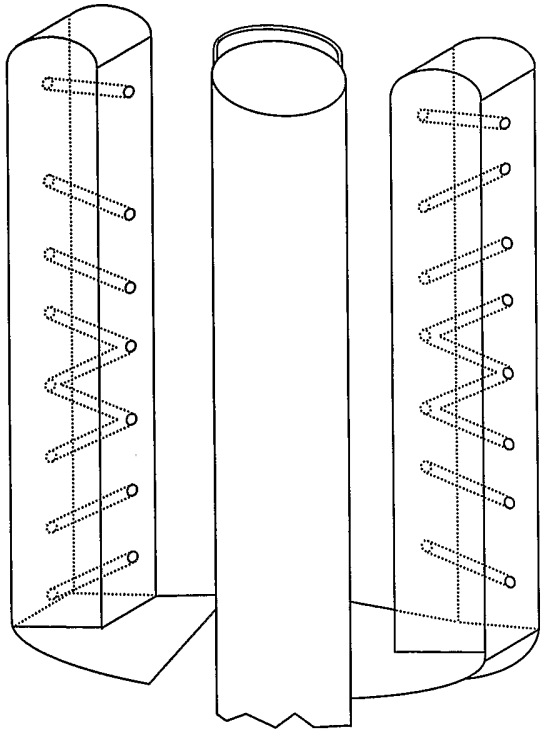

FIG. 5

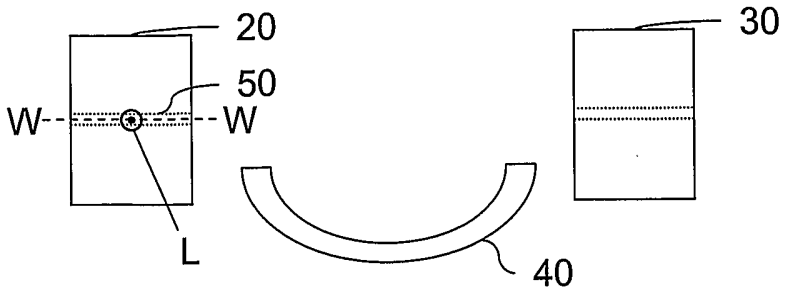

FIG. 6

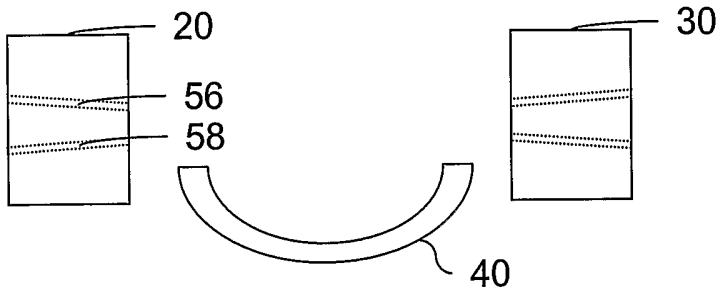

FIG. 7

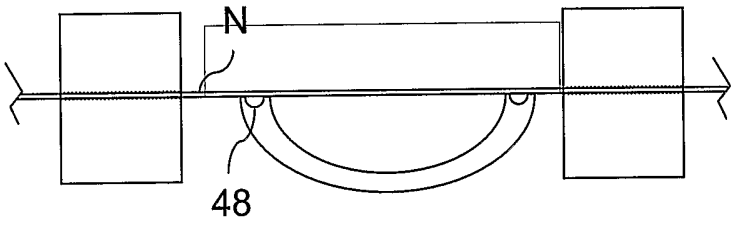

