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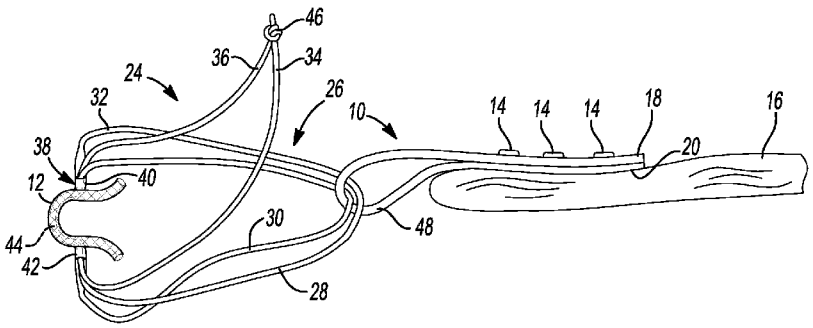

Fig-2

(57) Abstract: Methods and apparatuses for repairing a tear in soft tissue are disclosed. A method according to the principles of the present disclosure includes connecting an intermediate member to a bone anchor and placing the intermediate member on the soft tissue. The method further includes inserting a first suture through the intermediate member and the soft tissue to attach the intermediate member to the soft tissue and fixing the bone anchor to bone to secure the soft tissue to the bone.

METHOD AND APPARATUS FOR STITCHING TENDONS

FIELD

[0001] The present disclosure relates to methods and apparatuses for stitching tendons.

BACKGROUND

[0002] This section provides background information related to the present disclosure which is not necessarily prior art.

[0003] Tears caused by trauma or disease in soft tissue, such as cartilage, ligament, or muscle, can be repaired by suturing. A suture construct may be used to secure the soft tissue to bone. One end of the suture construct may be secured to the soft tissue using stitches, and the other end of the suture construct may be secured to the bone using an anchor. The suture construct may include an adjustable loop including strands that may be pulled to reduce the size of the adjustable loop and thereby bring the soft tissue closer to bone.

[0004] Occasionally, the stitches securing the suture construct to the soft tissue may pull through the tissue. In particular, the stitch closest to the end of the tissue tear, adjacent to the anchor, may pull through the tissue, resulting in considerable movement of the soft tissue with respect to its original location in or on the bone. Thus, there is a need in the relevant art for tissue repair techniques and associated devices for facilitating suturing and stitching while preventing stitches from pulling through tissue.

SUMMARY

[0005] This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

[0006] Methods and apparatuses for repairing a tear in soft tissue are disclosed. A method according to the principles of the present disclosure includes connecting an intermediate member to a bone anchor and placing the intermediate member on the soft tissue. The method further includes inserting a first suture through the intermediate member and the soft tissue to attach the

intermediate member to the soft tissue and fixing the bone anchor to bone to secure the soft tissue to the bone.

[0007] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

[0008] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

[0009] FIG. 1 is a perspective view of a first example of an intermediate member routed through a flexible anchor and placed on one side of soft tissue, with stiches extending through the intermediate member and into the soft tissue;

[0010] FIG. 2 is a side view of the intermediate member and soft tissue connected to the flexible anchor using a suture construct including an adjustable loop;

[0011] FIG. 3 is a top view of the intermediate member, soft tissue, flexible anchor, and suture construct of FIG. 2;

[0012] FIG. 4 is a side view of the intermediate member, soft tissue, flexible anchor, and suture construct of FIG. 2, with the intermediate member placed around the soft tissue and secured to the soft tissue using stiches;

[0013] FIG. 5 is a side view similar to that shown in FIG. 4 but with the intermediate member secured to the soft tissue using flexible anchors arranged in an inline configuration;

[0014] FIG. 6 is a side view similar to that shown in FIG. 4 but with the intermediate member secured to the soft tissue using flexible anchors arranged in a u-shaped configuration;

[0015] FIGS. 7A and 7B are perspective views of adjustable loops extending through soft tissue and a second example of an intermediate member, with locking members inserted through the adjustable loops;

[0016] FIGS. 8 and 9 are perspective views of a third example of an intermediate member connected to a flexible anchor using an adjustable loop, the intermediate member including needles for additional fixation to soft tissue;

[0017] FIG. 10 is a perspective view of a fourth example of an intermediate member connected to a flexible anchor using an adjustable loop, with stiches extending through the intermediate member and into soft tissue;

[0018] FIGS. 11 and 12 are perspective views of a fifth example of an intermediate member including an adjustable loop that is routed through a flexible anchor to secure the soft tissue to the flexible anchor; and

[0019] FIGS. 13A and 13B are side views of the intermediate member, soft tissue, flexible anchor, and suture construct of FIGS. 11 and 12, with the flexible anchor inserted into bone to secure the soft tissue to the bone.

[0020] Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

[0021] Example embodiments will now be described more fully with reference to the accompanying drawings.

[0022] Referring to FIG. 1, an intermediate or load-dispersing member 10 is shown routed through a flexible anchor 12, with stiches 14 extending through the intermediate member 10 and into soft tissue 16 to secure the intermediate member 10 to the soft tissue 16. The arrangement shown in FIG. 1 may be used to repair a tear in the soft tissue 16 such as by attaching the soft tissue 16 to another piece of soft tissue or to bone. Instead of applying tension directly to the stitches 14 when attaching the soft tissue 16 to another piece of soft tissue or to bone, tension may be applied to the intermediate member 10, which in turn applies tension to the stiches 14. The intermediate member 10 aids in the distribution of load on the stitches 14 to increase the stiffness and maximum failure strength of the repair. In this regard, the intermediate member 10 is configured to increase pull-out forces of the stitches 14 and transfer load from those of the stitches 14 disposed closest to the flexible anchor 12 to those of the stitches 14 disposed further away from the flexible anchor 12. The

intermediate member 10 may be folded over to form first and second segments 18, 20, both of which may be placed on one side of the soft tissue 16.

[0023] The intermediate member 10 may be a flat, planar ribbon or sheath having a width that is greater than its thickness. The intermediate member 10 may be sufficiently strong to prevent the stitches 14 from being pulled therethrough without tearing the intermediate member 10 but flexible enough to enable manipulation thereof. The intermediate member 10 may be made from polyester, polyethylene, polyurethane urea, and/or bioresorbable material. The intermediate member 10 may be braided, knit, or woven and/or may include a mesh or matrix such as a SportMesh™ Soft Tissue Reinforcement, available from Arthrotek®, a Biomet® company of Warsaw, Indiana.

[0024] The flexible anchor 12 defines a passage 22 through which the intermediate member 10 is routed. The flexible anchor 12 may be inserted into a hole drilled into bone, and tension may be applied to first and second segments 18, 20 of the intermediate member to set the flexible anchor 12. In turn, the flexible anchor 12 engages the portion of the bone surrounding the hole and thereby secures the soft tissue 16 to the bone. The flexible anchor 12 may be a JuggerKnot™ Soft Anchor, available from Biomet® of Warsaw, Indiana. Further examples of flexible anchors are disclosed in U.S. Patent Application Publication No. 2011/0264141, filed on July 6, 2011, which is incorporated by reference herein in its entirety.

[0025] Referring to FIGS. 2 and 3, the intermediate member 10 is shown connected to the flexible anchor 12 using a preformed adjustable self-locking suture construct 24 that includes a tensioning member 26 such as a double-loop configuration having two adjustable loops 28, 30. The tensioning member 26 may incorporate Ziploop™ Technology, available from Biomet of Warsaw, Indiana. The tensioning member 26 includes a suture 32 having a first end 34 and a second end 36. The suture 32 includes a braided body 38 having a first end 40 and a second end 42 and defining a passage 44 therein.

