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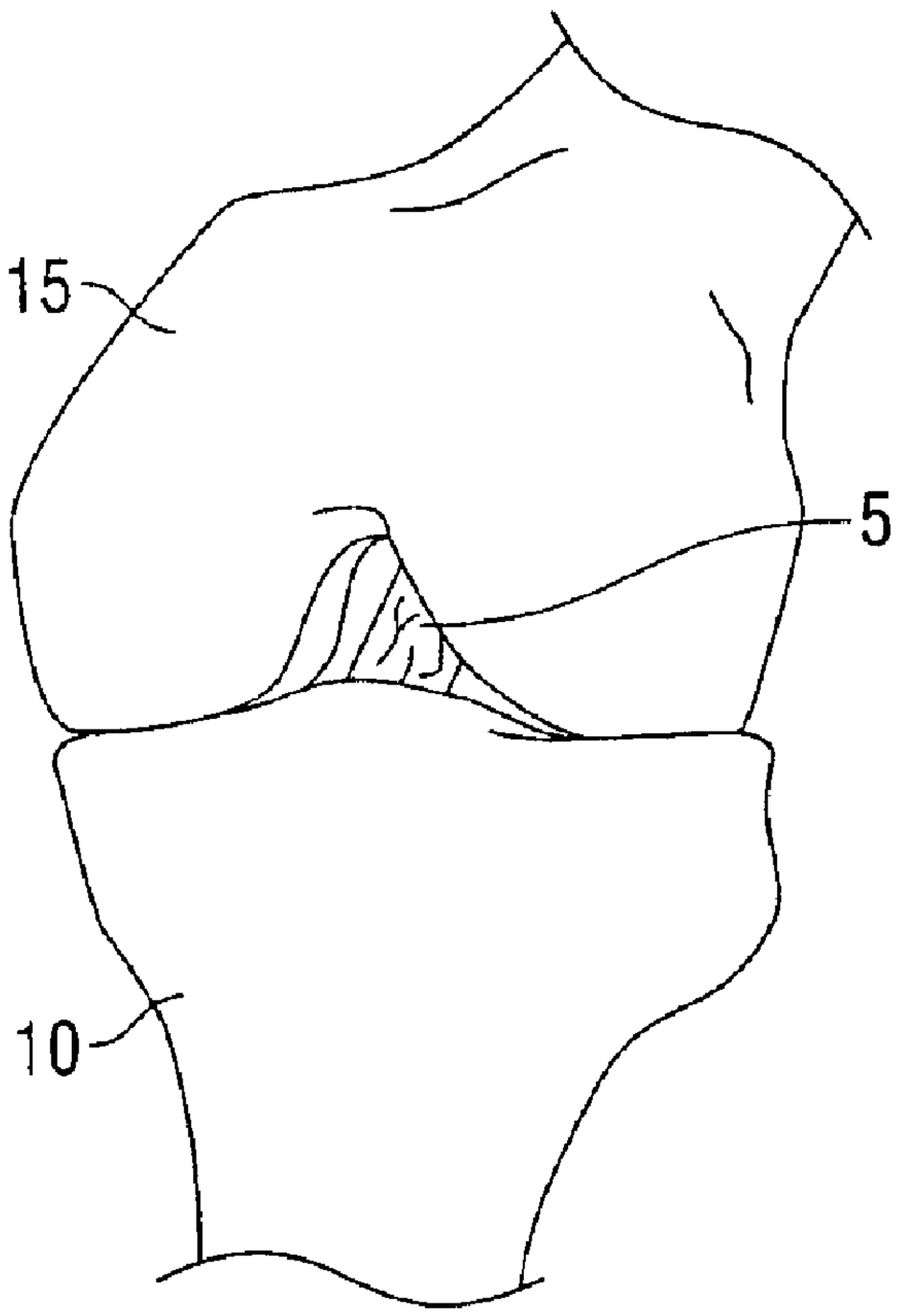
(54) Title: GUIDE FOR CREATING FEMORAL TUNNEL DURING ACL RECONSTRUCTION



(57) Abrégé/Abstract:
A guide for positioning a guide wire on a femur to allow a tunnel to be formed in the femur along the guide wire is provided. The guide includes an elongated body having proximal and distal ends, and a distal tip formed on the distal end of the elongated body, the distal tip having a diameter substantially similar in size to the diameter of the desired resultant femoral tunnel, wherein the elongated body and the distal tip are cannulated to receive the guide wire.

ABSTRACT

A guide for positioning a guide wire on a femur to allow a tunnel to be formed in the femur along the guide wire is provided. The guide includes an elongated body having proximal and distal ends, and a distal tip formed on the distal end of the elongated body, the distal tip having a diameter substantially similar in size to the diameter of the desired resultant femoral tunnel, wherein the elongated body and the distal tip are cannulated to receive the guide wire.

GUIDE FOR CREATING FEMORAL TUNNEL DURING ACL RECONSTRUCTION

BACKGROUND

Technical Field

[0001] This invention relates to surgical apparatus and procedures in general, and more particularly to surgical apparatus and procedures for reconstructing a ligament.

Background of Related Art

[0002] A ligament is a piece of fibrous tissue which connects one bone to another. Ligaments are frequently damaged (e.g., detached or torn or ruptured, etc.) as the result of injury and/or accident. A damaged ligament can cause instability, impede proper motion of a joint and cause pain. Various procedures have been developed to repair or replace a damaged ligament. The specific procedure used depends on the particular ligament which is to be restored and on the extent of the damage.

[0003] One ligament which is frequently damaged as the result of injury and/or accident is the anterior cruciate ligament (i.e., the ACL). Looking first at Figs. 1 and 2, it will be seen that the ACL 5 extends between the top of the tibia 10 and the bottom of the femur 15. A damaged ACL can cause instability of the knee joint and cause substantial pain and arthritis. For this reason, ACL reconstruction is a common procedure with more than 100,000 cases being performed in the United States annually.

[0004] Various procedures have been developed to restore and/or reconstruct a damaged ACL through a graft ligament replacement. Traditionally, this procedure is performed utilizing a trans-tibial approach. In this approach, a tibial tunnel or bone tunnel 20 is created in tibia 20 by drilling up through tibia 10. Bone tunnel 20 is then used to access an inner surface of femur 15 to drill a bone tunnel 25 up into femur 15. More particularly, once tibial tunnel 20 is created, a conventional femoral guide, often referred to as an "over-the-top" guide (Fig. 4), is used to

accurately locate the femoral tunnel 25. More specifically, the "over-the-top" guide is placed through the tibial tunnel, across the joint, through the femoral notch, and then into position so that the distal finger of the guide is positioned against the backside of the femur. (Fig. 5).

[0005] Proper placement of the femoral tunnel is imperative in order for the ACL graft to be properly positioned on the femur. However, as a result of using the aforementioned trans-tibial technique and the aforementioned conventional "over-the-top" femoral guide, the position of the femoral tunnel is effectively dictated by the position of the first-drilled tibial tunnel. This often results in a femoral tunnel position, and thus, an ACL reconstruction (i.e., graft orientation, etc.) that is less than optimal.

[0006] In an attempt to better position the femoral tunnel, surgeons have recently begun utilizing the so-called "medial portal technique" to drill and create the femoral tunnel. By drilling the femoral tunnel through the medial portal or an accessory portal, the femoral and tibial tunnels may be drilled independently of one another and, therefore, in a more appropriate anatomical position.

[0007] As shown in Fig. 6, when drilling the femoral tunnel through the medial portal, surgeons typically still use the same "over-the-top" femoral guide used during the aforementioned trans-tibial approach. However, because the "over-the-top" femoral guide is designed for use in a trans-tibial approach, the "over-the-top" femoral guide is not ideal for use in a medial portal approach. These "over-the-top" femoral guides generally have narrow-shaped distal tip geometries to aid in their ability to pass through the tibial tunnel. In addition, such femoral guides have an offset spatula design to hook the posterior femoral notch, thereby aiding in positioning of the guide. Aside from this spatula design, these femoral guides have no other specific referencing geometries for properly positioning the femoral tunnel.

[0008] Traditionally, surgeons utilize what is known as a "clock face" orientation in

order to decide where to place the femoral tunnel within the notch of knee. This clock face orientation technique designates positions along the notch from 9 o'clock to 3 o'clock, depending on which knee is being reconstructed. This technique, while seemingly simplistic, is limited by a number of factors, one being that the positioning of the imaginary clock face along the notch is completely subjective and hence widely affected by the specific implementation of the surgeon.

[0009] Therefore, it would be beneficial to have a femoral guide for use in medial approach ACL reconstruction surgery that is configured for more accurate femoral tunnel positioning. In addition, it would be beneficial if the femoral guide is designed in such a way that it might also be utilized during a trans-tibial approach.

SUMMARY

[0010] A guide for positioning a guide wire on a femur to allow a tunnel to be formed in the femur along the guide wire is provided. The guide includes an elongated body having proximal and distal ends, and a distal tip formed on the distal end of the elongated body, the distal tip having a diameter substantially similar in size to the diameter of the desired resultant femoral tunnel, wherein the elongated body and the distal tip are cannulated to receive the guide wire.

