US 20060030465A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2006/0030465 A1**

Johnson et al. (43) **Pub. Date: Feb. 9, 2006**

(54) **RECONFIGURABLE ATTACHMENT FOR REHABILITATION EQUIPMENT**

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(21) Appl. No.: **10/911,571**

(22) Filed: **Aug. 5, 2004**

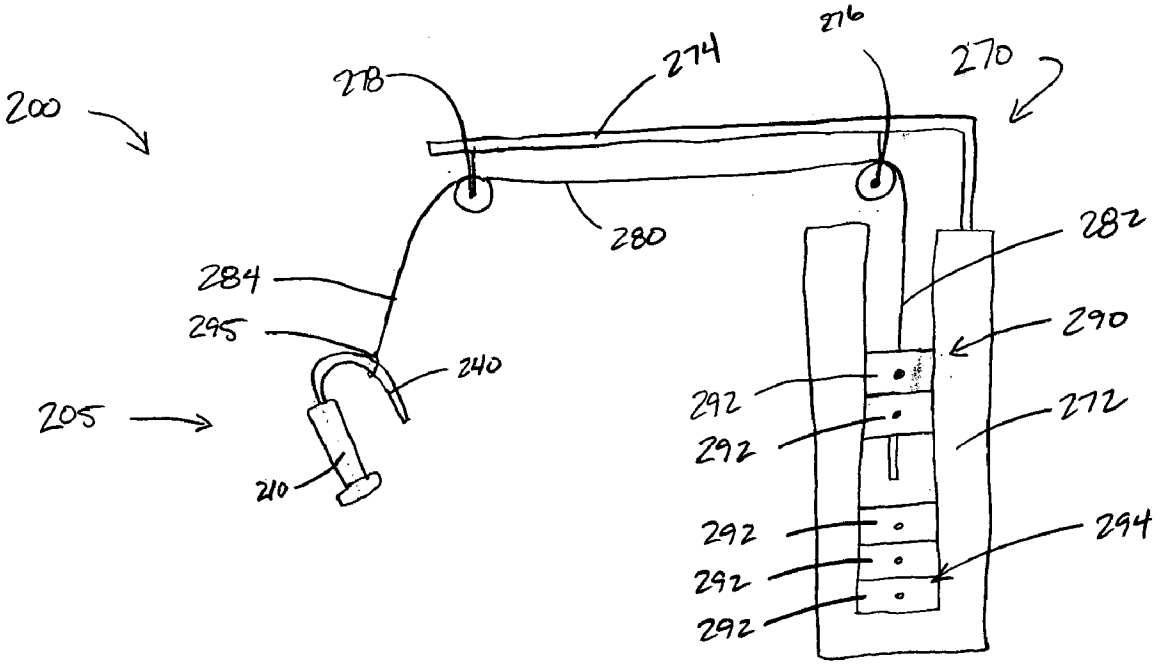
Publication Classification

(51) **Int. Cl.**
A63B 71/00 (2006.01)
A63B 23/00 (2006.01)

(52) **U.S. Cl.** **482/139**; 482/148

(57) **ABSTRACT**

An apparatus includes a handle member that has a grip portion and a coupling portion. In one embodiment, the grip portion is removably coupled to the coupling portion. The coupling portion is configured to be slidably coupled to a tension member such that the tension member may slide with respect to the coupling portion from a first portion of the coupling portion to a second portion of the coupling portion. In one embodiment, the travel distance of the tension member from the first portion of the coupling portion to the second portion of the coupling portion is greater than 2 inches (5 cm). In another embodiment, the grip portion includes a vertex location. A first axis is defined by the handle member and extends from the vertex location to the first portion of the coupling portion. A second axis is defined by the handle member and extends from the vertex location to the second portion of the coupling portion. In one embodiment, the angle defined by the first axis and the second axis is greater than 5°.