[0026] To form the suture construct 24, the first end 34 of the suture 32 can be inserted through the passage 22 in the flexible anchor 12 to position the first and second ends 40, 42 of the braided body 38 on opposite sides of the

passage 22 as shown. The first end 34 of the suture 32 can then be inserted through the first end 40 of the braided body 38, through the passage 44 in the braided body 38, and out the second end 42 of the braided body 38 to form the adjustable loop 28. The second end 36 of the suture 32 can then be inserted through the second end 42 of the braided body 38, through the passage 44 in the braided body 38, and out the first end 40 of the braided body 38 to form the adjustable loop 30. The first and second ends 34, 36 can then be tied together to form a knot 46 as shown or left as separate strands. The flexible anchor 12 and the suture construct 24 can be provided together with the suture construct 24 formed as shown.

[0027] To secure the soft tissue 16 to bone, the intermediate member 10 can be inserted partially through the adjustable loops 28, 30, folded, and placed on one side of the soft tissue 16 to form a loop 48. The stitches 14 can then be formed through the intermediate member 10 and the soft tissue 16 to fix the intermediate member 10 to the soft tissue 16. The flexible anchor 12 can then be fixed within the bone, and the first and second ends 34, 36 of the suture 32 can be pulled to decrease the size of the adjustable loops 28, 30. As the size of the adjustable loops 28, 30 decreases, the soft tissue 16 is pulled closer to the location where the flexible anchor 12 is fixed to the bone.

[0028] In various implementations, the suture construct 24 may include multiple adjustable loops and/or multiple braided bodies arranged in various configurations. Further examples of suture constructs are disclosed in U.S. Patent No. 7,601,165, filed on September 29, 2006, and U.S. Patent No. 7,959,650, filed on August 22, 2008, which are incorporated by reference herein in their entirety. Further examples of suture constructs incorporating flexible anchors are disclosed in U.S. Patent No. 7,905,904, filed on January 15, 2008, and U.S. Patent Application Publication No. 2011/0098727 ("the '727 publication"), filed on October 29, 2010, which are incorporated by reference herein in their entirety. An exemplary embodiment of a preformed adjustable self-locking suture construct including a double-loop configuration is disclosed in FIG. 14 of the '727 publication, although other embodiments of the '727 publication may be employed.

[0029] Referring to FIG. 4, the first and second segments 18, 20 of the intermediate member 10 are shown placed on opposite sides of the soft tissue 16 and secured to the soft tissue 16 using stiches 50. To form each of the stiches 50, a suture 52 may be passed through the first segment 18, the soft tissue 16, and the second segment 20 in one direction. The suture 52 may then be passed back through the first segment 18, the soft tissue 16, and the second segment 20 in the opposite direction to form a loop 54. Opposite ends of the suture 52 may then be tied together to form a knot 56.

[0030] Referring to FIG. 5, the intermediate member 10 is shown wrapped around the soft tissue 16 with the first and second segments 18, 20 placed on opposite sides of the soft tissue 16 and secured to the soft tissue 16 using preformed adjustable self-locking suture constructs 58 arranged in an inline configuration. Each of the suture constructs 58 includes flexible anchors 60, 62 positioned on opposite sides of the soft tissue 16 and held together using a tensioning member 64. Each of the tensioning members 64 can include a suture 65 arranged in a double-loop configuration with two adjustable loops 66, 67 and ends 68. The tensioning members 64 may incorporate Ziploop™ Technology, available from Biomet of Warsaw, Indiana.

[0031] Each of the suture constructs 58 may be preformed by passing the ends 68 of the suture 65 through passages in the flexible anchors 60, 62 in a manner similar to that described above with respect to the suture construct 24. One of the flexible anchors 60, 62 may then be pushed through the soft tissue 16 to position the flexible anchors 60, 62 on opposite sides of the soft tissue 16. The ends 68 of the suture 65 may then be pulled to decrease the size of the adjustable loops 66, 67 and thereby bring the first and second segments 18, 20 of the intermediate member 10 closer to each other. The ends 68 of the suture 65 may then be tied together as shown or left as separate strands. An exemplary suture construct including a double-loop configuration passed through two flexible anchors is disclosed in FIG. 14 of the '727 publication.

[0032] Referring to FIG. 6 the intermediate member 10 is shown wrapped around the soft tissue 16 with the first and second segments 18, 20 placed on opposite sides of the soft tissue 16 and secured to the soft tissue 16 using preformed adjustable self-locking suture constructs 69 arranged in a u-

shaped configuration. Each of the suture constructs 69 includes flexible anchors 70, 72 positioned on the same side of the soft tissue 16 and held together using a tensioning member 74. Each of the tensioning members 74 includes a suture 75 arranged in a double-loop configuration with adjustable loops 76, 77 and ends 78. The tensioning members 74 may incorporate Ziploop™ Technology, available from Biomet of Warsaw, Indiana.

[0033] Each of the suture constructs 69 may be preformed by passing the ends 78 of the suture 75 through passages in the flexible anchors 70, 72 in a manner similar to that described above with respect to the suture constructs 58. One of the flexible anchors 70, 72 may then be pushed through the soft tissue 16 in one direction and then pushed through the soft tissue 16 again in the opposite direction to position the flexible anchors 70, 72 on the same side of the soft tissue 16. The ends 78 of the suture 75 may then be pulled to decrease the size of the adjustable loops 76, 77 and thereby bring the first and second segments 18, 20 of the intermediate member 10 closer to each other. The ends 78 of the suture 75 may then be tied together as shown or left as separate strands.

[0034] Referring to FIGS. 7A and 7B, an intermediate member 80 is shown wrapped around the soft tissue 16 to form spaced apart segments 80a, 80b with the soft tissue 16 disposed between the segments 80a, 80b and suture constructs 82 extending through the segments 80a, 80b and the soft tissue 16. Each of the suture constructs 82 includes a suture 84 arranged in a double-loop configuration with two adjustable loops 86, 87 and ends 88. The suture constructs 82 may incorporate Ziploop™ Technology, available from Biomet of Warsaw, Indiana. An exemplary suture construct including two adjustable loops is disclosed in FIG. 4A of U.S. patent number 7,601,165.

[0035] Each of the suture constructs 82 may be preformed in a manner similar to that described above with respect to the suture construct 24. The adjustable loops 86, 87 may then be pushed partially through the intermediate member 80 and the soft tissue 16 to position portions of the adjustable loops 86, 87 on both opposite sides of the soft tissue 16 as shown. The ends 88 of the suture 84 may then be pulled to decrease the size of the adjustable loops 86, 87. The ends 88 may then be tied together as shown or left as separate strands.

[0036] Locking members 90 may be inserted into the adjustable loops 86 to prevent the adjustable loops 86 from being pulled through the intermediate member 80 when the ends 88 are pulled. The locking members 90 may have sufficient rigidity and size to prevent the adjustable loops 86 from being pulled through the intermediate member 80 but flexible enough to enable manipulation thereof. The locking members 90 may be strips, rods, or sutures, may be made from polyester, polyethylene, and/or polyether ether ketone (PEEK), and may have a thickness or diameter between 0.25 millimeters (mm) and 0.5 mm. Further examples of suture constructs and locking members are disclosed in U.S. Patent Application Publication No. 2011/0208240 (see, e.g., FIGS. 4 through 6), filed on May 2, 2011, which is incorporated by reference herein in its entirety.

[0037] Referring to FIG. 8, an intermediate member 100 defines a plurality of bifurcations or openings 102. The intermediate member 100 may be a flat, planar ribbon or sheath having a width that is greater than its thickness. The intermediate member 100 may be formed (e.g., braided) from polyester, polyethylene, polyurethane urea, and/or bioresorbable material. Each end of the intermediate member 100 has suture ends 104 extending therefrom and converging at a connection 106 between the suture ends 104 and a needle 108. The suture ends 104 may be incorporated as part of the intermediate member 100 or be separate and passed through passages within the intermediate member 100. In one example, the intermediate member 100 can be formed by braiding portions of a plurality of strands and the unbraided portions of the strands may form the suture ends 104.