[0011] The distal tip further may further include at least one of opposed fingers and a distal projection. The opposed fingers or distal projection may be configured to reference a leading edge of the posterior cruciate ligament. The opposed fingers or distal projections may further be configured to reference a posterior femoral cortex. The elongated body may be configured to extend across a knee joint, the length of a tibial tunnel, or out of a medial port. The distal end may include a substantially circular cross-section, a substantial semi-spherical cross-section, or an unroofed cross-section.

[0012] Additionally, provided is method of positioning a femoral tunnel during an ACL

reconstruction. The method includes the steps of providing a femoral guide including an elongated body having a distal end, the distal end including a diameter substantially similar in size to the diameter of the desired resultant femoral tunnel, wherein the elongated body and the distal end are cannulated to receive a guide wire therethrough, inserting the femoral guide into a knee joint, positioning the distal end of the guide against the femur, and inserting the guide wire through the femoral guide and into the femur.

[0013] The femoral guide may include one of opposed fingers and distal projection configured for referencing a posterior cruciate ligament. The method may further include the step of referencing a leading edge of a posterior cruiciate ligament and/or the posterior femoral cortex. The method may also include the step of flexing the knee to 120 degrees. The femoral guide may be inserted into the knee joint using a medial portal approach or a trans-tibial approach.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the disclosure and, together with a general description of the disclosure given above, and the detailed description of the embodiment(s) given below, serve to explain the principles of the disclosure, wherein:

[0015] FIG. 1 is a perspective view of a knee joint showing an ACL;

[0016] FIG. 2 is an alternate perspective view of the knee joint of FIG. 1;

[0017] FIG. 3 is a perspective view of a knee joint including tibial and femoral tunnels (shown in phantom) and a ligament graft;

[0018] FIG. 4 is a side view of a conventional "over-the-top" femoral guide;

[0019] FIG. 5 is side view of a knee joint including the "over-the-top" femoral guide of

FIG. 4 accessing the femur using the trans-tibial approach;

[0020] FIG. 6 is a side view of a knee joint including the "over-the-top" femoral guide of FIG. 4 access the femur using the medial portal approach;

[0021] FIGS. 7A-7C are side views of the distal end of various embodiments of a femoral guide according to the present disclosure;

[0022] FIGS. 8A-8C are end views of the distal end of the embodiments of FIGS. 7A-7C, respectively;

[0023] FIGS. 9A-9C are end views of the distal end of alternative embodiments of a femoral guide according to the present disclosure;

[0024] FIG. 10A is a side view of a distal end of a femoral guide according to another embodiment of the present disclosure;

[0025] FIG. 10B is an end view of the distal end of the femoral guide of FIG. 10A;

[0026] FIG. 10 C is a side view of the femoral guide of FIGS. 10A and 10B;

[0027] FIG. 10 D is an end view of the femoral guide of FIGS. 10A-10C;

[0028] FIG. 10 E is top view of the distal end of the femoral guide of FIGS. 10A-10D;

[0029] FIG. 11 is a partial cut-away view of a femoral guide according to an embodiment of the present disclosure being used in a medial portal approach;

[0030] FIG. 12 is a partial cut-away view of a femoral guide according to an embodiment of the present disclosure being used in a trans-tibial approach;

[0031] FIG. 13 is a side view of the proximal end of a femoral guide according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0032] The femoral guide of the present disclosure is designed to be used in determining the position of a femoral tunnel guide wire which facilitates position of a femoral tunnel during an ACL reconstruction. As with conventional femoral guides, the femoral guide of the present disclosure may reference an "over-the-top" position with an offset spatula; however, it can also be designed and utilized without such an offset spatula. This includes having no spatula, or instead having one or multiple spike projections or other similar projections to hold the spatula in position on the bone.

[0033] Figs. 7A-10E show various embodiments of a femoral guide 100 formed in accordance with the present disclosure. Femoral guide 100 generally includes a distal tip 105 and a shaft 110 extending proximally therefrom. Distal tip 105 of femoral guide 100 may be dimensioned and configured to have the same geometry and circumference as the desired resulting femoral tunnel. In this manner, distal tip 105 acts as a visual aid to assist the surgeon in determining proper tunnel placement by providing a direct visual confirmation of where the resulting femoral tunnel will be located. Alternatively, distal tip 105 may be formed with a semi-hemispherical cross-section (FIGS. 7B, 8B and 9B), or with an "unroofed" cross-section (FIGS. 7C, 8C, 9C and 10A-E) to aid in visualization.

[0034] Shaft 110 of femoral guide 100 is configured to be of such a length so as to at least extend (i) across the knee joint, (ii) across the length of the tibial tunnel and/or (iii) out of the medial portal. Shaft 110 and distal tip 105 are cannulated so as to accept (and thereby aim) a guidewire of an appropriate circumference, length and width.

[0035] In addition, the geometry of distal end 105 of femoral guide 100 may include (i) diametrically-opposed fingers 115 (FIGS. 9A-9C), and/or (ii) a distal projection 120 (FIGS. 10A-10E). Fingers 115 and/or projection 120 serve to reference the leading edge of the posterior

cruciate ligament (PCL) and the posterior femoral cortex. Using the PCL as an anatomical reference enables a surgeon to set the femoral guide wire, and therefore the resulting femoral tunnel, in a position that better avoids any impingement of the PCL after the graft ligament has been placed in position. Such ACL/PCL impingement occurs when the femoral tunnel has been improperly positioned. In this manner, femoral guide 100 is configured to avoid any such ACL/PCL impingement, by using the PCL as an anatomical reference during formation of the femoral tunnel.

[0036] As shown in Fig. 11, femoral guide 100 is used in a medial portal approach with the knee in hyper-flexion, at approximately 120 degrees. However, it should be appreciated that femoral guide 100 may also be used with any ACL reconstruction approach, and with any angle of knee flexion. See, for example, Fig. 12, where femoral guide 100 is used during a traditional trans-tibial approach. Because of the size and/or configuration of distal end 105 of femoral guide 100, for use in the trans-tibial approach, femoral guide 100 may be halved, with one half for use with the right knee and the other half for use with the left knee.

[0037] Once the location of femoral tunnel 25 is identified by the surgeon with distal end 105 of femoral guide 100, guide wire 30 (FIG. 11) is extended through the cannulated shaft of elongated body 110 and into femur 15. Once guide wires 30 has been inserted into femur 15 to a desired depth, femoral guide 100 is then removed from about guide wire 30 and from the medial portal into the knee. A cannulated drill bit (not shown) is then received about guide wire 30 and through the medial portal to drill femoral tunnel 25.

[0038] Looking next at Fig. 13, the proximal (or "butt") end 125 of femoral guide 100 is preferably provided with a docking port 130 to mate with a handle 135 to aid the surgeon in aiming the guide more easily and accurately. Handle 135 may be configured in any desired geometry so as to be ergonomically comfortable and/or to facilitate in the placement or holding of distal tip 105 in a particular position.

[0039] Femoral guide 100 provides surgeons with several significant improvements over prior art femoral guides. First, the distal portion of femoral guide 100 is configured (both in shape and diameter), to mirror that of the resulting tunnel and, therefore, the resulting graft. This gives the surgeon a visual "preview" or reference of the femoral tunnel prior to actually drilling the femoral tunnel. In addition, the distal shape of the femoral guide references the leading edge of the PCL's insertion onto the femur (i.e., the location where the PCL attaches to the femur) and places the resulting femoral tunnel in a position which avoids graft ACL/PCL impingement.

[0040] It should be understood that many additional changes in the details, materials, steps and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the present disclosure, may be made by those skilled in the art while still remaining within the principles and scope of the disclosure.

What Is Claimed Is:

1. A guide for positioning a guide wire on a femur to allow a tunnel to be formed in the femur along the guide wire, the guide comprising:

an elongated body having proximal and distal ends; and

a distal tip formed on the distal end of the elongated body, the distal tip having a diameter substantially similar in size to the diameter of the desired resultant femoral tunnel, wherein the elongated body and the distal tip are cannulated to receive the guide wire.

2. The guide of claim 1, wherein the distal tip further includes at least one of opposed fingers and a distal projection.

3. The guide of claim 2, wherein the opposed fingers or distal projection are configured to reference a leading edge of the posterior cruciate ligament.

4. The guide of claim 3, wherein the opposed fingers or distal projections are further configured to reference a posterior femoral cortex.

5. The guide of claim 1, wherein the elongated body is configured to extend across a knee joint.

6. The guide of claim 1, wherein the elongated body is configured to extend the length of a tibial tunnel.

7. The guide of claim 1, wherein the elongated body is configured to extend out of a medial port.

8. The guide of claim 1, wherein the distal end includes a substantially circular cross-section.

9. The guide of claim 1, wherein the distal end includes a substantial semi-spherical cross-section.

10. The guide of claim 1, wherein the distal end includes an unroofed cross-section.

11. A method of positioning a femoral tunnel during an ACL reconstruction, the method comprising the steps of:

providing a femoral guide including an elongated body having a distal end, the distal end including a diameter substantially similar in size to the diameter of the desired resultant femoral tunnel, wherein the elongated body and the distal end are cannulated to receive a guide wire therethrough;

inserting the femoral guide into a knee joint;

positioning the distal end of the guide against the femur; and

inserting the guide wire through the femoral guide and into the femur.