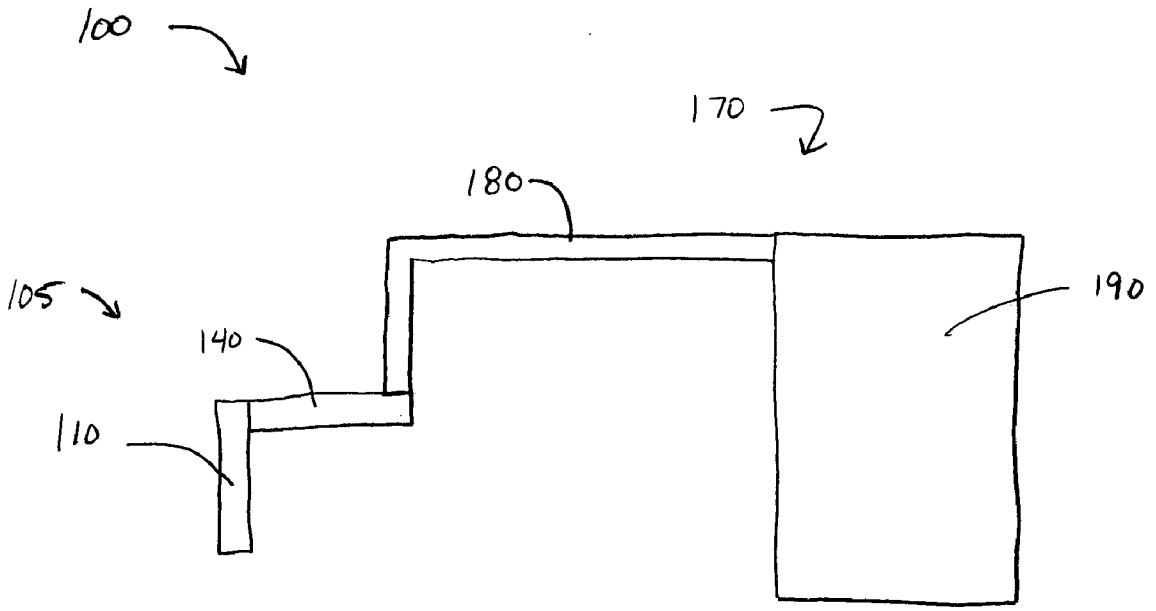


FIGURE 1

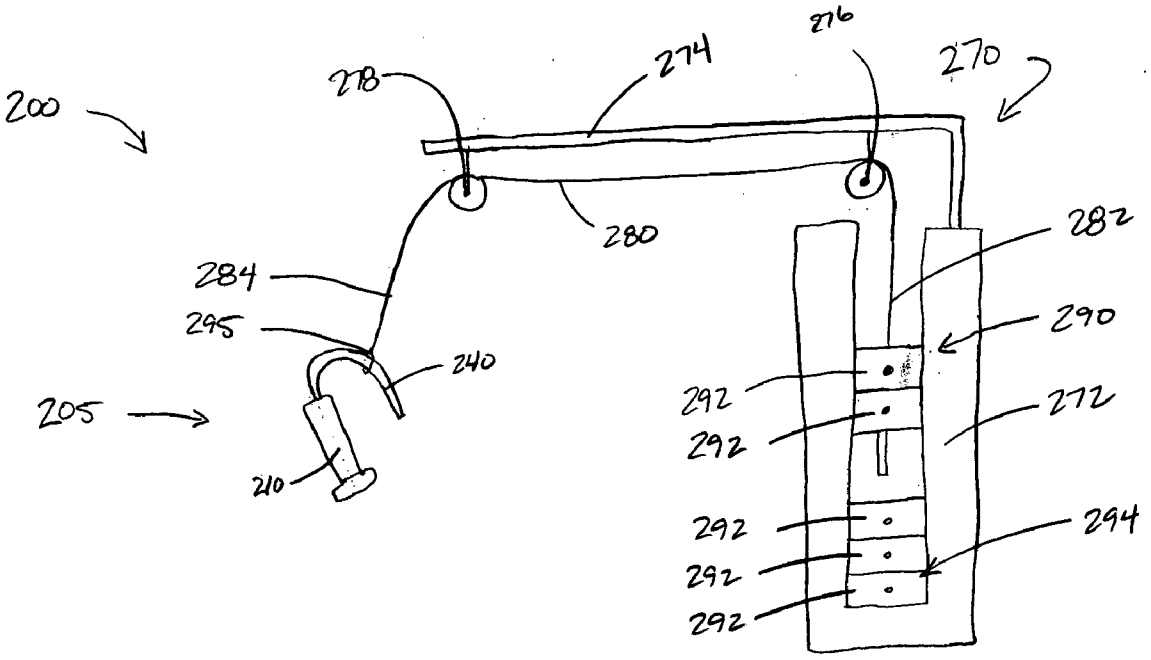


FIGURE 2

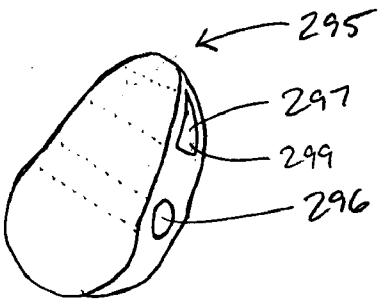