[0038] The intermediate member 100 is shown connected to the flexible anchor 12 using a preformed adjustable self-locking suture construct 110 that includes a double-loop configuration with two adjustable loops 112, 113 and ends 114. The suture construct 110 may be formed in the manner described above with respect to the suture construct 24. When the flexible anchor 12 is secured to bone, the ends 114 may be pulled to decrease the size of the adjustable loop 112 and thereby bring the intermediate member 100 closer to the flexible anchor 12. Further examples of suture constructs including adjustable loops and needles are disclosed in U.S. Patent Application Publication No.

2012/0046693 (see, e.g., FIG. 13), filed on November 3, 2011, which is incorporated by reference herein in its entirety.

[0039] Referring to FIG. 9, the intermediate member 100 may be placed around the soft tissue 16 to form spaced-apart segments 100a, 100b with the soft tissue 16 disposed therebetween, and the needles 108 may be inserted into the soft tissue 16 to secure the intermediate member 100 to the soft tissue 16. Sutures 116, 118 may then be passed through the openings 102 as the sutures 116, 118 are stitched in and out of the soft tissue 16. The sutures 116, 118 are stitched in and out of the soft tissue 16 towards a distal end 120 of the soft tissue 16 on one side of the soft tissue 16 and then stitched back in the opposite proximal direction on the opposite side of the soft tissue 16. The ends of the suture 116 may then be tied to the ends of the suture 118 as shown and the needles 108 may be cut.

[0040] Instead of placing the intermediate member 100 around the soft tissue 16 as shown, both ends of the intermediate member 100 may be placed on one side of the soft tissue 16 in a manner similar to that shown in FIGS. 1 through 3. In addition, various stitching methods other than that shown in FIG. 9 can be utilized to secure the intermediate member 100 to the soft tissue 16. In any of these variations, the intermediate member 100 transfers load from near the end 120 of the soft tissue 16 to further away from the flexible anchor 12 and the intermediate member 100 reinforces the suture/tendon interfaces.

[0041] Referring to FIG. 10, an intermediate member 130 may be a thin, flat, planar ribbon or braid having a width that is greater than its thickness. The intermediate member 130 may be similar to the intermediate member 10 of FIG. 1. However, the intermediate member 10 of FIG. 1 may be sized to cover a larger surface area on the soft tissue 16, such as between 50 and 60 percent of the soft tissue surface area, to better distribute the load to the stitches 14. In contrast, the intermediate member 130 may be sized to cover a smaller surface area on the soft tissue 16, such as about 10 percent of the soft tissue surface area, to maximize the direct contact between the soft tissue 16 and bone and thereby promote integration.

[0042] In various implementations, an orthopedic matrix or mesh 132 may be wrapped around the soft tissue 16 and the intermediate member 130

may be placed over the mesh 132 on opposite sides of the soft tissue 16. Stitches 134 may be inserted through the intermediate member 130, through the mesh 132, and into the soft tissue 16 to secure the intermediate member 130 to the soft tissue 16. The stitching patterns disclosed above can be incorporated in any of the embodiments disclosed herein. Thus, for example, the stitches 14 shown in FIGS. 1 through 3 and/or the stitches 134 shown in FIG. 10 can incorporate one or more of the stitching patterns described with reference to FIGS. 4 through 6.

[0043] The mesh 132 may be a SportMesh™ Soft Tissue Reinforcement, available from Arthrotek®, a Biomet® company of Warsaw, Indiana. The mesh 132 may improve the distribution of load on the stitches 134 without increasing the amount of surface area on the soft tissue 16 that is completely covered. Further examples of orthopedic meshes are disclosed in U.S. Patent Application No. 2009/0318961 (see, e.g., FIGS. 36A, 36B, and 36C), filed on June 22, 2009, which is incorporated by reference herein in its entirety.

[0044] The intermediate member 130 is shown connected to the flexible anchor 12 using a preformed adjustable self-locking suture construct 136 that includes a double-loop configuration with adjustable loops 138, 139 and ends 140. The adjustable loop 138 may be formed in the manner described above with respect to the suture construct 24. When the flexible anchor 12 is secured to bone, the ends 140 may be pulled to decrease the size of the adjustable loop 112 and thereby bring the intermediate member 100 closer to the flexible anchor 12. The intermediate member 130 may then be inserted partially through the adjustable loop 138 and secured to the soft tissue 16, and the ends 140 may be pulled to bring the soft tissue 16 closer to the flexible anchor 12.

[0045] Referring to FIGS. 11 and 12, a two-piece suture construct 150 is shown connected to the flexible anchor 12. The suture construct 150 includes a pair of separate sutures 152a, 152b having ends 154a, 154b and braided bodies 156a, 156b that form an intermediate member. Each of the braided bodies 156a, 156b includes a first portion 158 that defines a passage 160, a second portion 162, and a third portion 164. The first portion 158 may be a generally cylindrical braid, the third portion 164 may be a relatively flat braid such as a braided ribbon, and the second portion 162 may be a transition braid from

the cylindrical braid to a flat braid. The first portion 158 may be wider than the second portion 162 and narrower than the third portion 164.

[0046] To form the suture construct 150, the suture 152a may be passed through the passage 160 in the braided body 156b, and the suture 152b may be passed through the passage 160 in the braided body 156a. The suture construct 150 may then be passed through the passage 44 in the flexible anchor 12 to position the braided bodies 156a, 156b on opposite sides of the passage 44 as shown. A suture 166 may then be stitched through the braided bodies 156a, 156b and the soft tissue 16 as shown in FIG. 12 to secure the suture construct 150 to the soft tissue 16. The suture 166 may be stitched using the crisscross pattern shown in FIG. 12 or other stitching techniques. Further examples of two-piece suture constructs are disclosed in U.S. Patent Application Publication No. 2012/0053630 (see, e.g., FIG. 2), filed on November 3, 2011, which is incorporated by reference herein in its entirety.

[0047] Referring to FIGS. 13A and 13B, the flexible anchor 12, the suture construct 150, and the soft tissue 16 may then be inserted into a hole 168 drilled through cancellous bone 170 and cortical bone 172. The hole 168 may be a through bore that extends completely through the cancellous bone 170 and the cortical bone 172 as shown. Alternatively, the hole 168 may be a blind bore that extends only partially through the cancellous bone 170 and/or the cortical bone 172.

[0048] If the hole 168 is a through bore, the flexible anchor 12 may be pushed all of the way through the hole 168 and tension may be applied to the ends 154 of the suture 152 to set the flexible anchor 12 against the cortical bone 172. If the hole 168 is a blind bore, the flexible anchor 12 may be pushed into the hole 168 and tension may be applied to the ends 154 of the suture 152 to set the flexible anchor 12 against the cancellous bone 170 and/or the cortical bone 172. Once the flexible anchor 12 is set, applying tension to the ends 154 pulls the soft tissue 16 further into the hole 168. Although FIGS. 13A and 13B illustrating attaching soft tissue to bone using the suture construct 150, other embodiments of suture constructs and intermediate members disclosed herein may be used in a similar manner to attach soft tissue to bone.

[0049] The foregoing description of the embodiments has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. The same may also be varied in many ways. Such variations are not to be regarded as a departure from the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

CLAIMS

What is claimed is:

1. A method for attaching soft tissue to bone comprising:

connecting an intermediate member to a bone anchor;

placing the intermediate member on the soft tissue;

inserting a first suture through the intermediate member and the soft tissue to attach the intermediate member to the soft tissue; and

fixing the bone anchor to bone to secure the soft tissue to the bone.

2. The method of claim 1 wherein the intermediate member is a flat, planar member that includes at least one of a ribbon and a sheath.