12. The method of claim 11, wherein the femoral guide includes one of opposed fingers and distal projection configured for referencing a posterior cruciate ligament.

13. The method of claim 12, further including the step of referencing a leading edge of a posterior cruiciate ligament.

14. The method of claim 12, further including the step of referencing the posterior femoral cortex.

15. The method of claim 11, further including flexing the knee to 120 degrees.

16. The method of claim 11, wherein the femoral guide is inserted into the knee joint using a medial portal approach.

17. The method of claim 11, wherein the femoral guide is inserted into the knee joint using a trans-tibial approach.

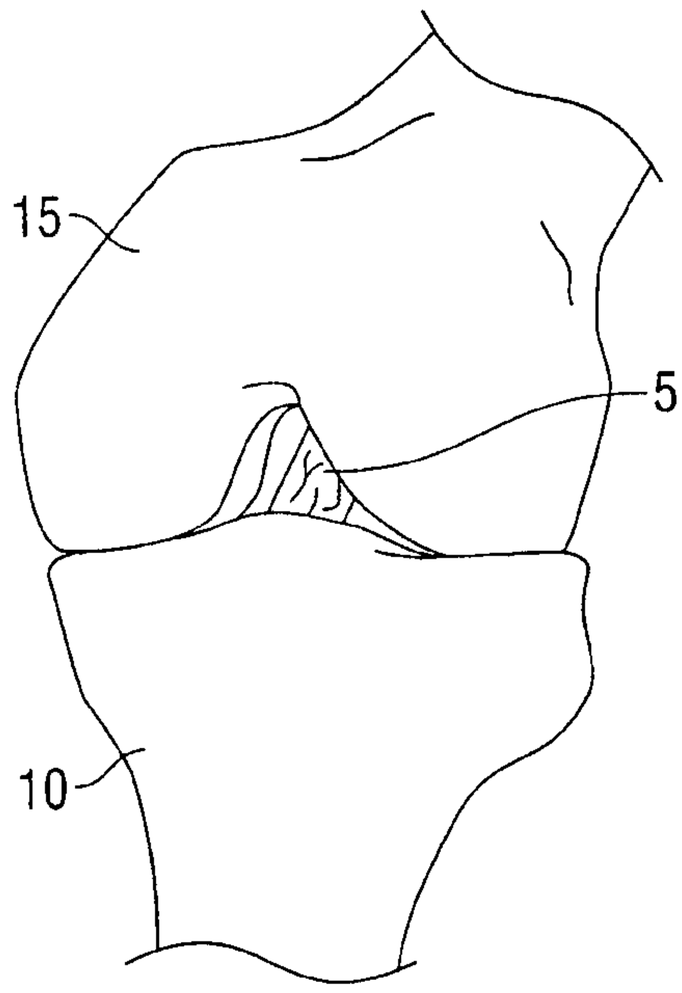


FIG. 1

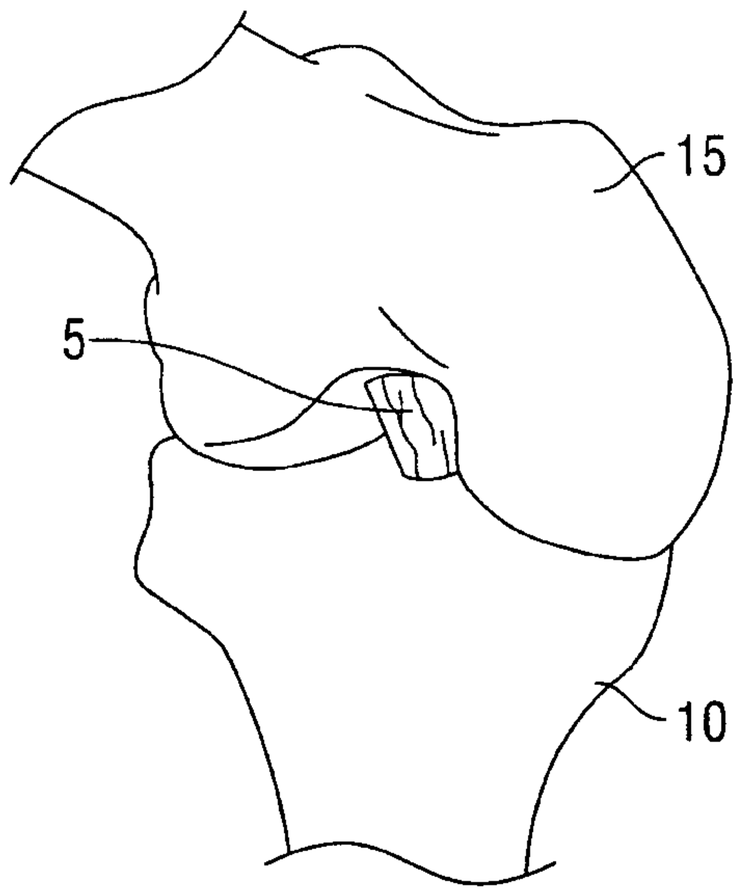


FIG. 2

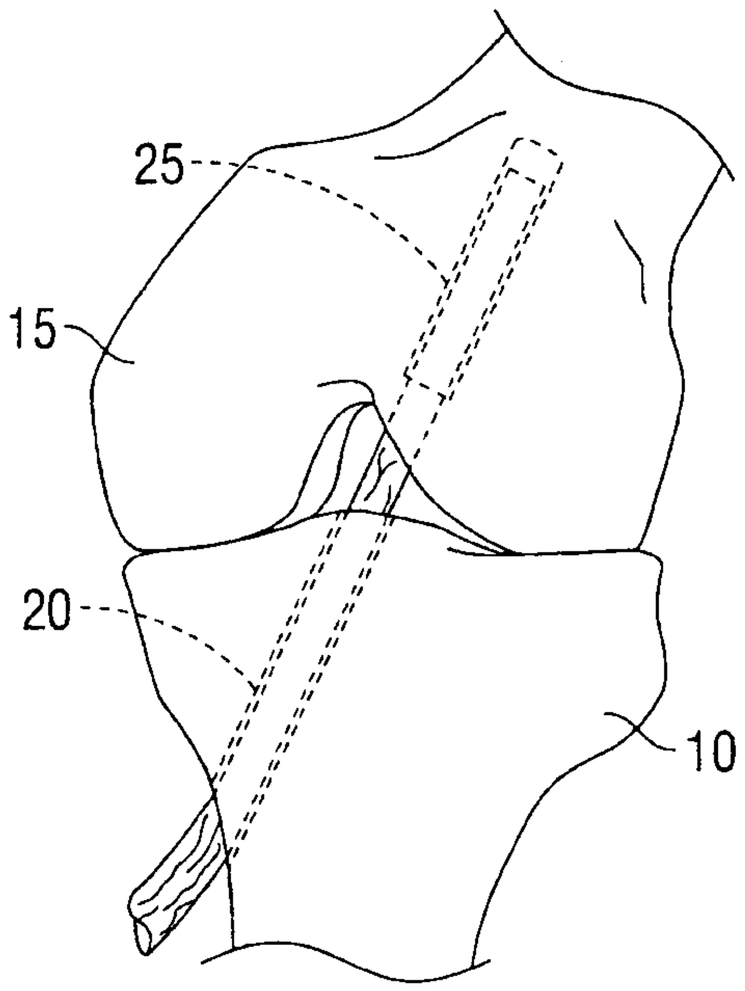


FIG. 3

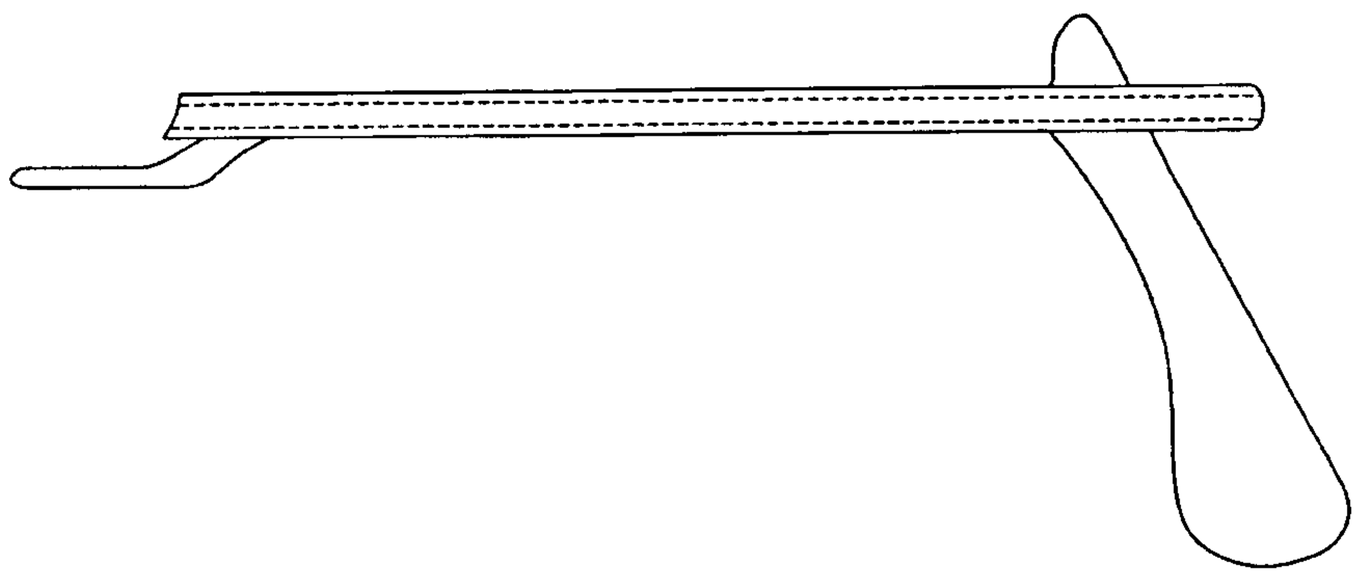


FIG. 4
Prior Art

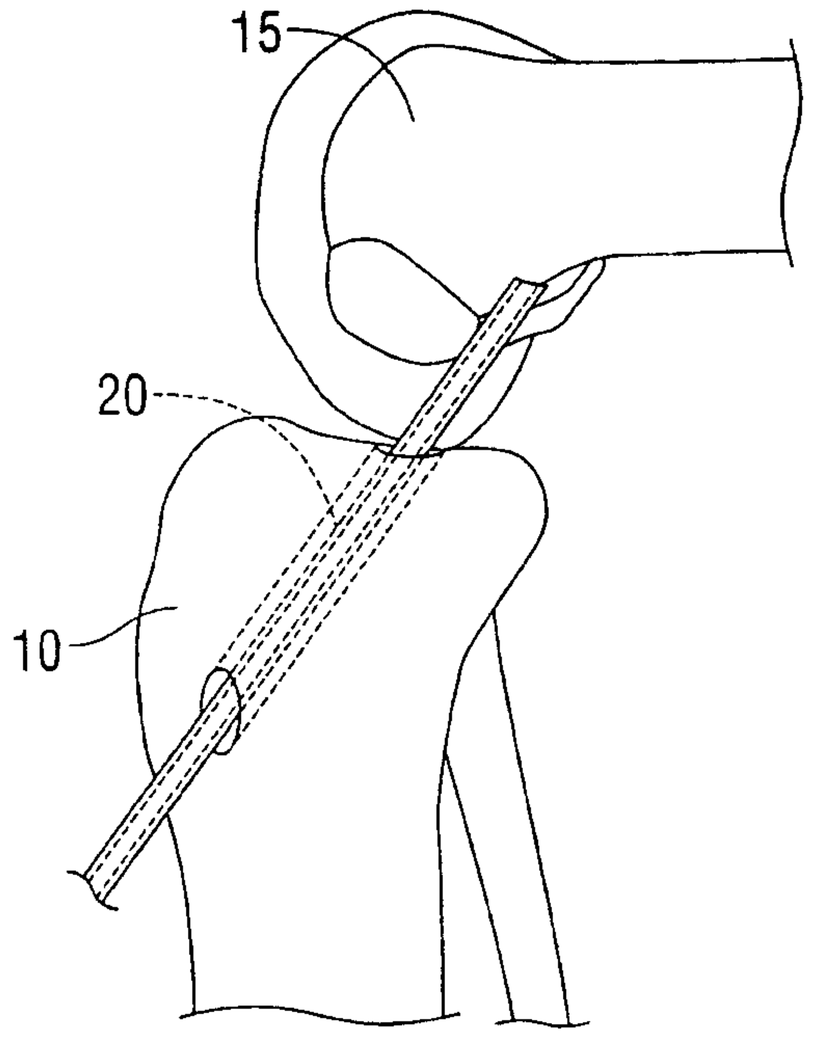


FIG. 5
Prior Art

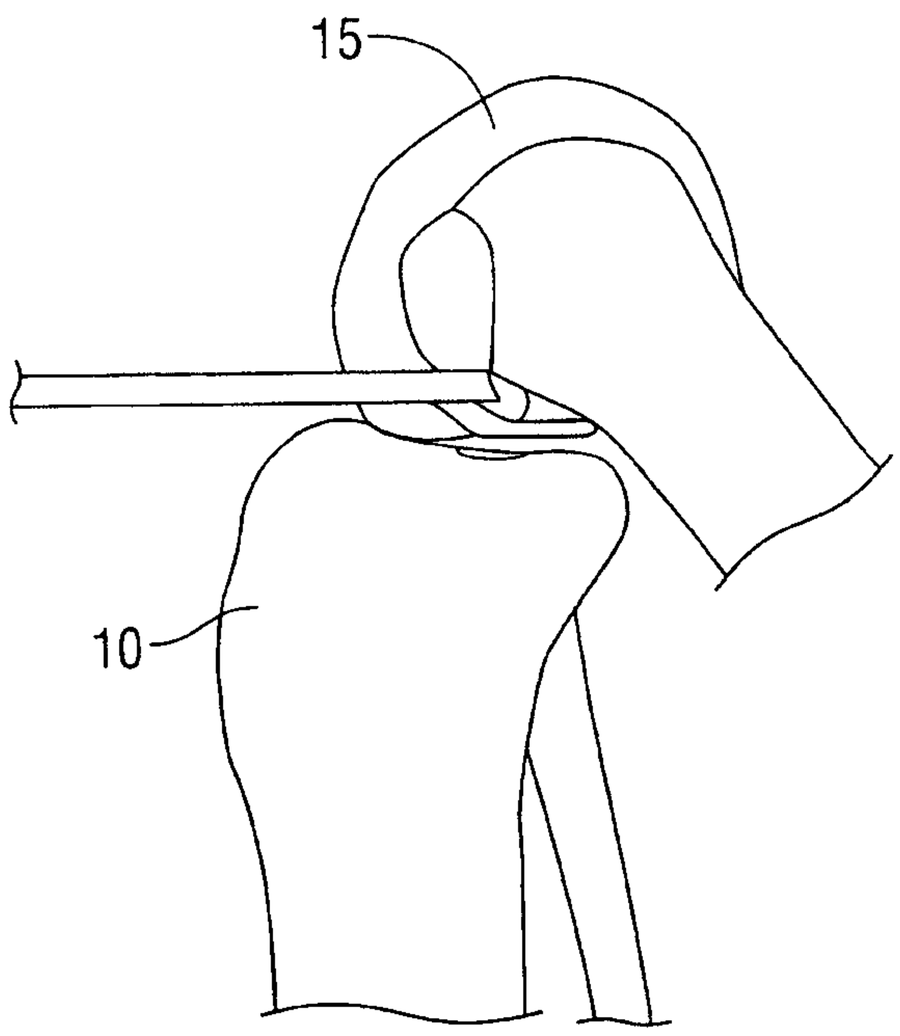