FIG. 8

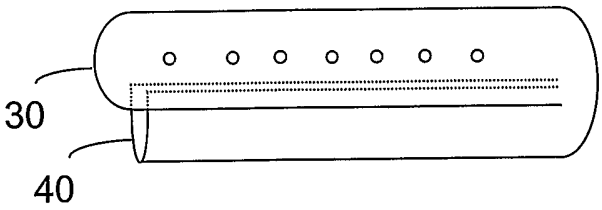

FIG. 9

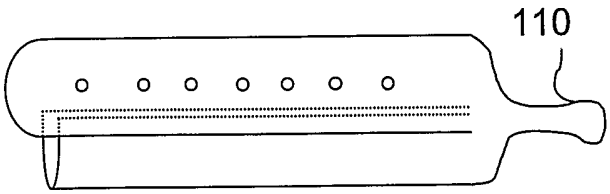

FIG. 10

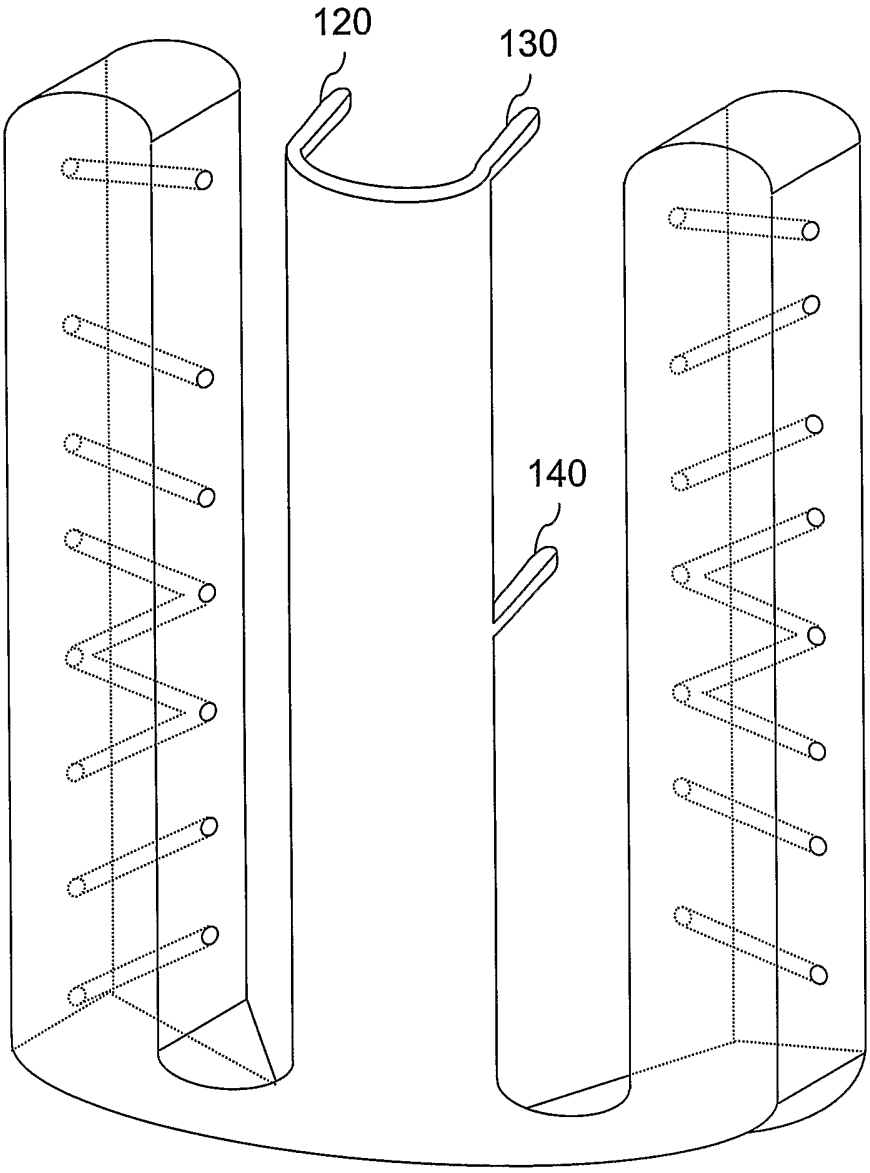

FIG. 11