3. The method of claim 1 wherein the intermediate member includes at least one of polyester, polyethylene, polyurethane urea, polyether ether ketone (PEEK), and bioresorbable material.

4. The method of claim 1 wherein the intermediate member is at least one of braided, knit, and woven.

5. The method of claim 1 wherein the intermediate member has a thickness between 0.25 millimeters (mm) and 0.75 mm.

6. The method of claim 1 further comprising folding the intermediate member to form first and second segments and placing the first and second segments on one side of the soft tissue before attaching the intermediate member to the soft tissue.

7. The method of claim 1 further comprising folding the intermediate member to form first and second segments and placing the first and second segments on opposite sides of the soft tissue before attaching the intermediate member to the soft tissue.

8. The method of claim 7 further comprising inserting a plurality of suture constructs through the intermediate member and the soft tissue such that a pair of anchors included in each of the suture constructs are disposed on opposite sides of the soft tissue to form an inline attachment configuration.

9. The method of claim 7 further comprising inserting a plurality of suture constructs through the intermediate member and the soft tissue and such that a pair of anchors included in each of the suture constructs are disposed on one side of the soft tissue to form a u-shaped configuration.

10. The method of claim 7 further comprising:

inserting a plurality of suture constructs through the intermediate member and the soft tissue such that adjustable loops included in each of the suture constructs are disposed on opposite sides of the soft tissue;

inserting locking members into the adjustable loops to prevent the adjustable loops from being pulled through the intermediate member as the adjustable loops are tightened; and

tensioning ends of the suture constructs to tighten the adjustable loops onto the locking members and thereby secure the intermediate member to the soft tissue.

11. The method of claim 1, further comprising connecting the intermediate member to the bone anchor by passing the intermediate member through a passage in the bone anchor.

12. The method of claim 1 further comprising connecting the intermediate member to the bone anchor using a tensioning member that includes a suture construct forming a self-locking adjustable loop.

13. The method of claim 12 further comprising inserting the intermediate member partially through the adjustable loop, folding the intermediate member to form first and second segments, and stitching the first and second segments of the intermediate member to the soft tissue.

14. The method of claim 12 further comprising pulling opposite ends of the suture construct to decrease the size of the adjustable loop and to apply tension to the intermediate member and thereby bring the soft tissue closer to a location on the bone at which the bone anchor is fixed.

15. The method of claim 14 wherein the bone anchor is flexible and pulling the ends of the second suture sets the flexible bone anchor against the bone.

16. An apparatus for repairing a tear in soft tissue comprising:

a bone anchor defining a passage that extends through the bone anchor;

a suture construct including a first suture that extends through the passage in the bone anchor to form an adjustable loop;

an intermediate member configured to be inserted partially through the adjustable loop and folded to form first and second segments that are placeable on the soft tissue; and

a second suture that is configured to be passed through the first and second segments of the intermediate member and the soft tissue to form stiches that secure the intermediate member to the soft tissue, wherein the intermediate member is configured to increase pull-out forces of the stitches and transfer load from those of the stitches disposed closest to the bone anchor to those of the stitches disposed further away from the bone anchor.

17. The apparatus of claim 16 wherein the intermediate member defines preformed openings for receiving the second suture as the second suture is passed in and out of the soft tissue to stitch the intermediate member to the soft tissue.

18. The apparatus of claim 16 further comprising needles and third and fourth sutures, the third and fourth sutures extending from opposite ends of the intermediate member and connecting the needles to the intermediate member.

19. An apparatus for repairing a tear in soft tissue comprising:

a bone anchor defining a first passage; and

a suture construct including a first suture having a first braided body and a second suture having a second braided body, the second suture extending through a second passage in the first braided body, the first suture extending through a third passage in the second braided body, the first and second sutures extending through the first passage in the bone anchor such that the first and second braided bodies are disposed on opposite sides of the first passage, the first and second braided bodies each including a first portion that defines one of the second and third passages and a second portion that extends from the first portion in a direction away from the bone anchor, the first portion having a cylindrical shape and the second portion having a flat shape.