FIG. 6
Prior Art

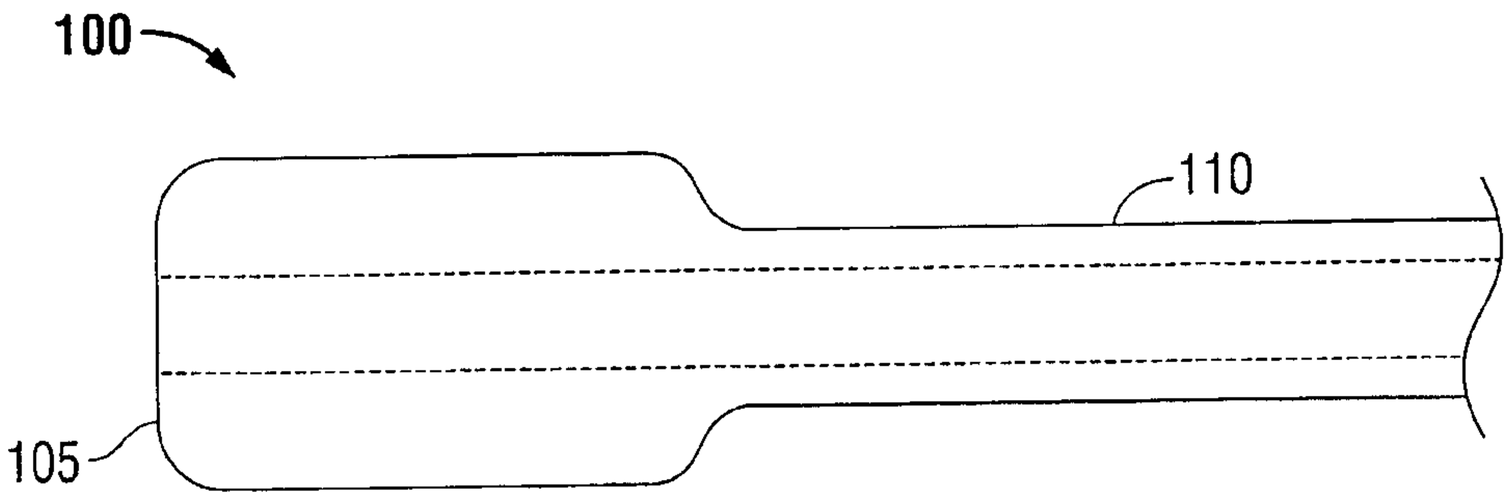


FIG. 7A

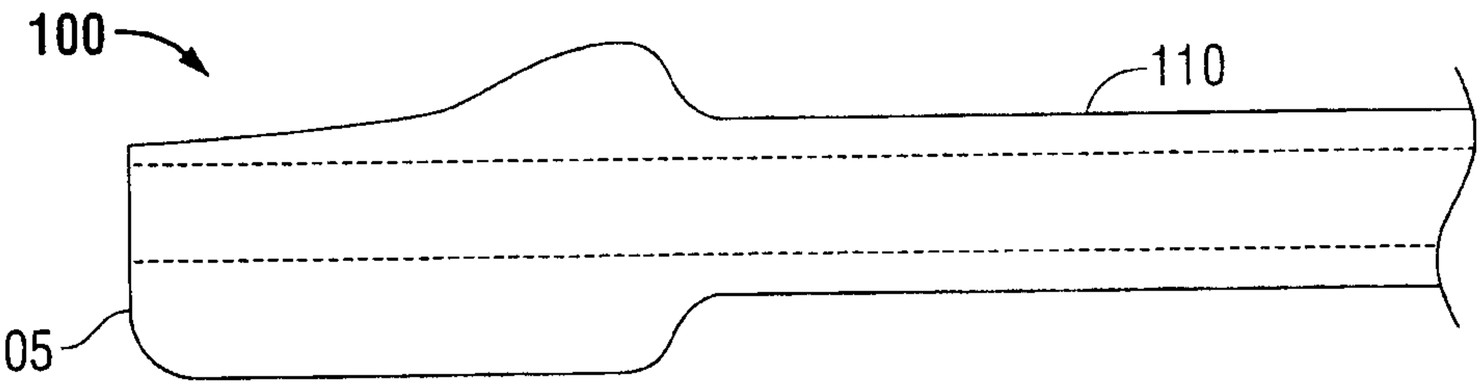


FIG. 7B

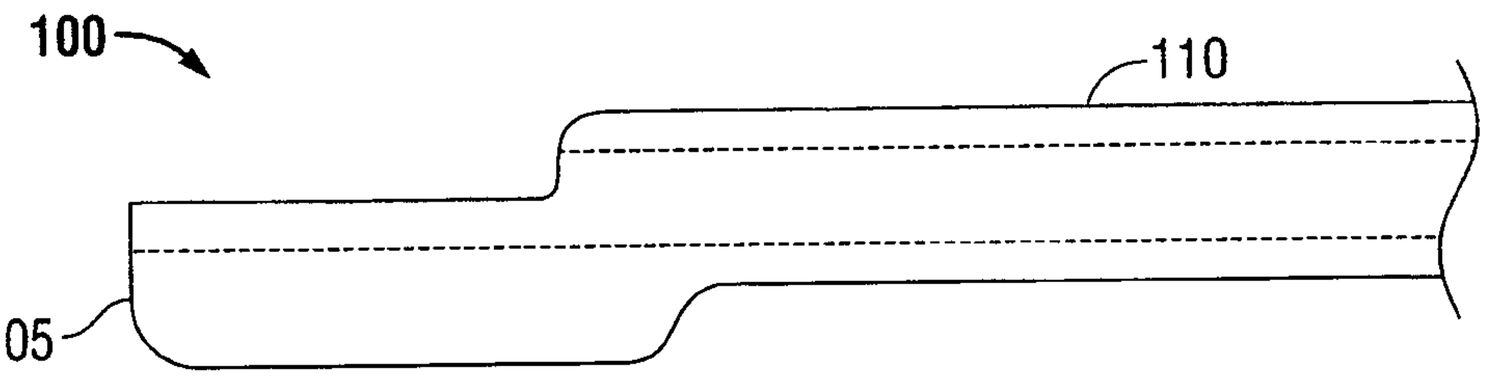


FIG. 7C

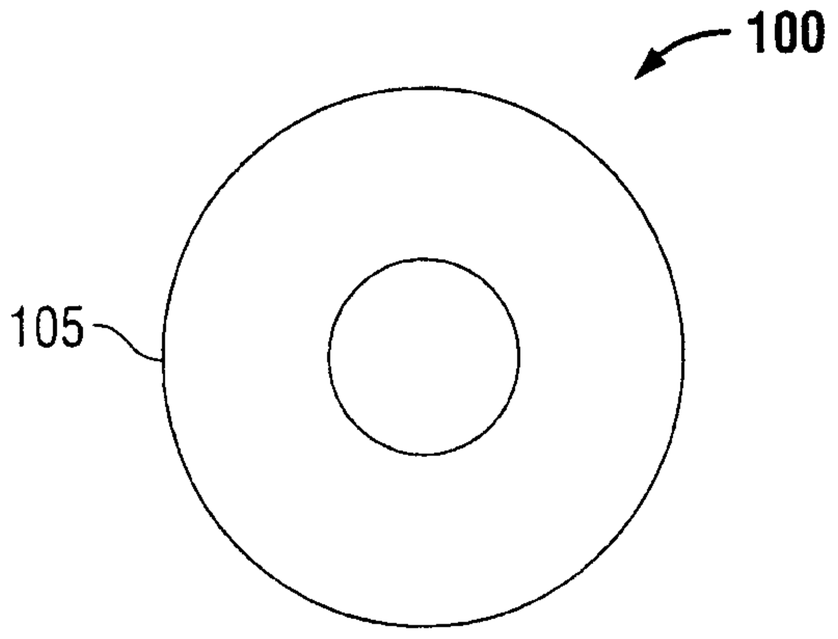


FIG. 8A

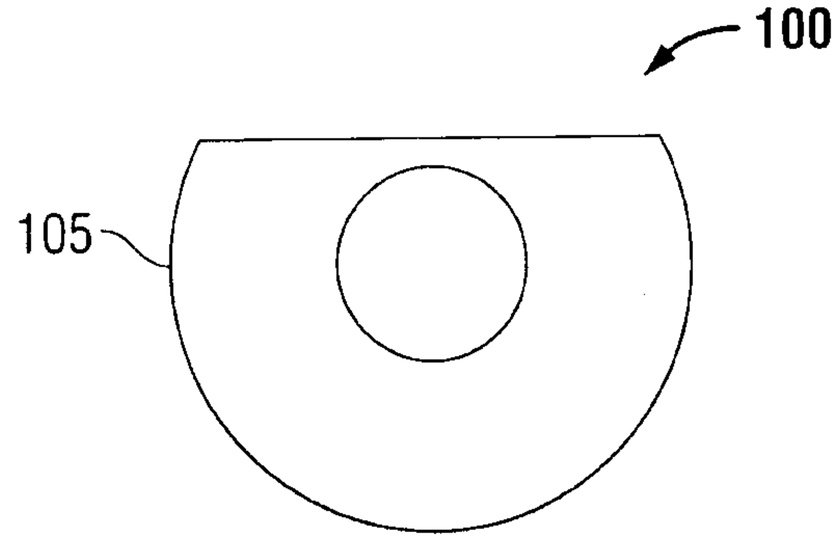


FIG. 8B

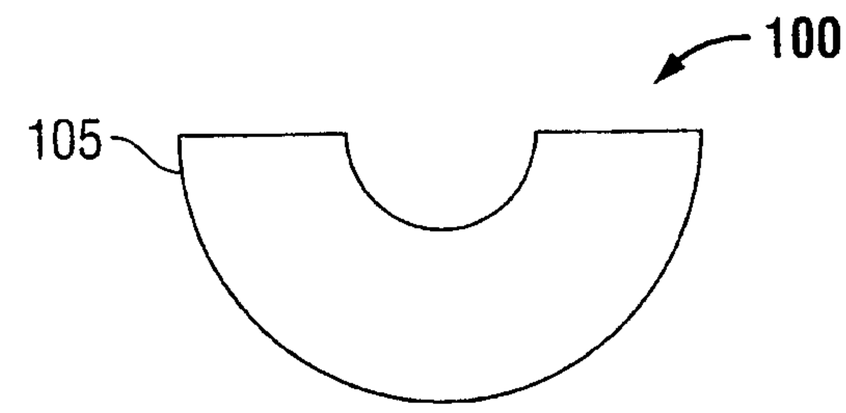