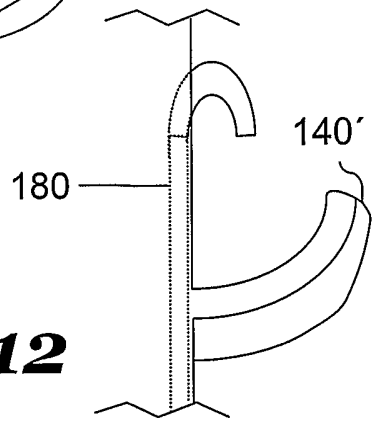

FIG. 12

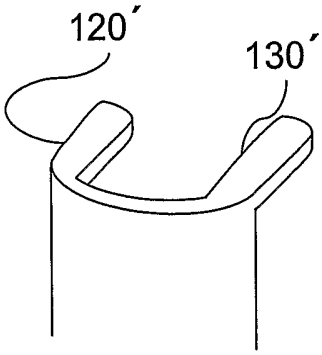

FIG. 13

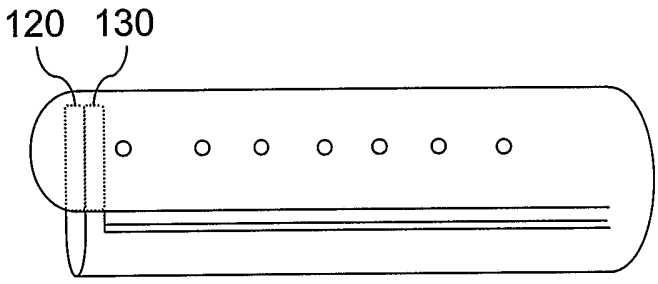

FIG. 14

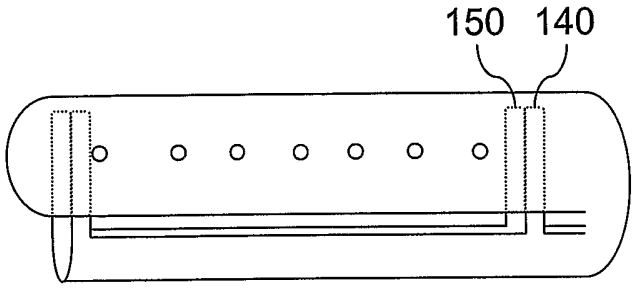

FIG. 15