20. The apparatus of claim 19 wherein the bone anchor is a flexible anchor.

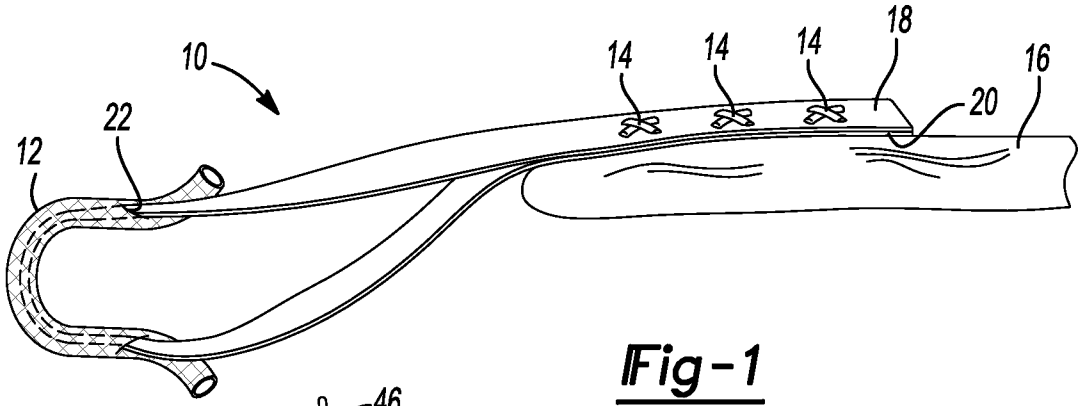

Fig-1

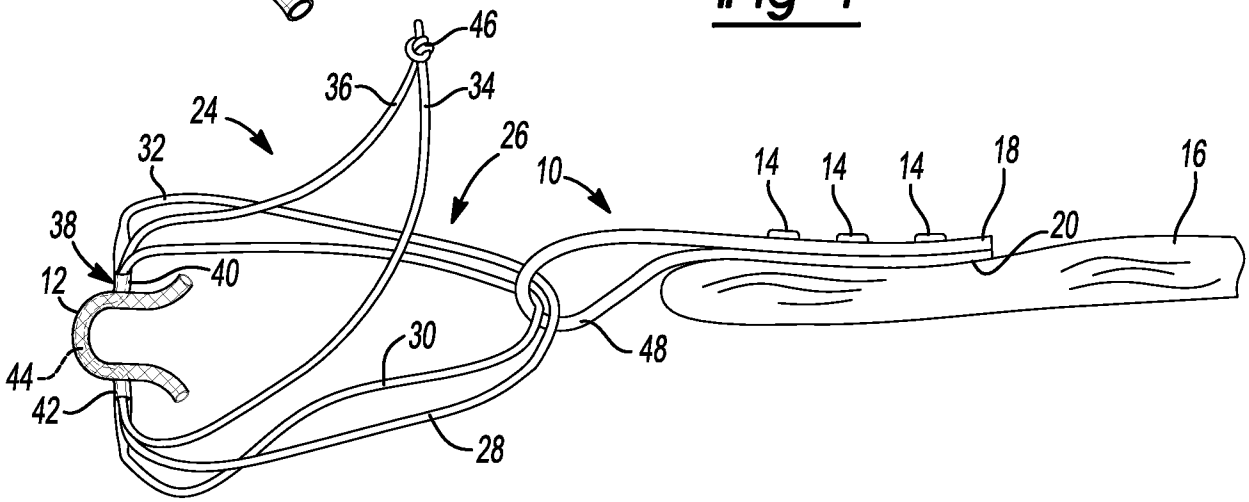

Fig-2

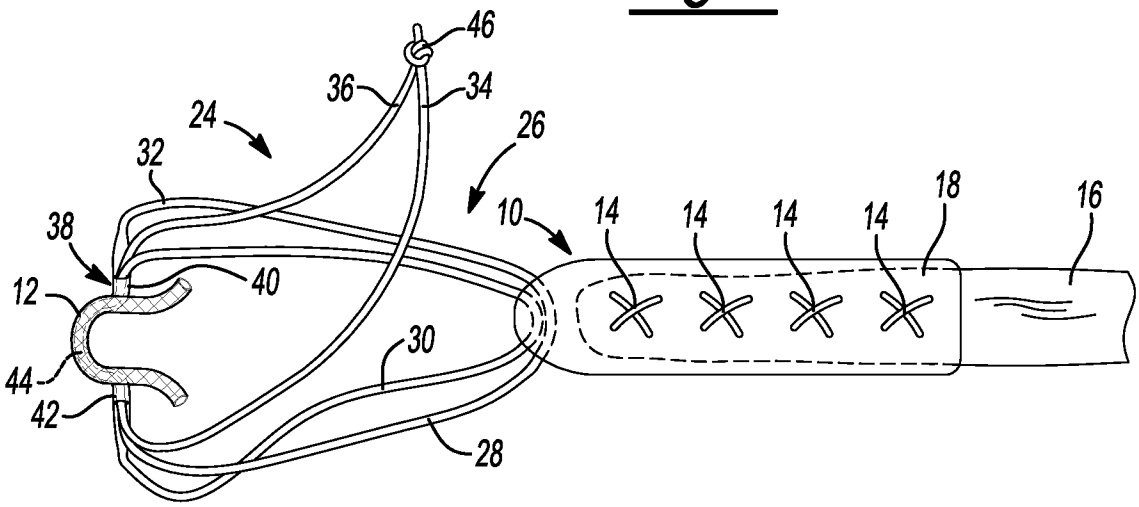

Fig-3