FIG. 8C

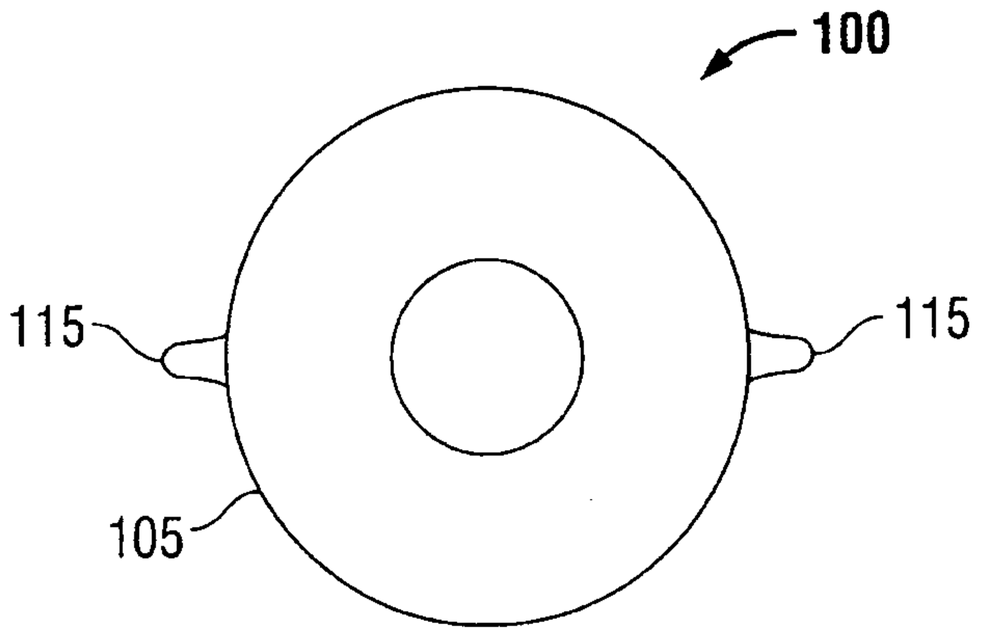


FIG. 9A

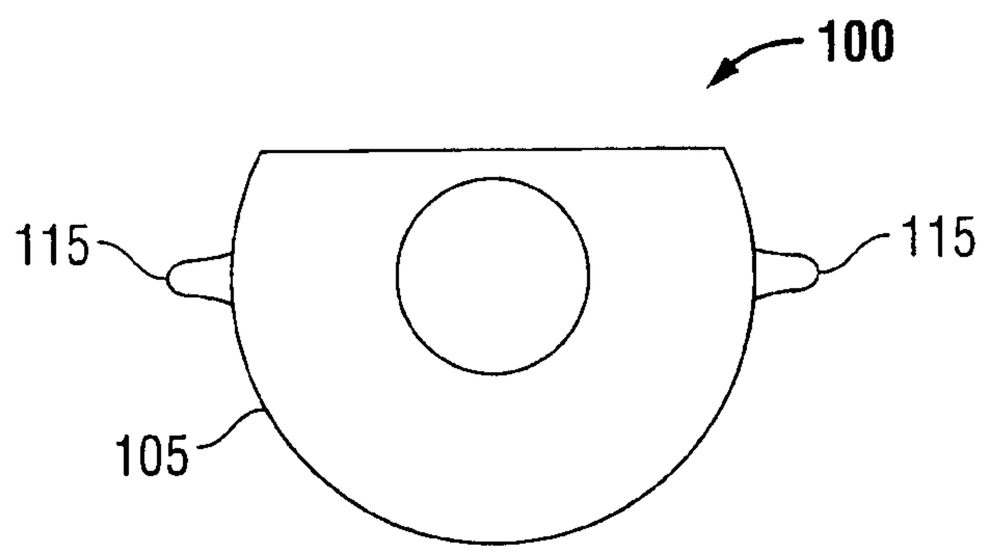


FIG. 9B

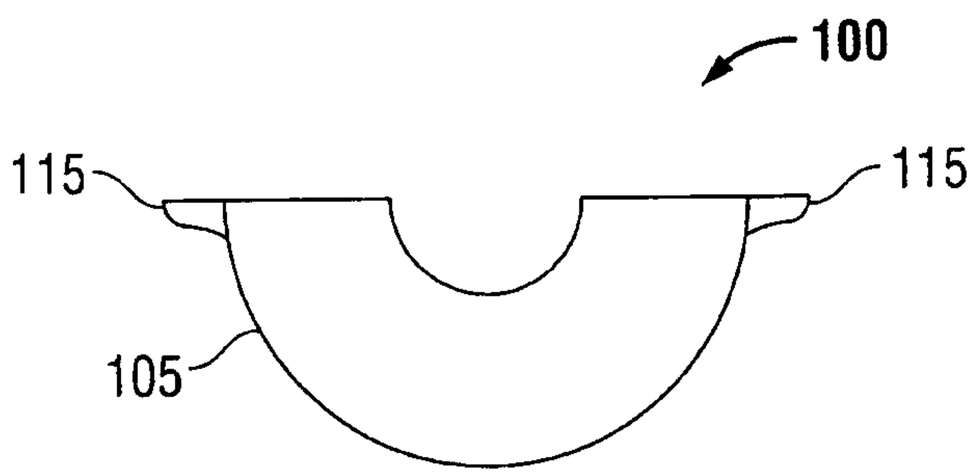


FIG. 9C

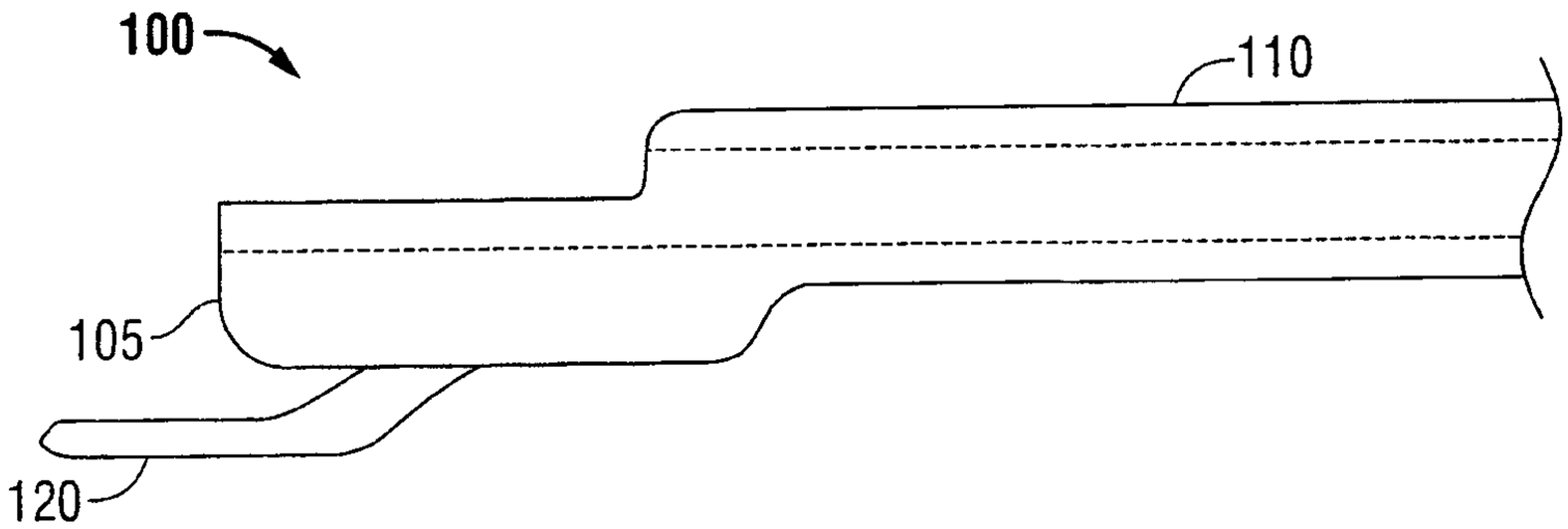


FIG. 10A

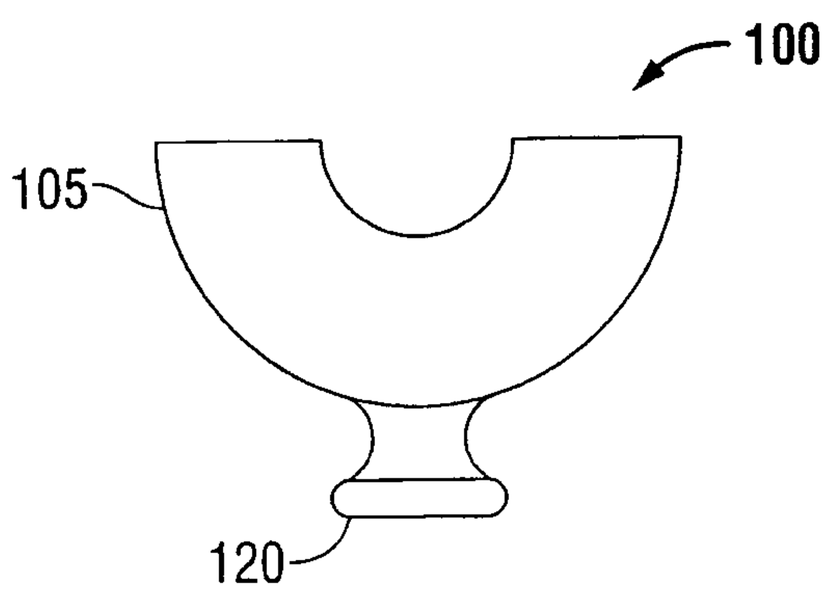


FIG. 10B

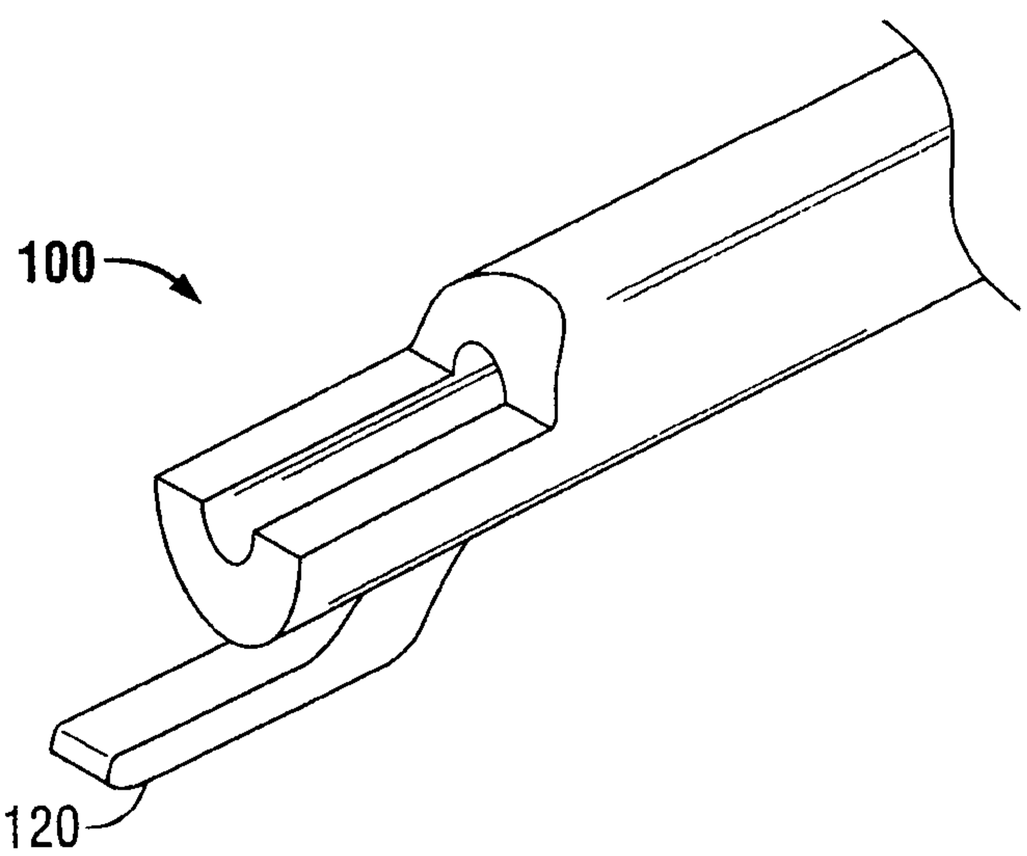


FIG. 10C