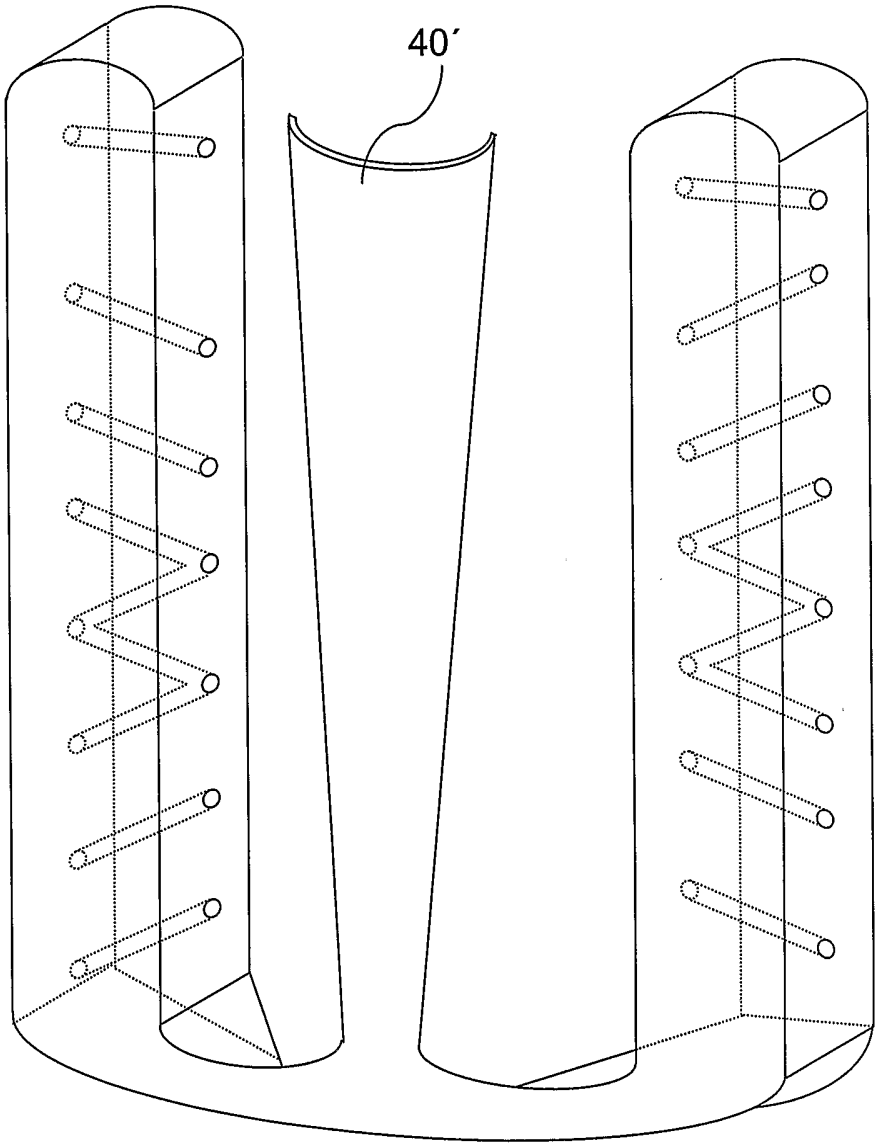

FIG. 16

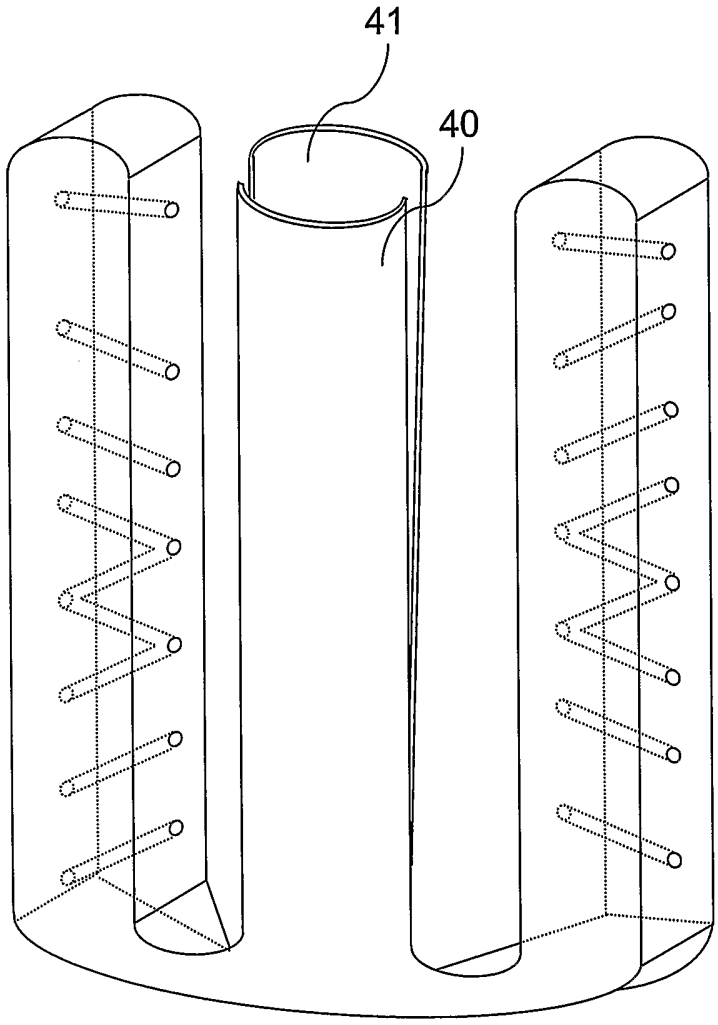

FIG. 17

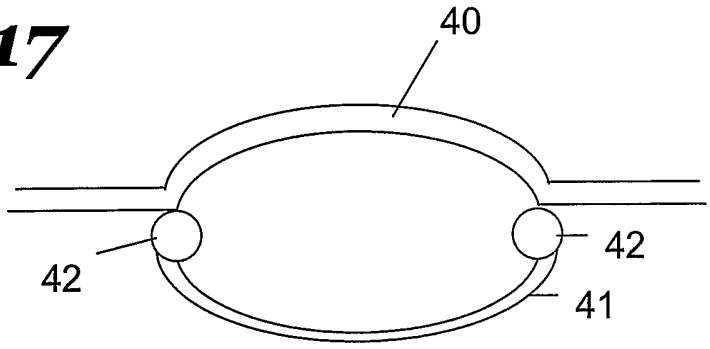

FIG. 17A

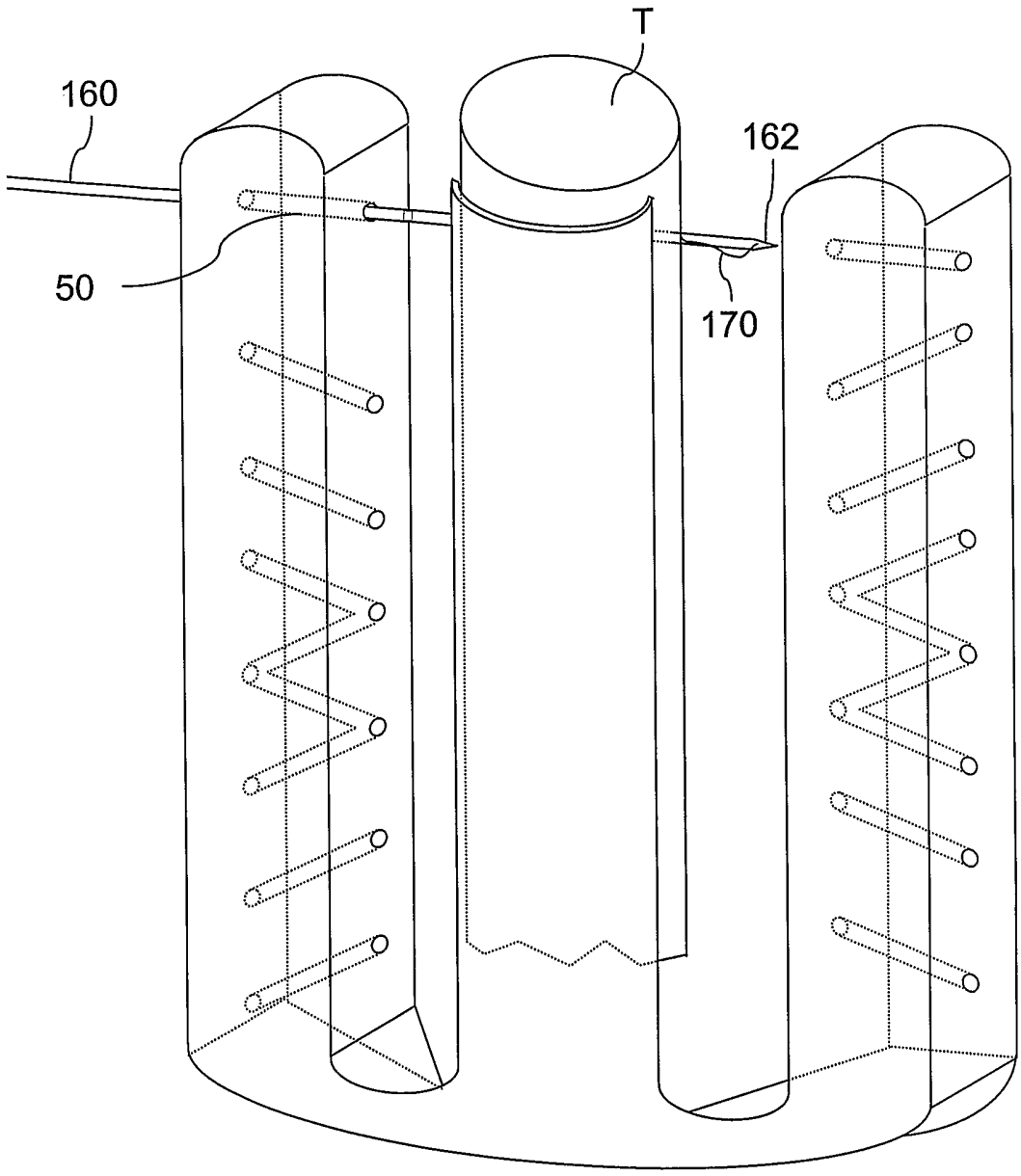