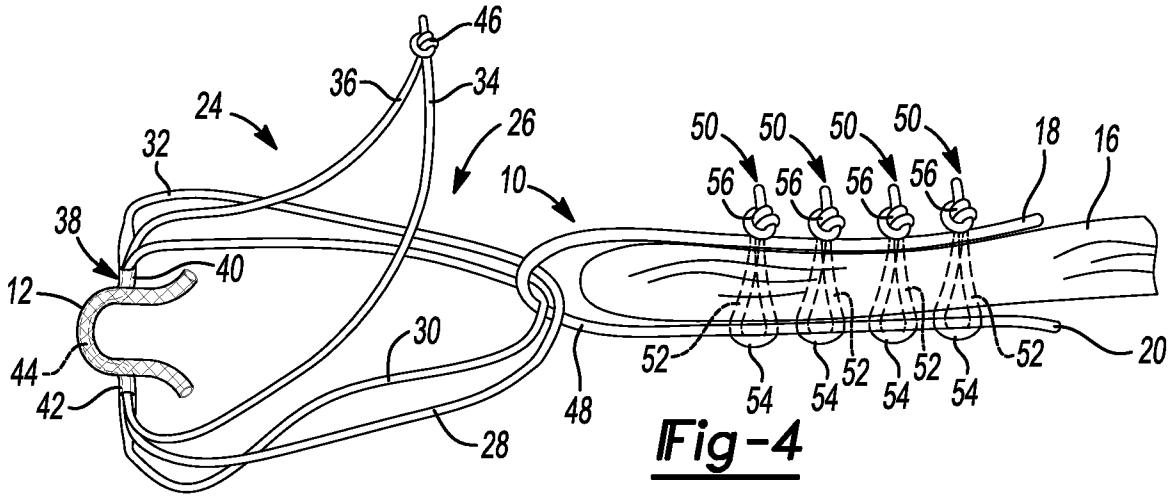

Fig-4

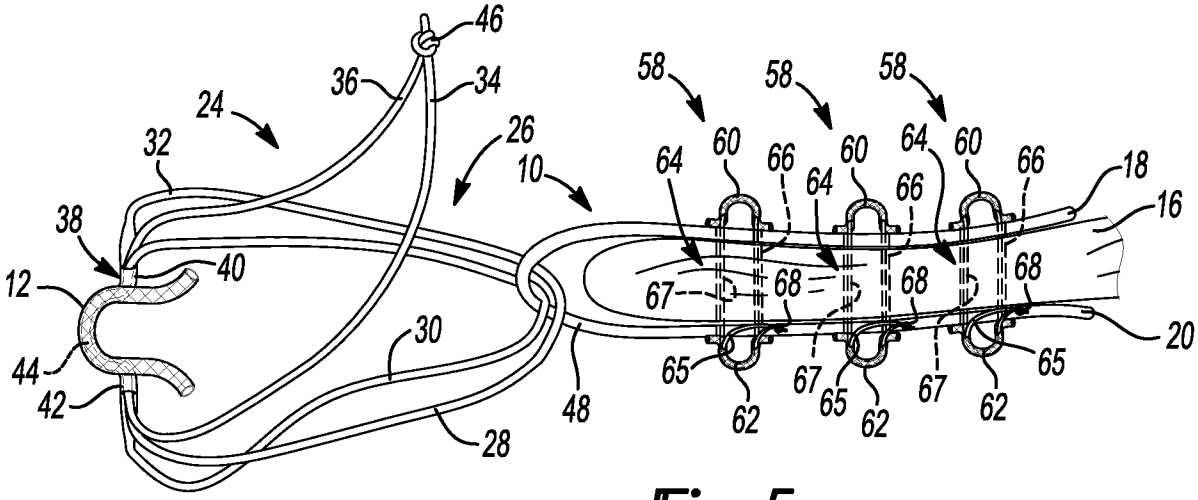

Fig-5

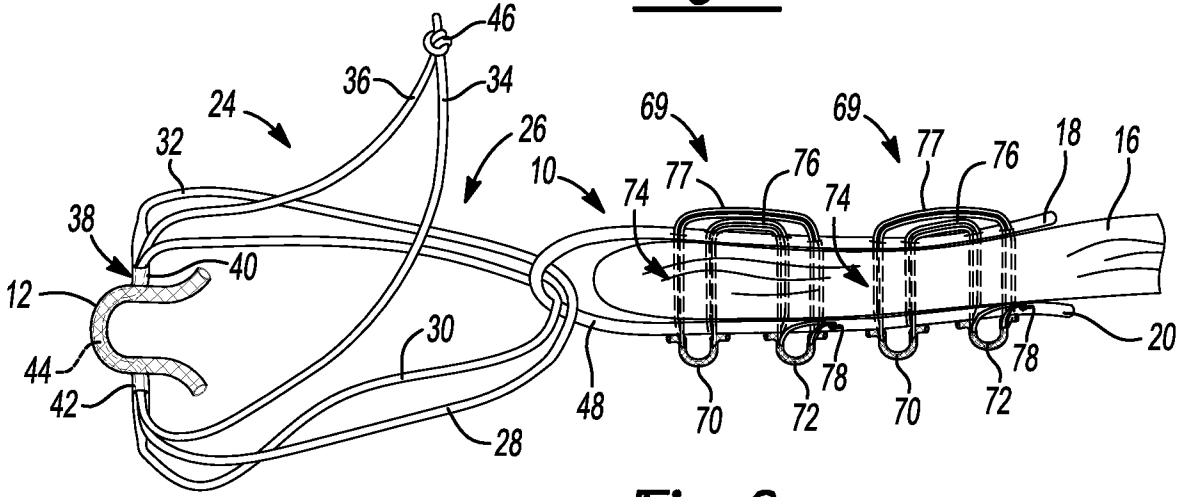

Fig-6

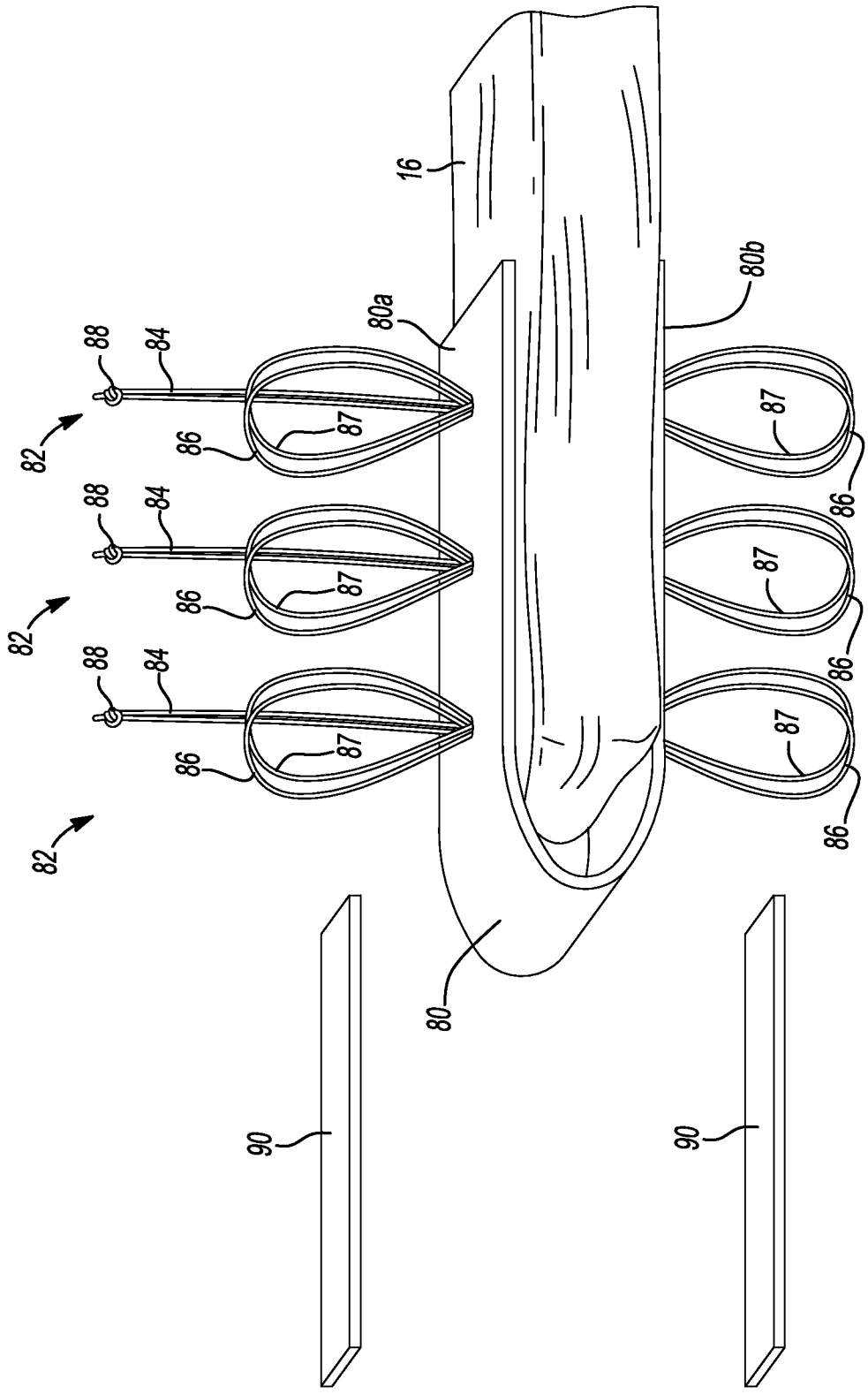

Fig-7A

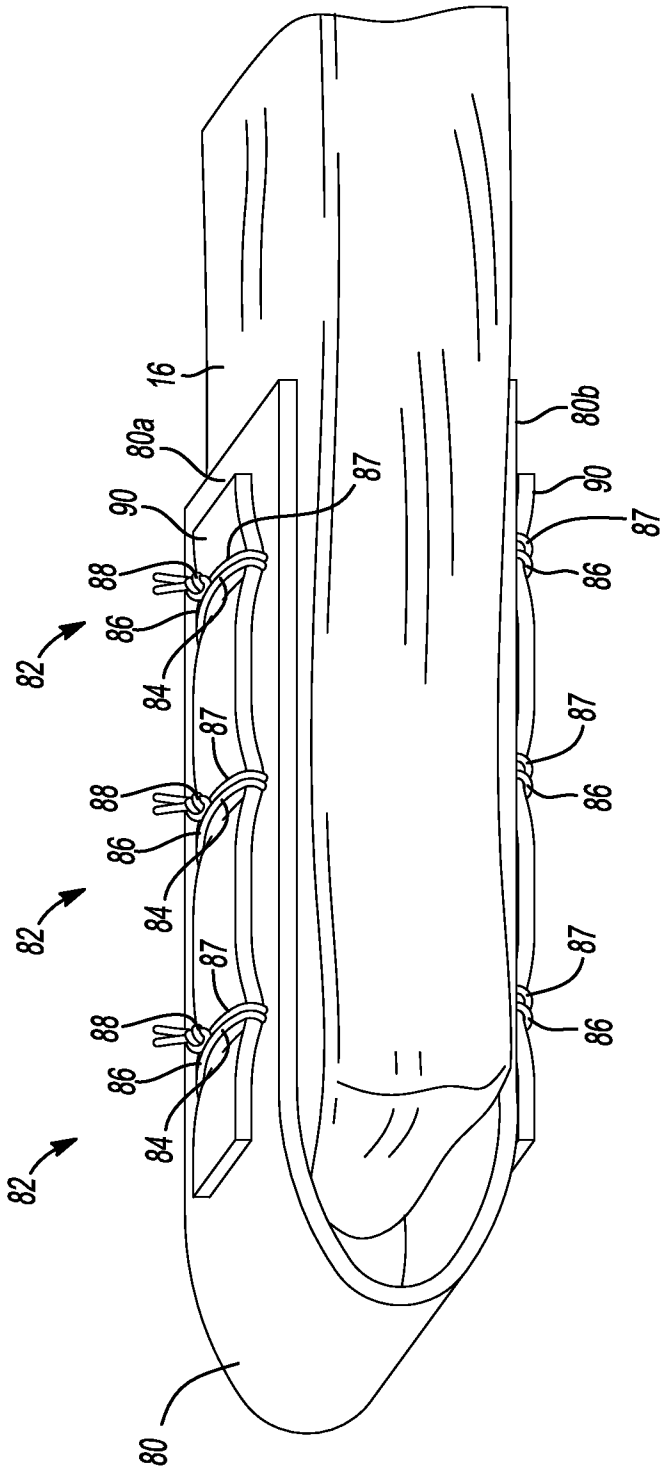