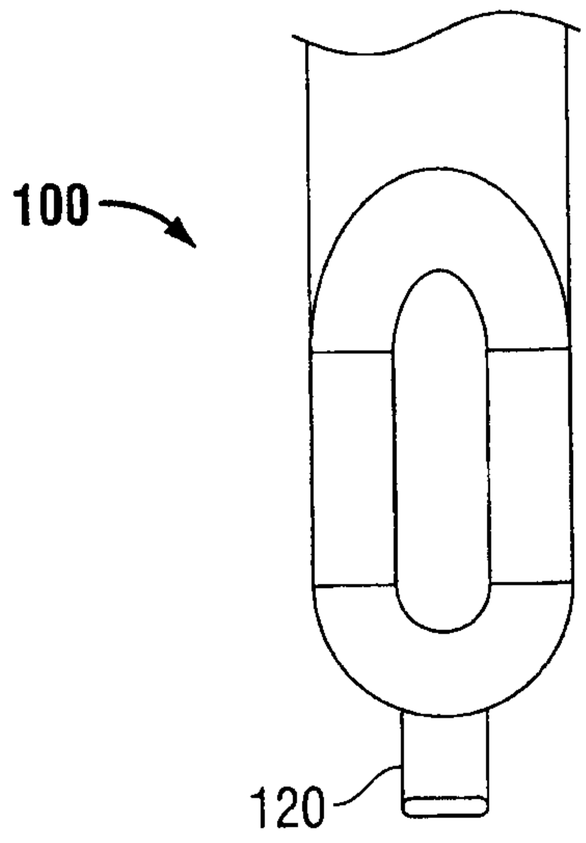


FIG. 10D

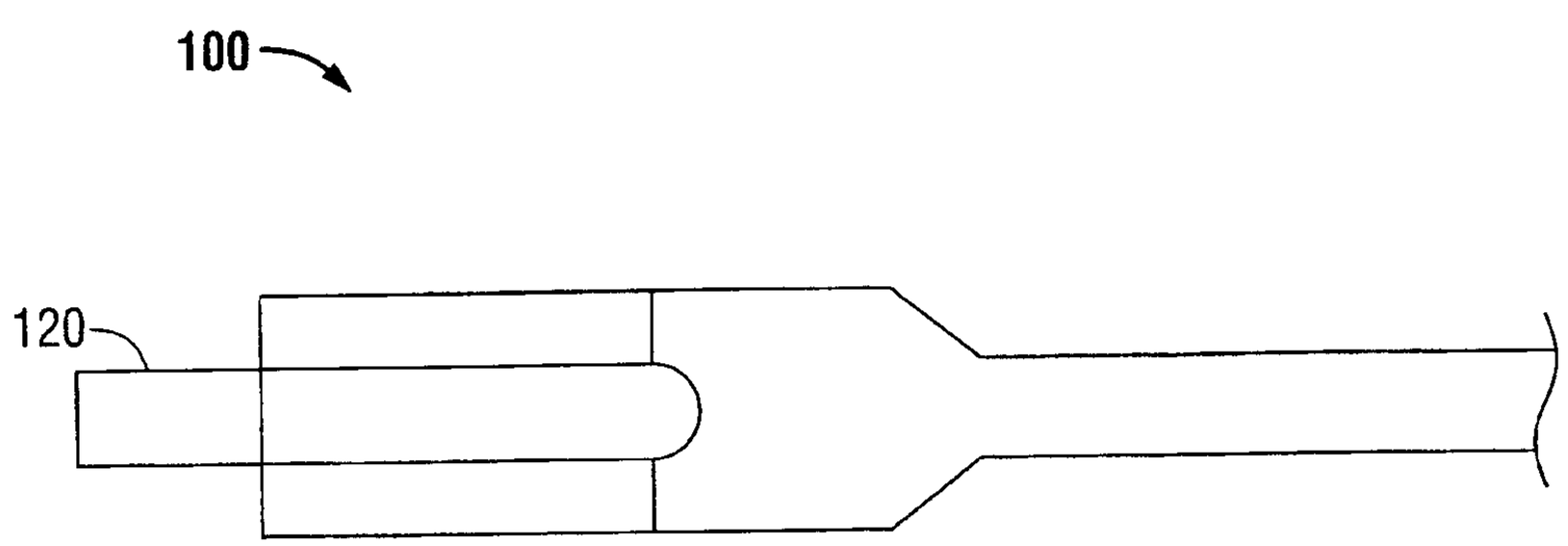


FIG. 10E

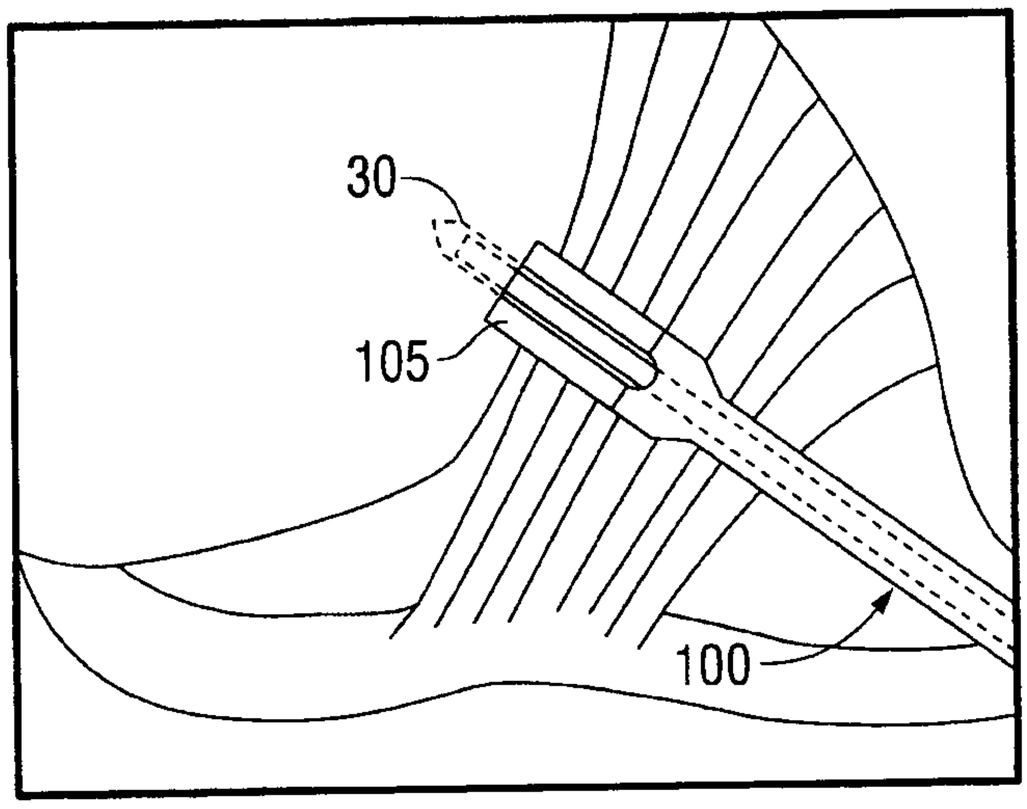


FIG. 11

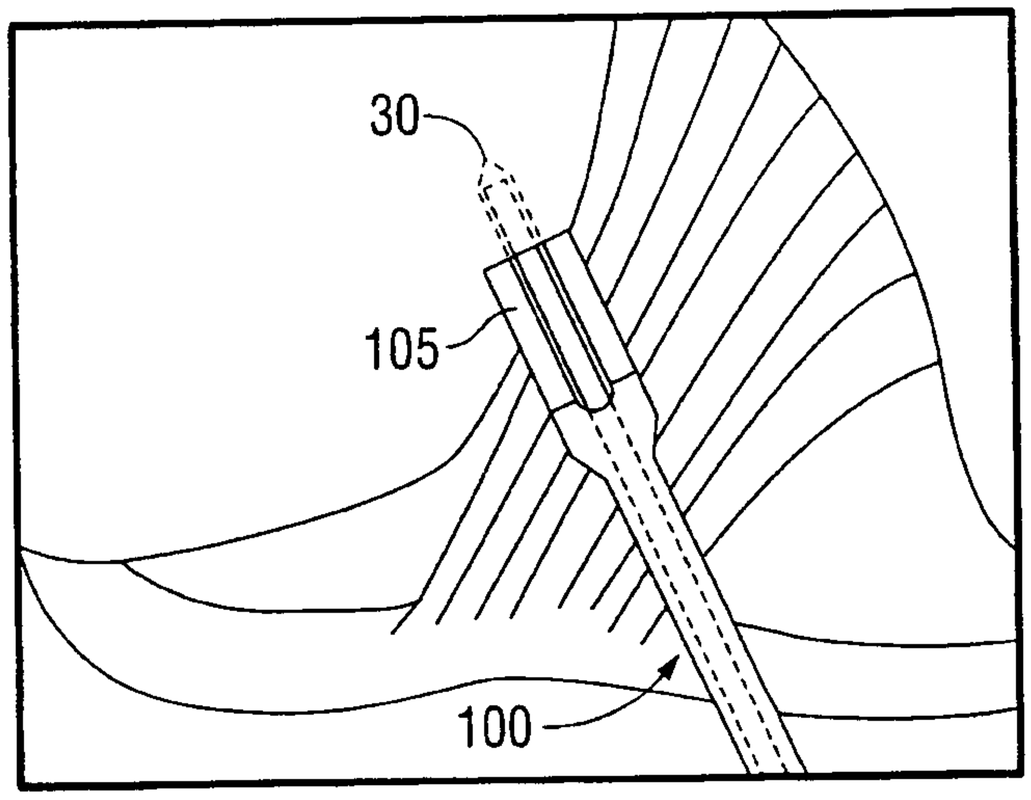


FIG. 12

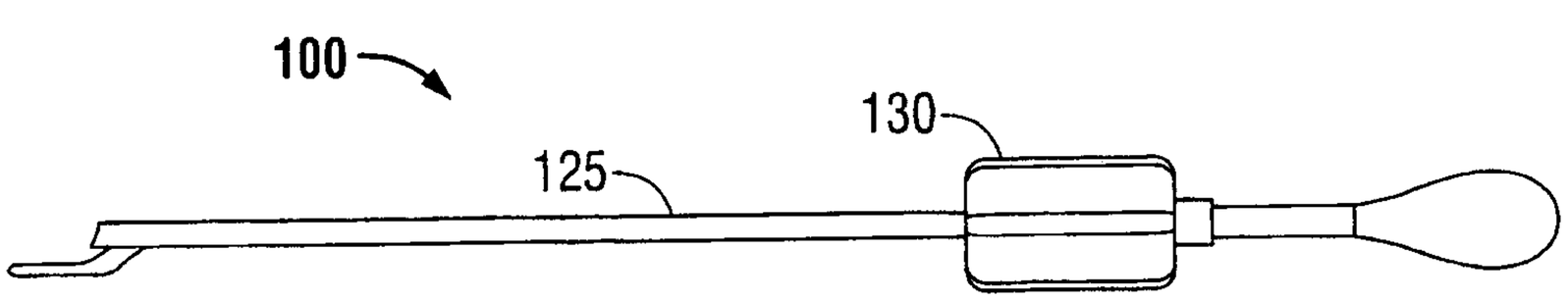
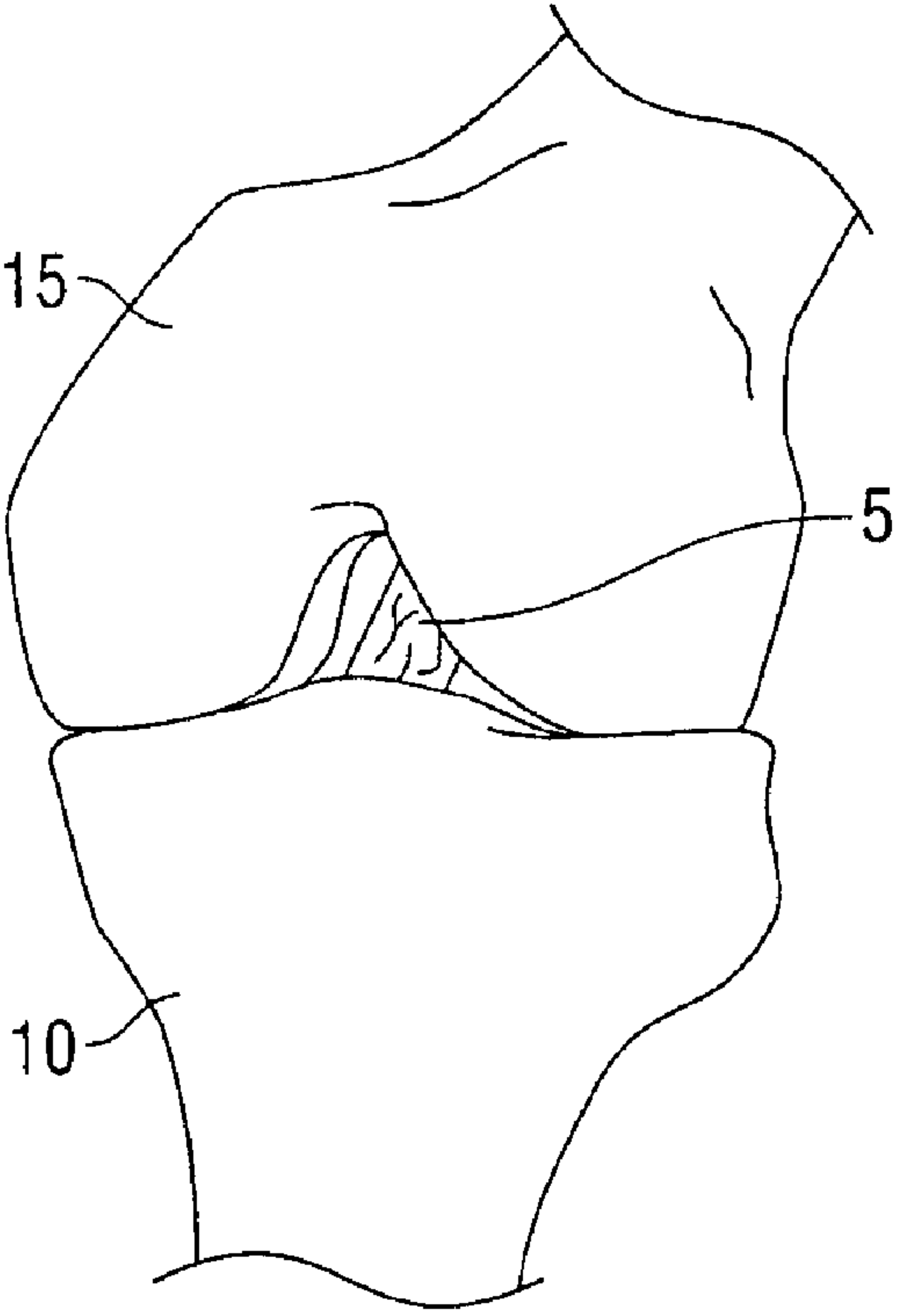


FIG. 13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