FIG. 18

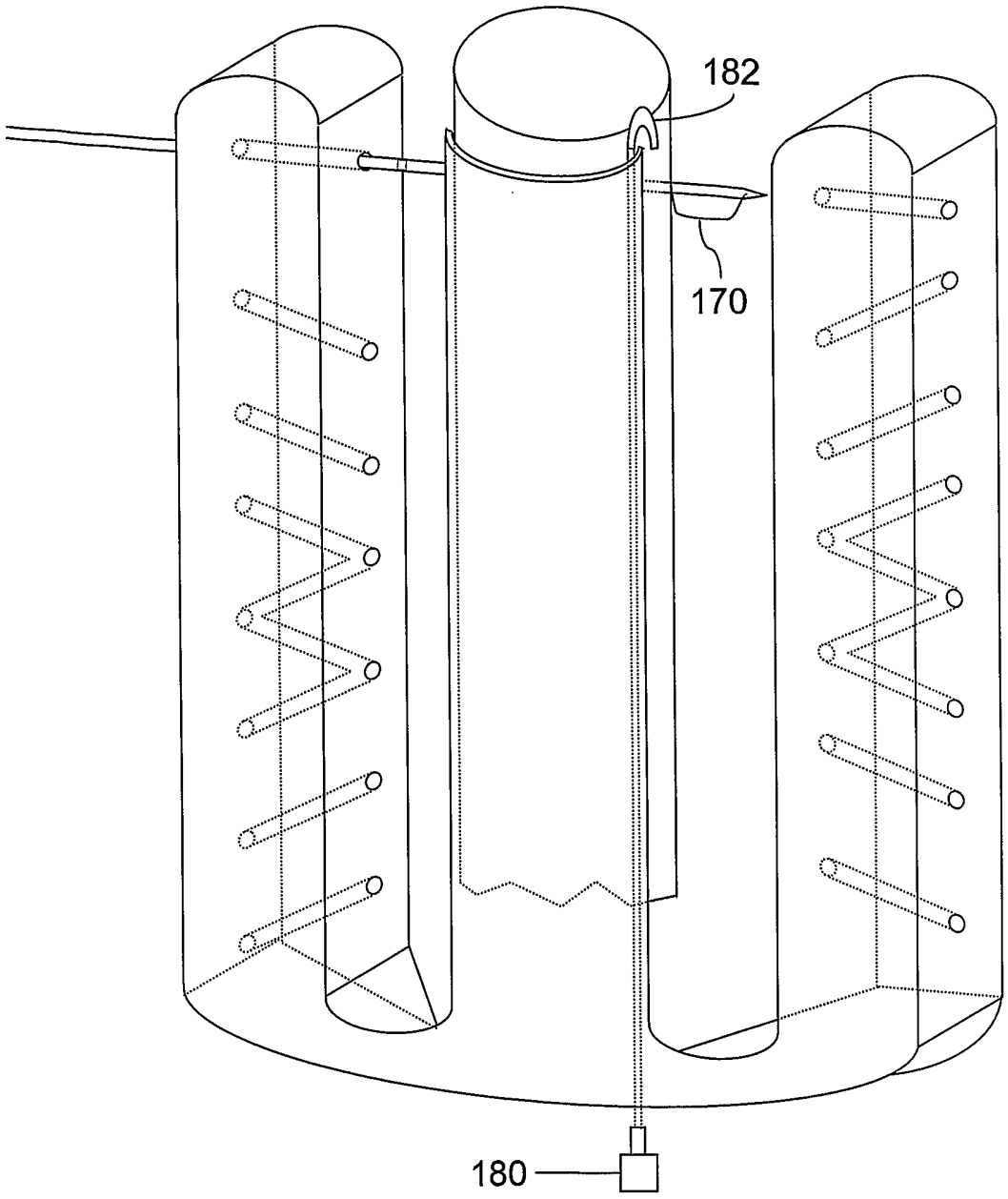

FIG. 19

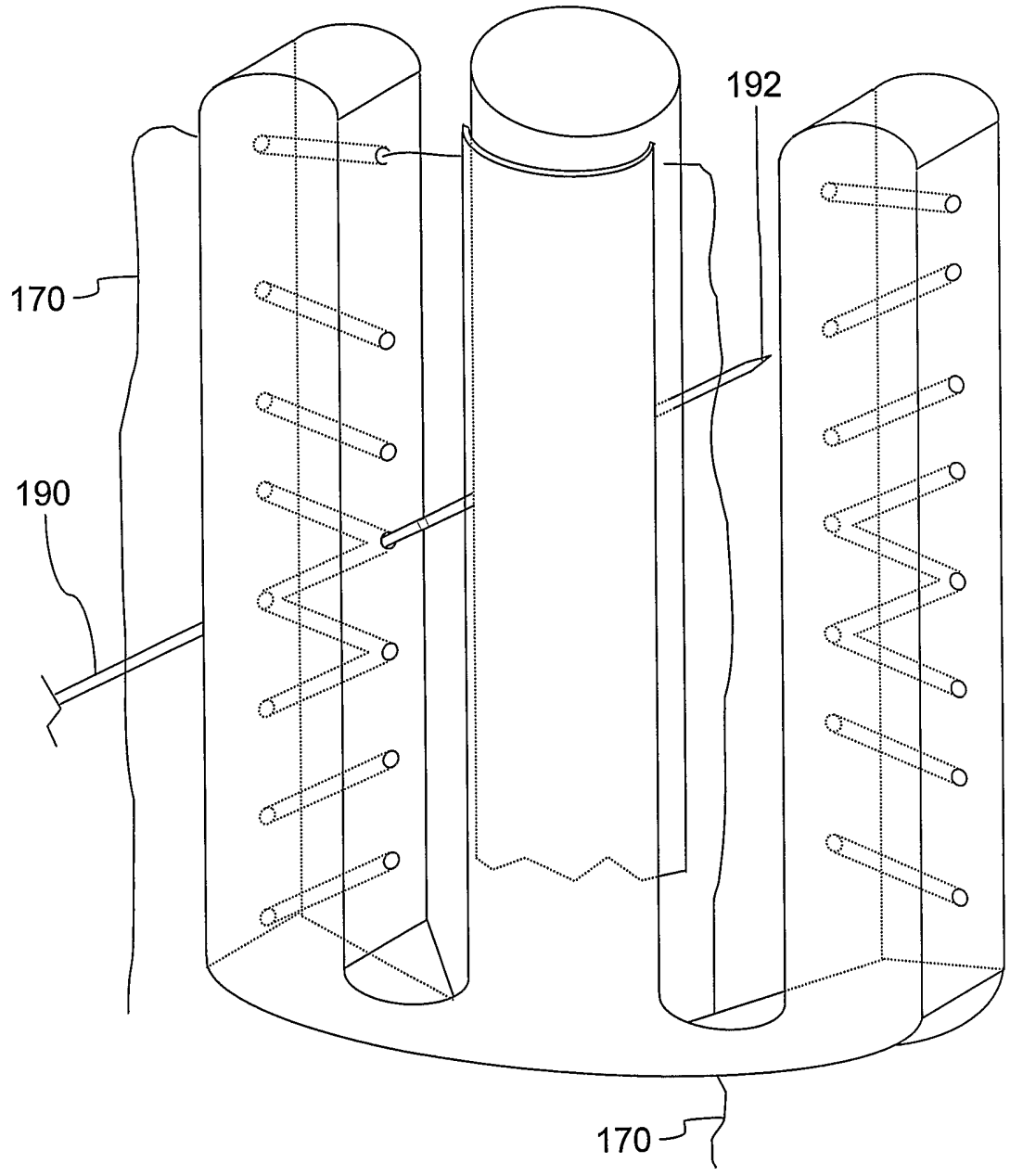

FIG. 20

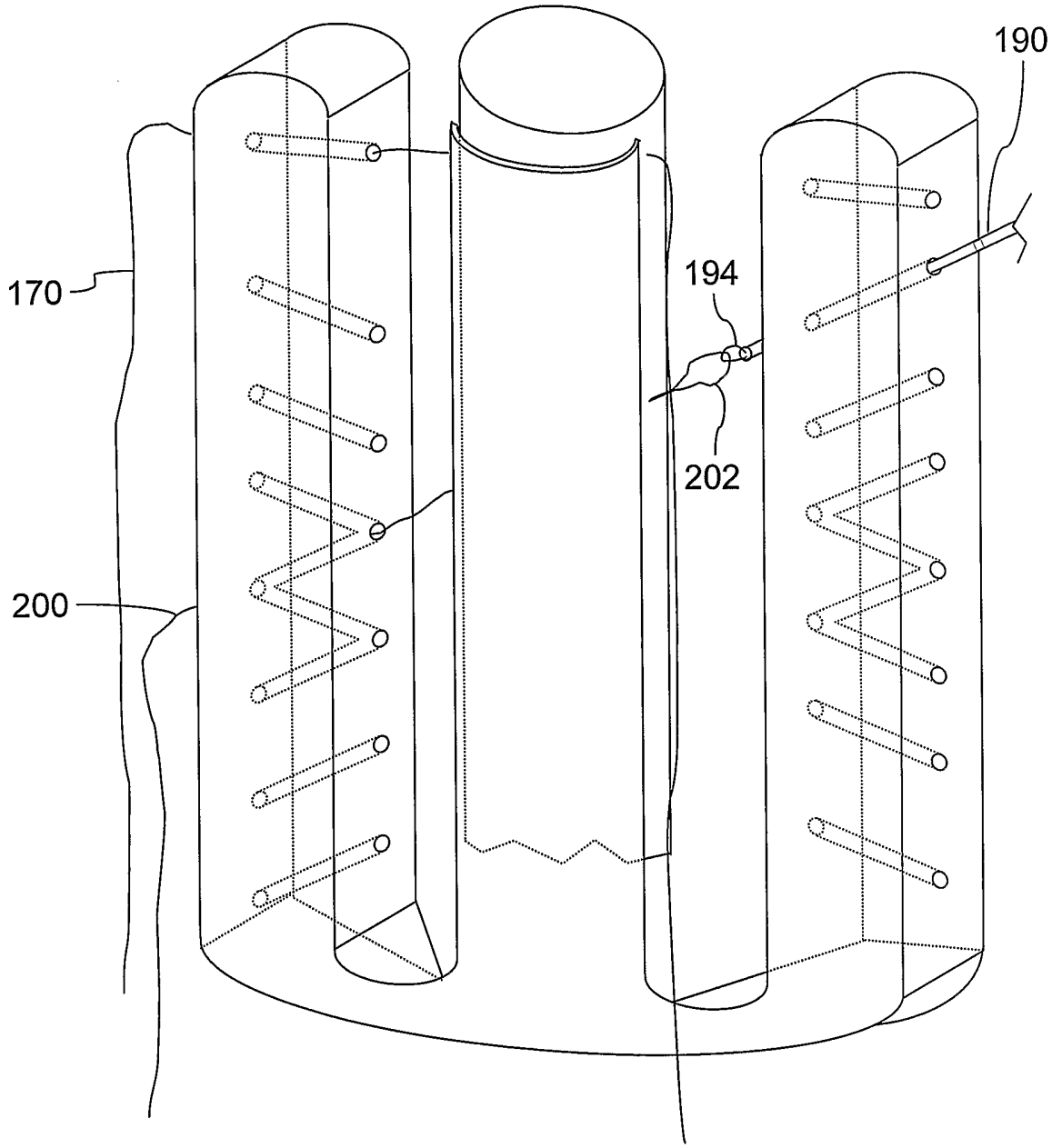

FIG. 21