Fig-7B

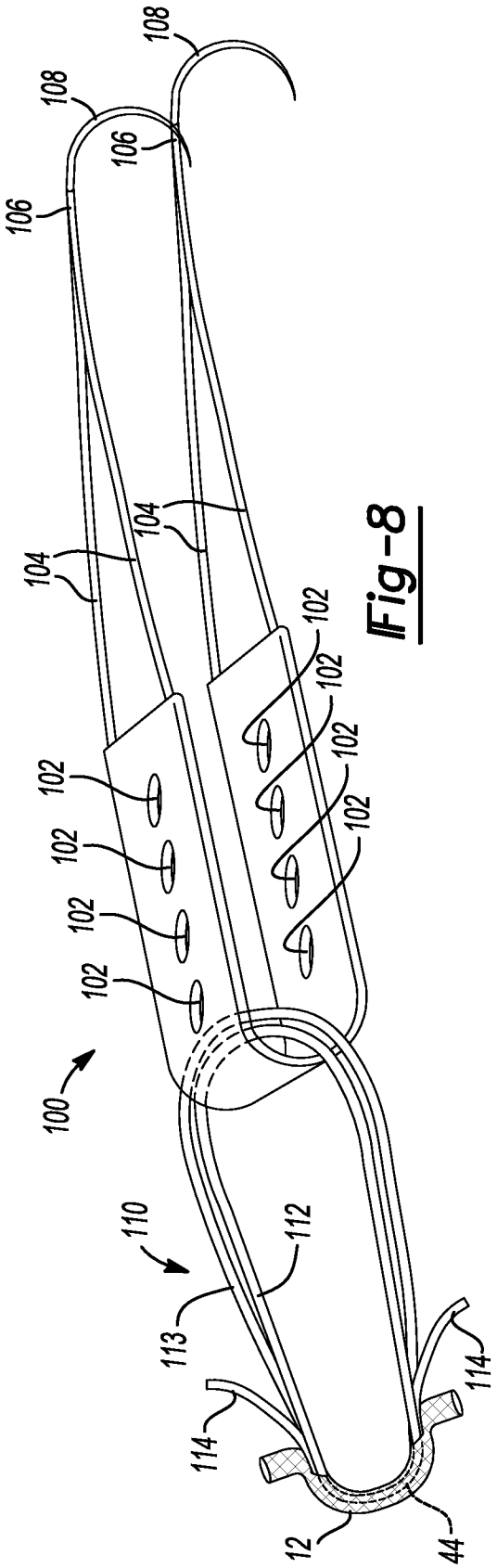
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Fig-8

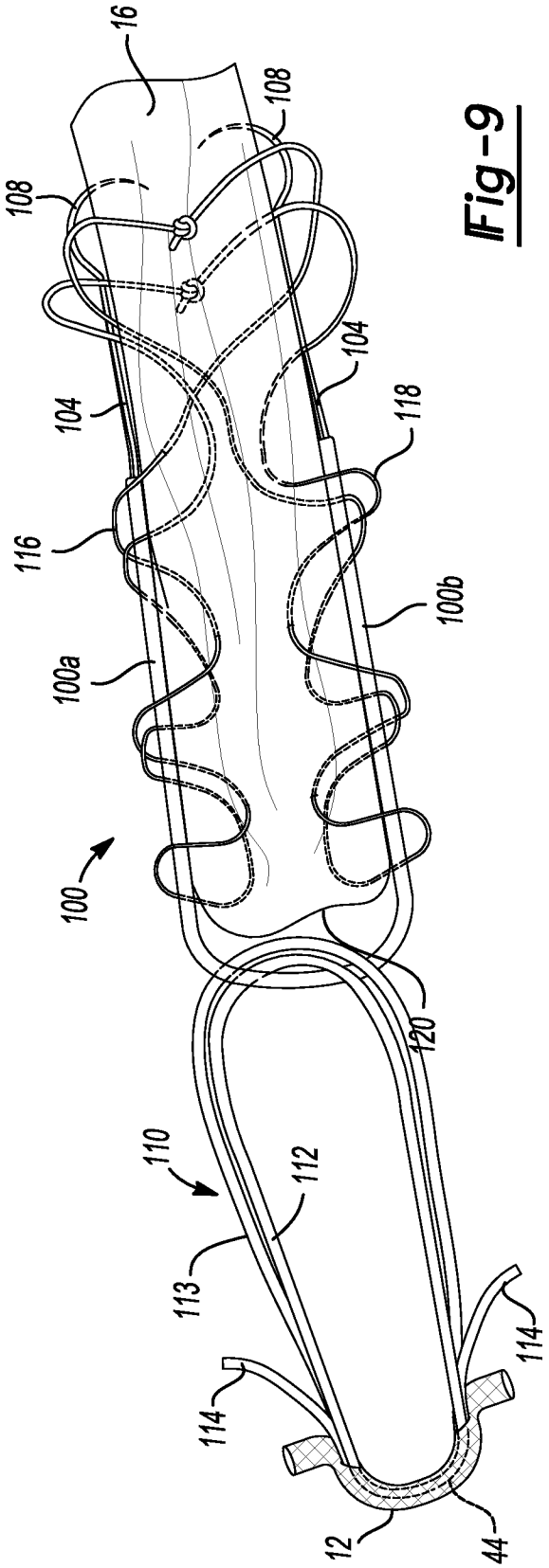
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Fig-9