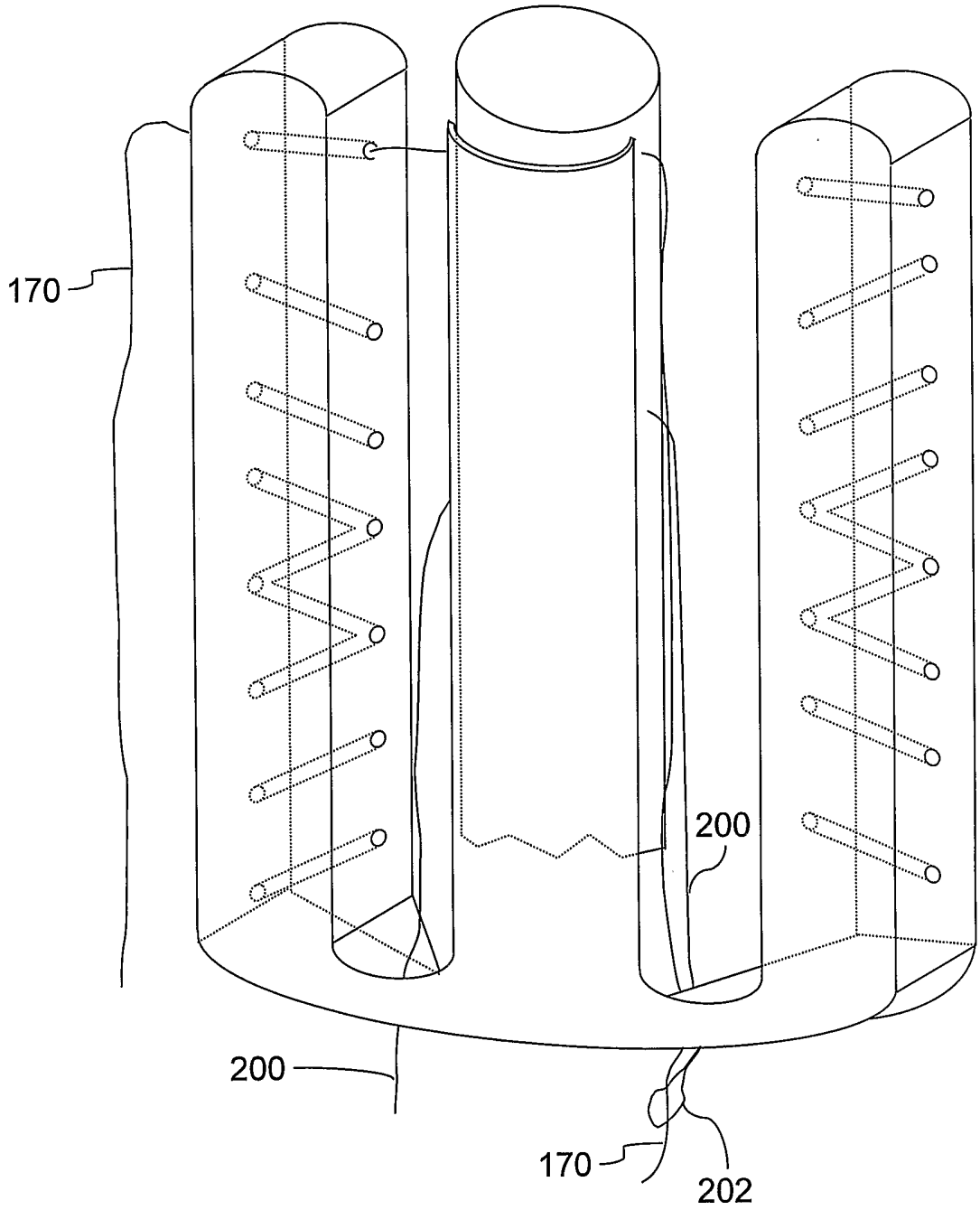

FIG. 22

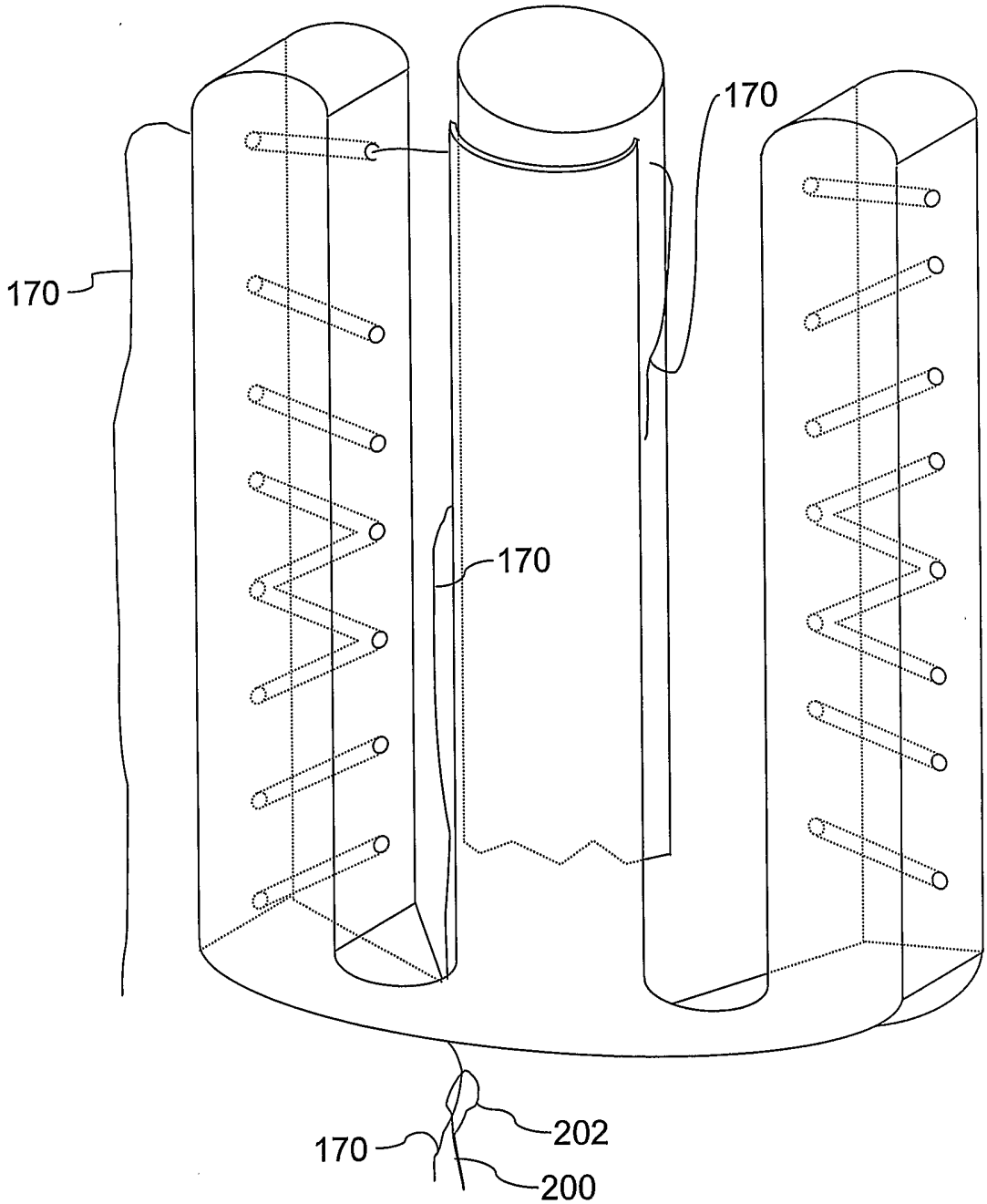

FIG. 23

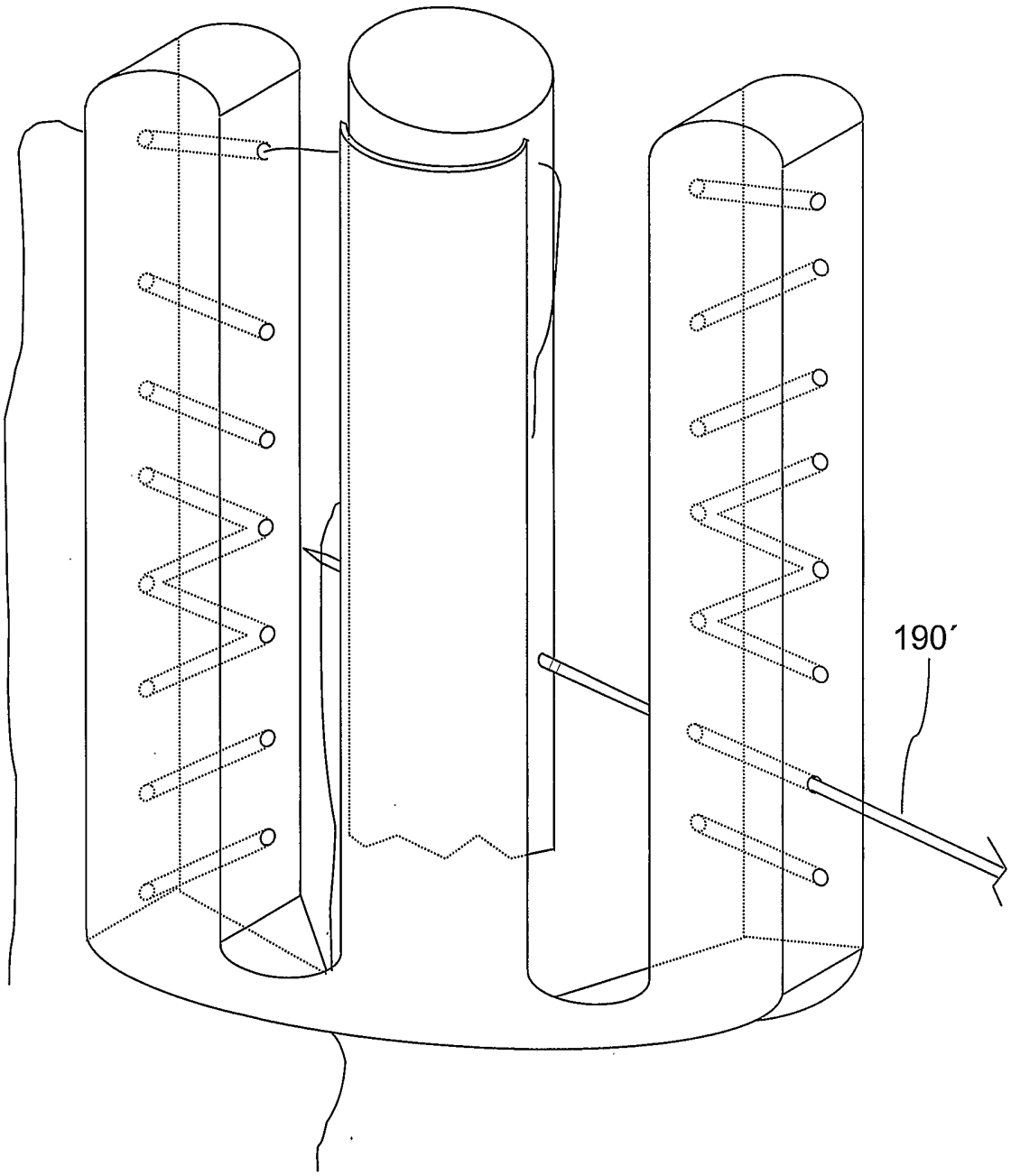

FIG. 24

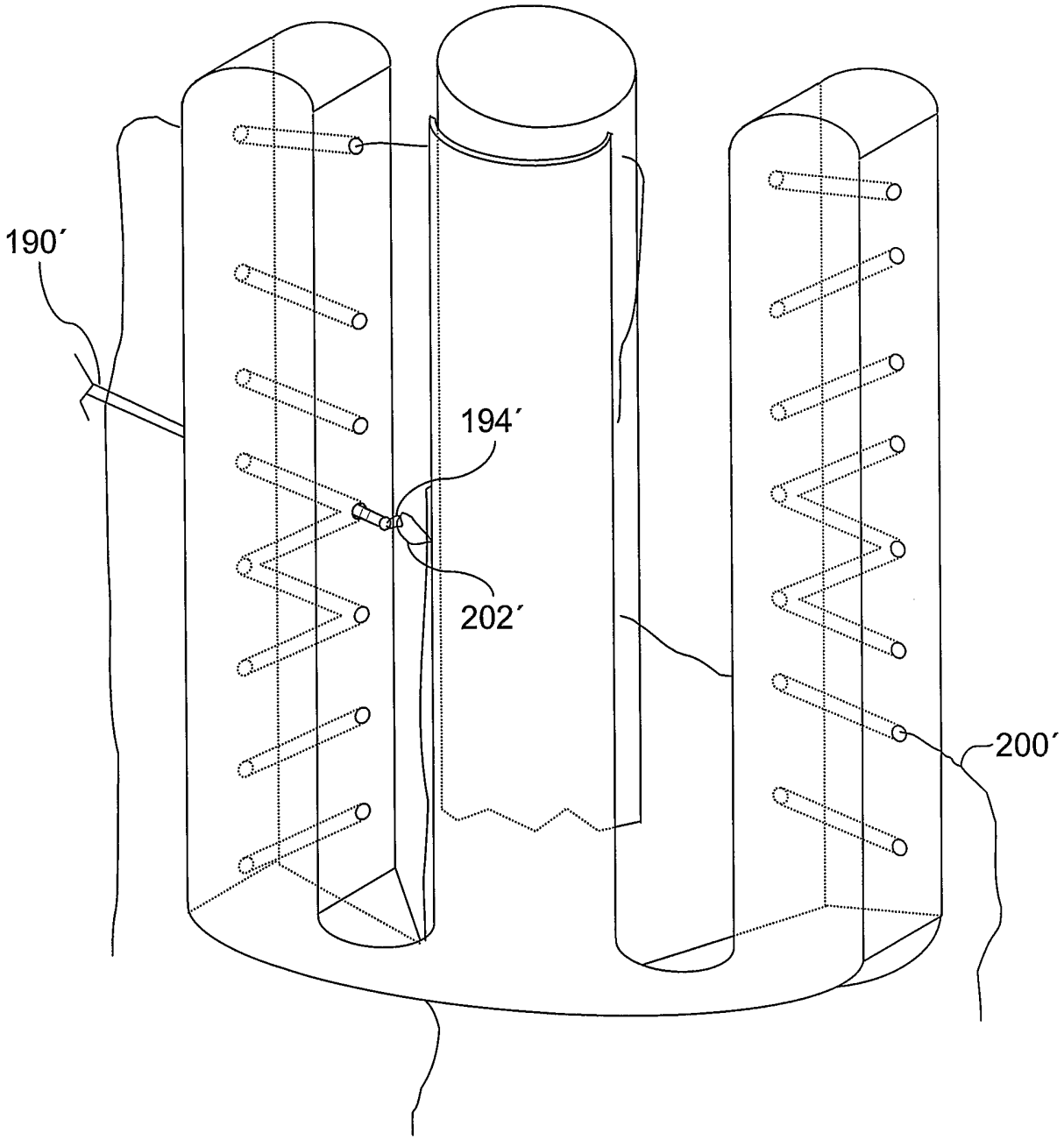

FIG. 25

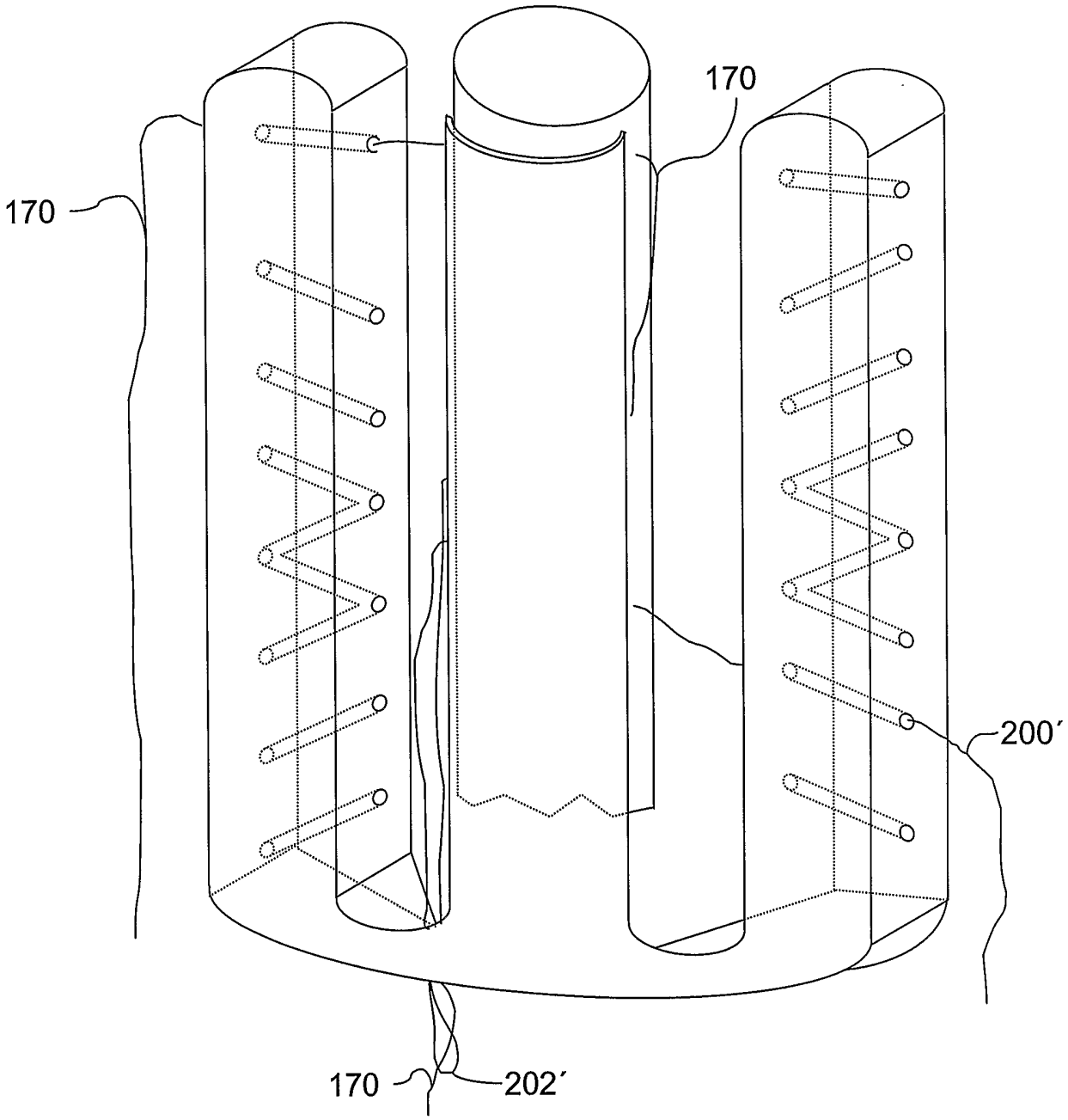

FIG. 26

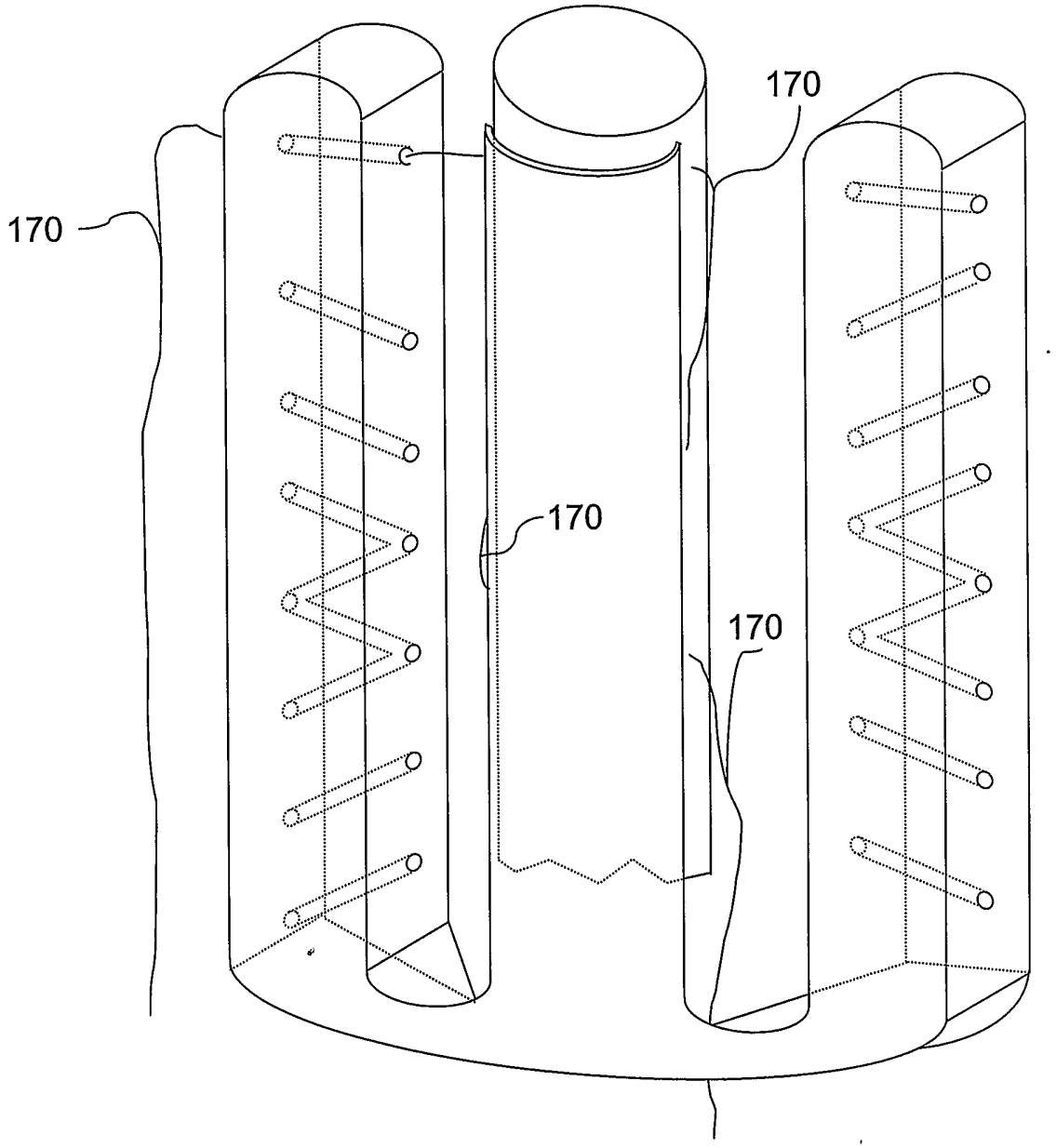

FIG. 27

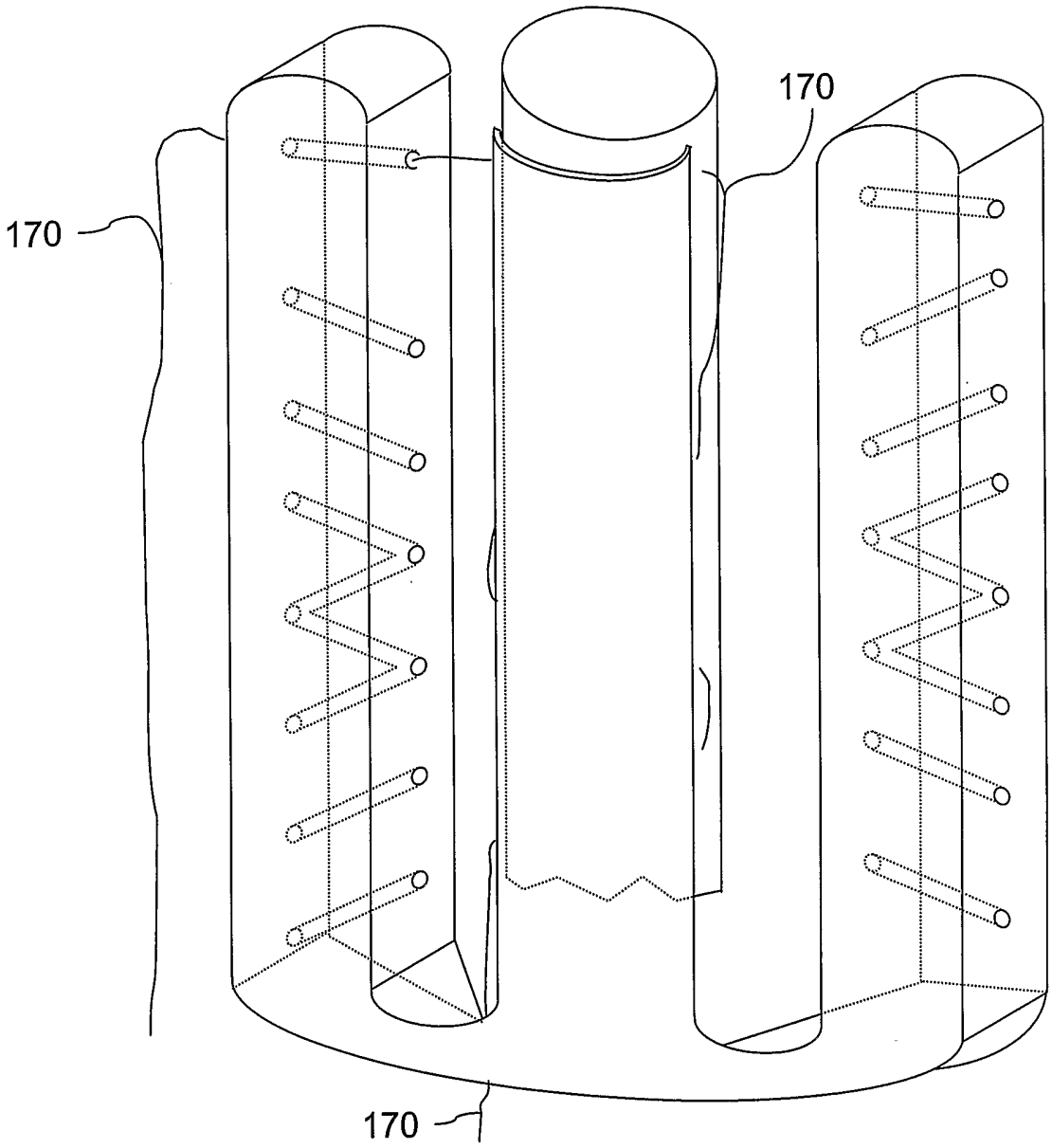

FIG. 28