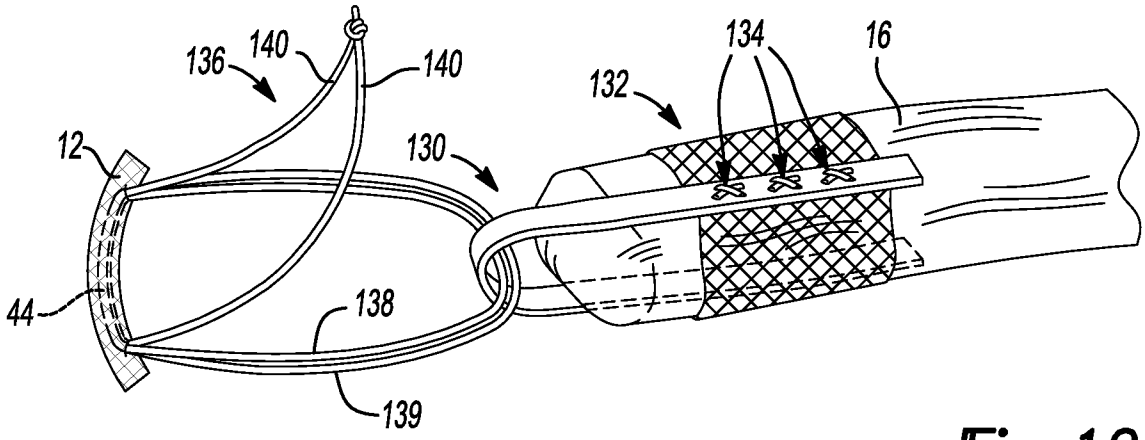

Fig-10

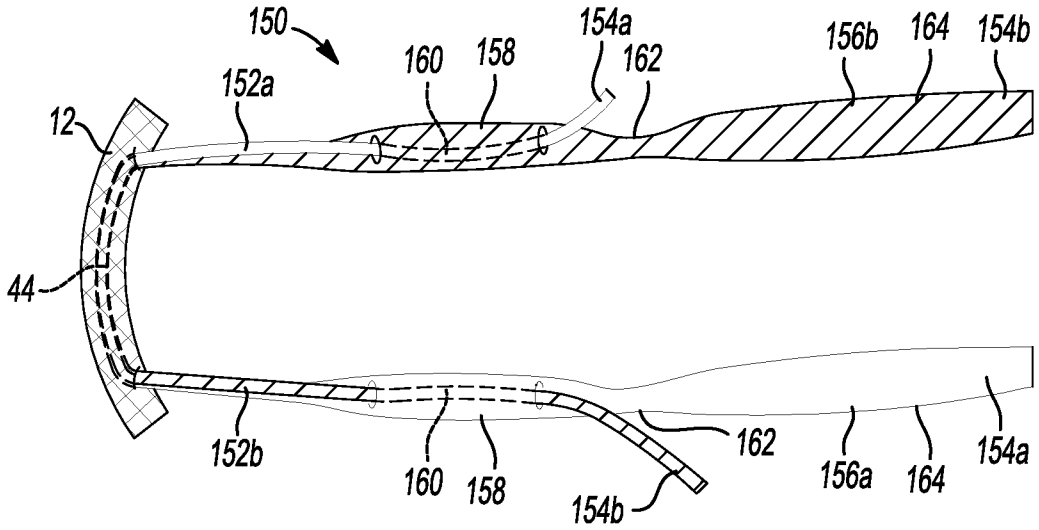

Fig-11

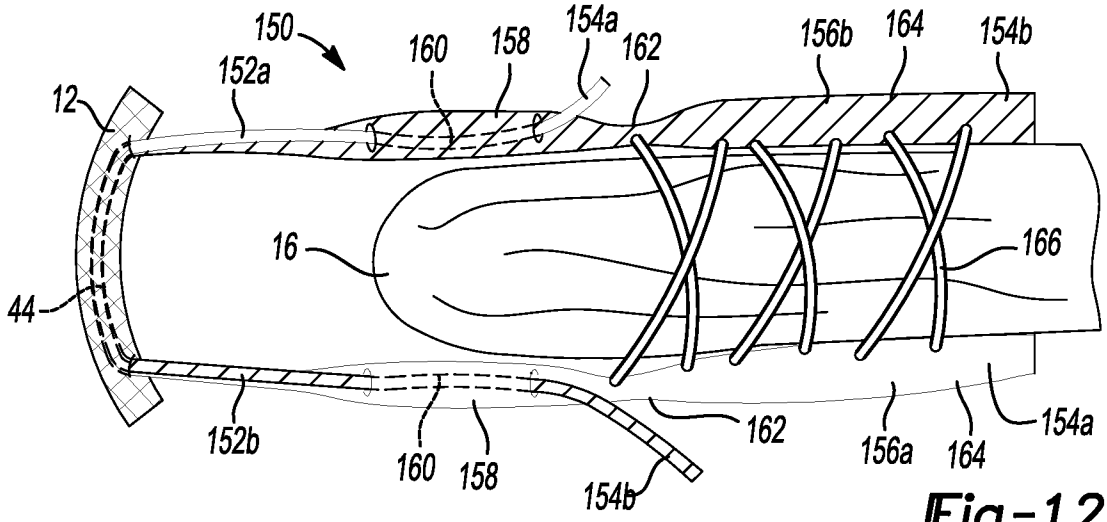

Fig-12

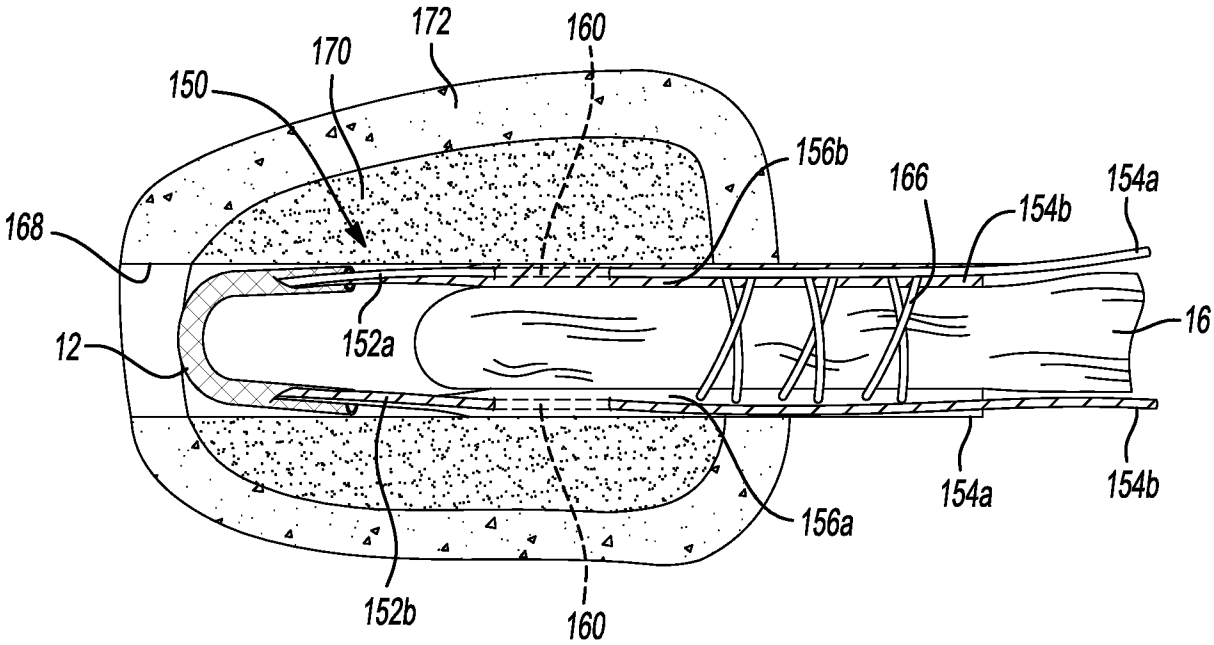

Fig-13A

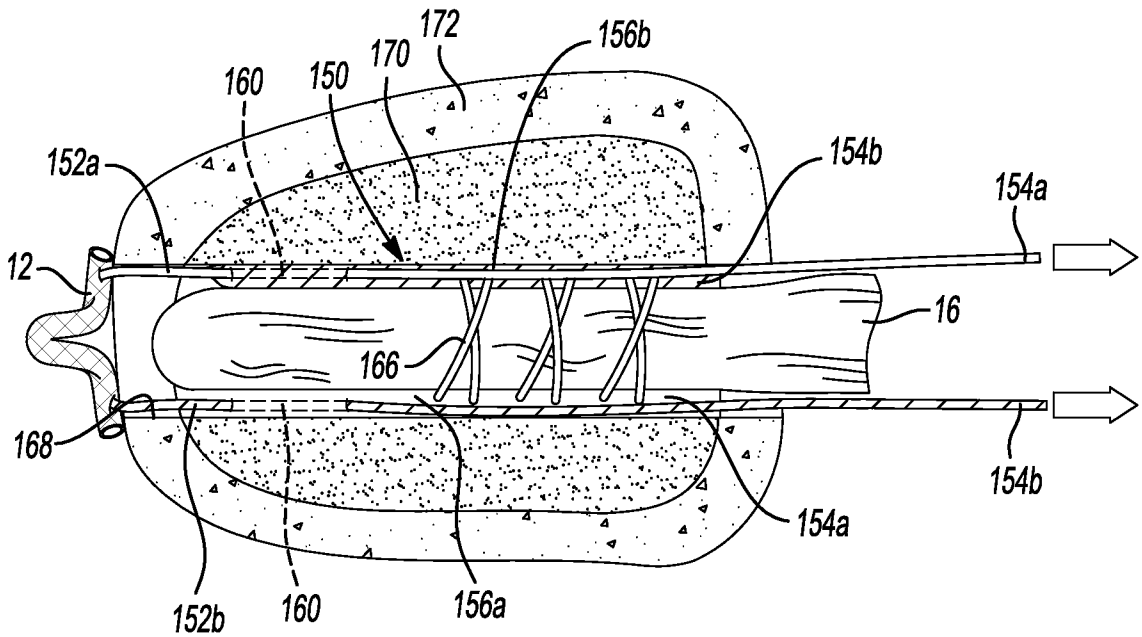

Fig-13B

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/075989

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61F2/08 A61B17/06 A61B17/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61F A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012/046693 A1 (DENHAM GREGORY J [US] ET AL) 23 February 2012 (2012-02-23) cited in the application paragraph [0037] - paragraph [0043]; figures	16-20
A	US 2012/059417 A1 (NORTON DANIEL [US] ET AL) 8 March 2012 (2012-03-08) paragraphs [0045] - [0048], [0058] - [0061]; figures	16-20
A	US 2011/098727 A1 (KAISER RYAN A [US] ET AL) 28 April 2011 (2011-04-28) cited in the application paragraphs [0042], [0043], [0050] - [0055]; figures	16-20

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 February 2014	06/03/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Neumann, Elisabeth

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/075989

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.: 1-15
because they relate to subject matter not required to be searched by this Authority, namely:

Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery

2. [ ] Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

[ ] The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2013/075989

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012046693 A1	23-02-2012	NONE	
US 2012059417 A1	08-03-2012	NONE	
US 2011098727 A1	28-04-2011	US 2011098727 A1	28-04-2011
		US 2014046368 A1	13-02-2014