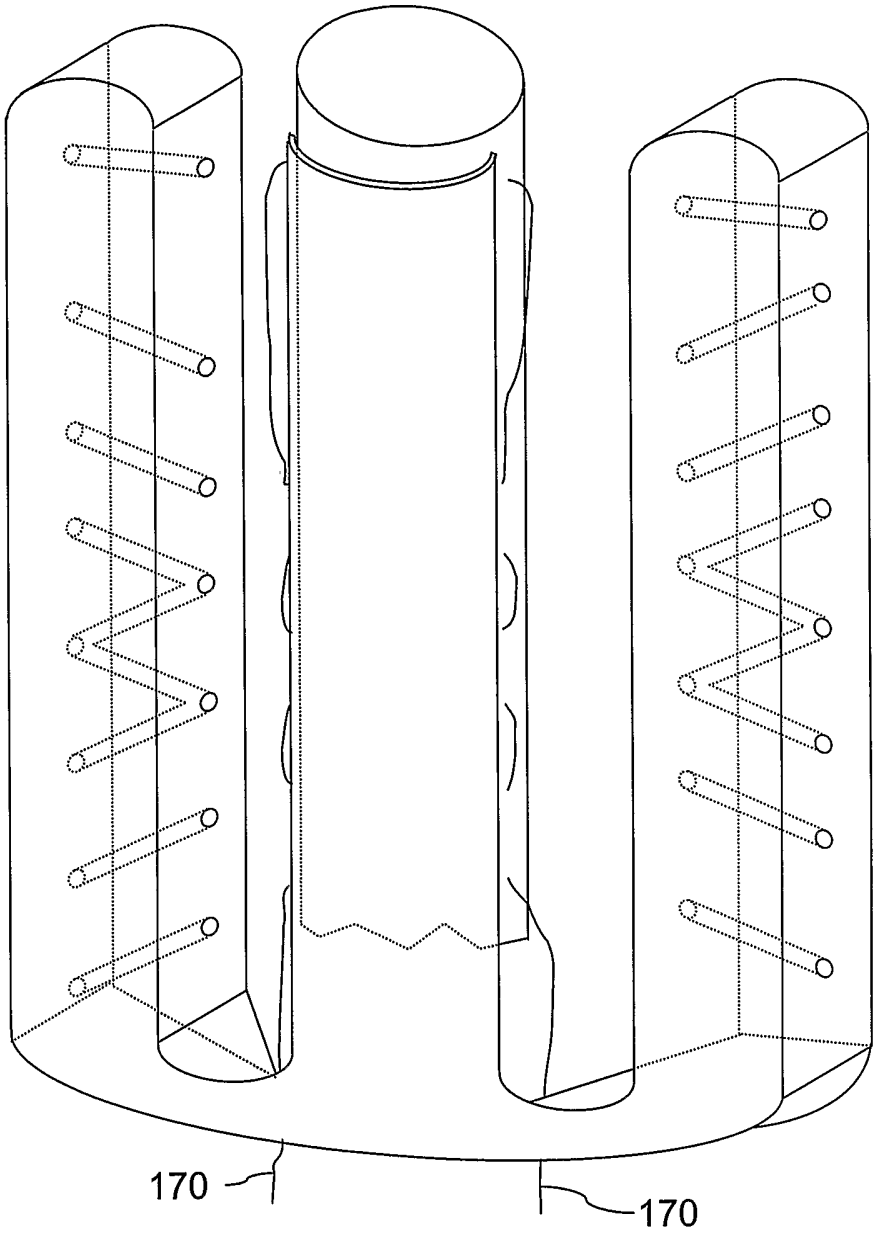

FIG. 29

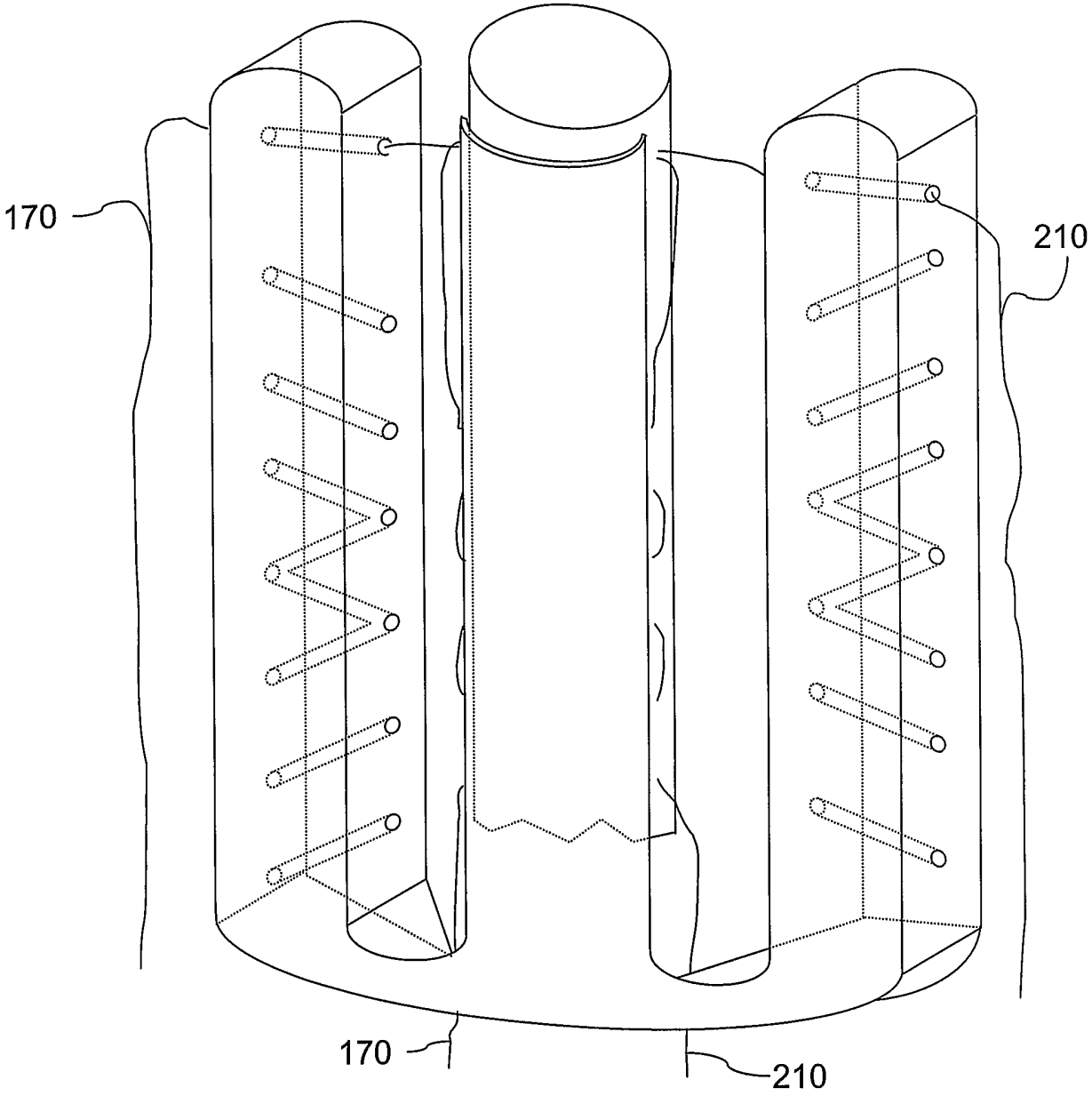

FIG. 30

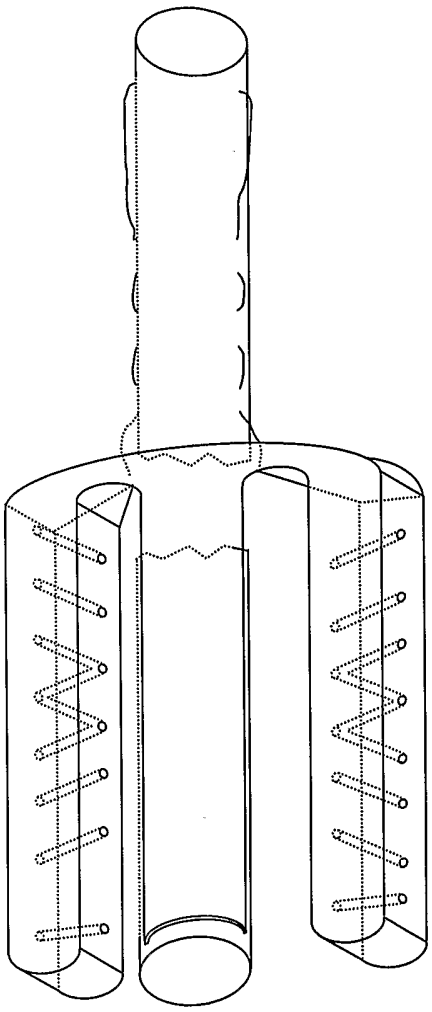

FIG. 31

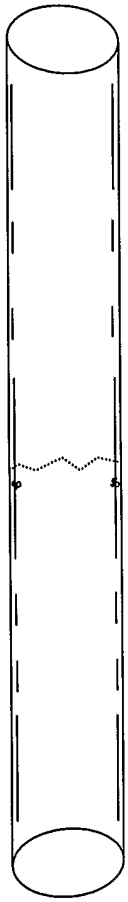

FIG. 32