FIGURE 3

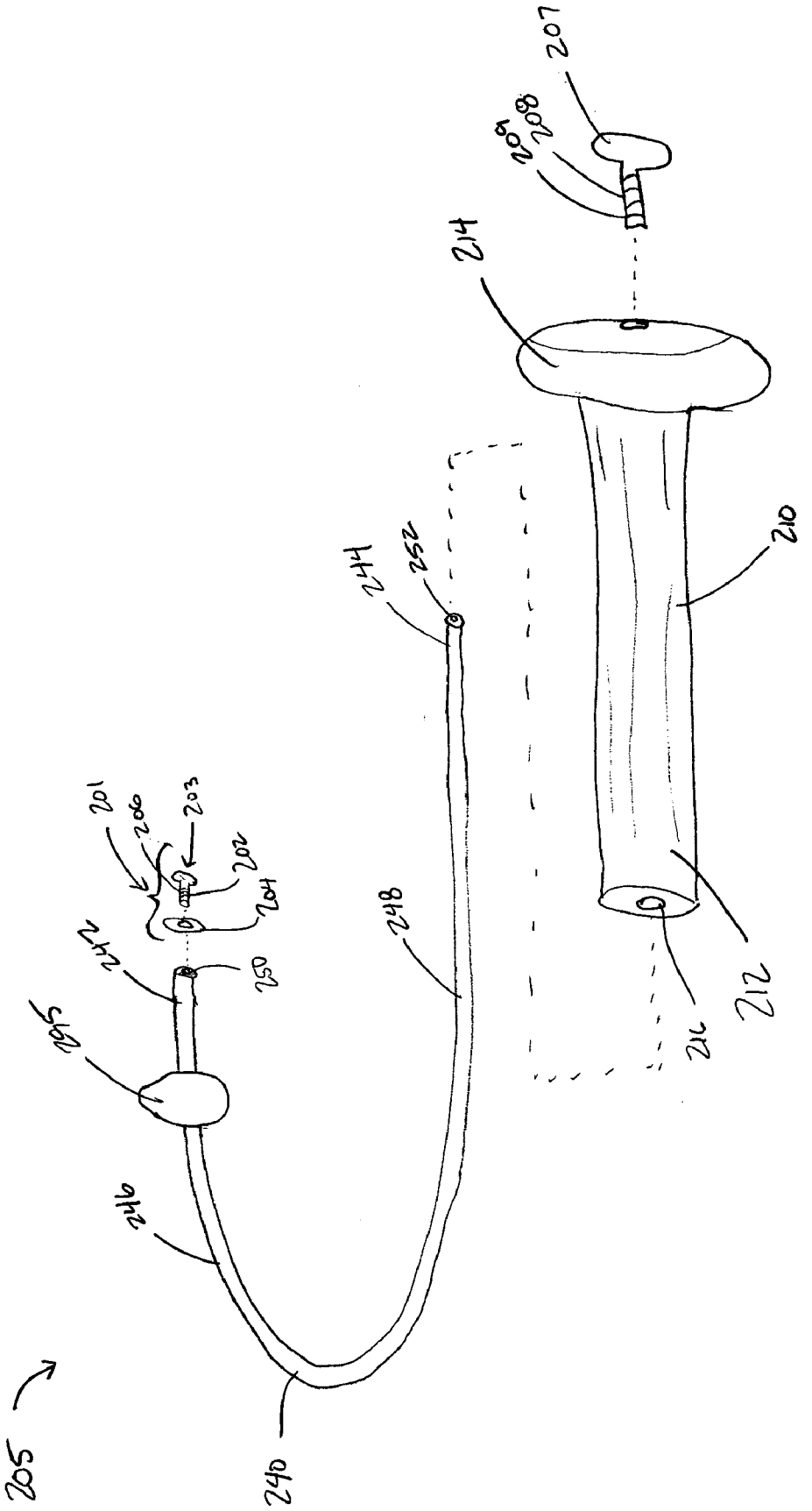

207
208
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FIGURE 4

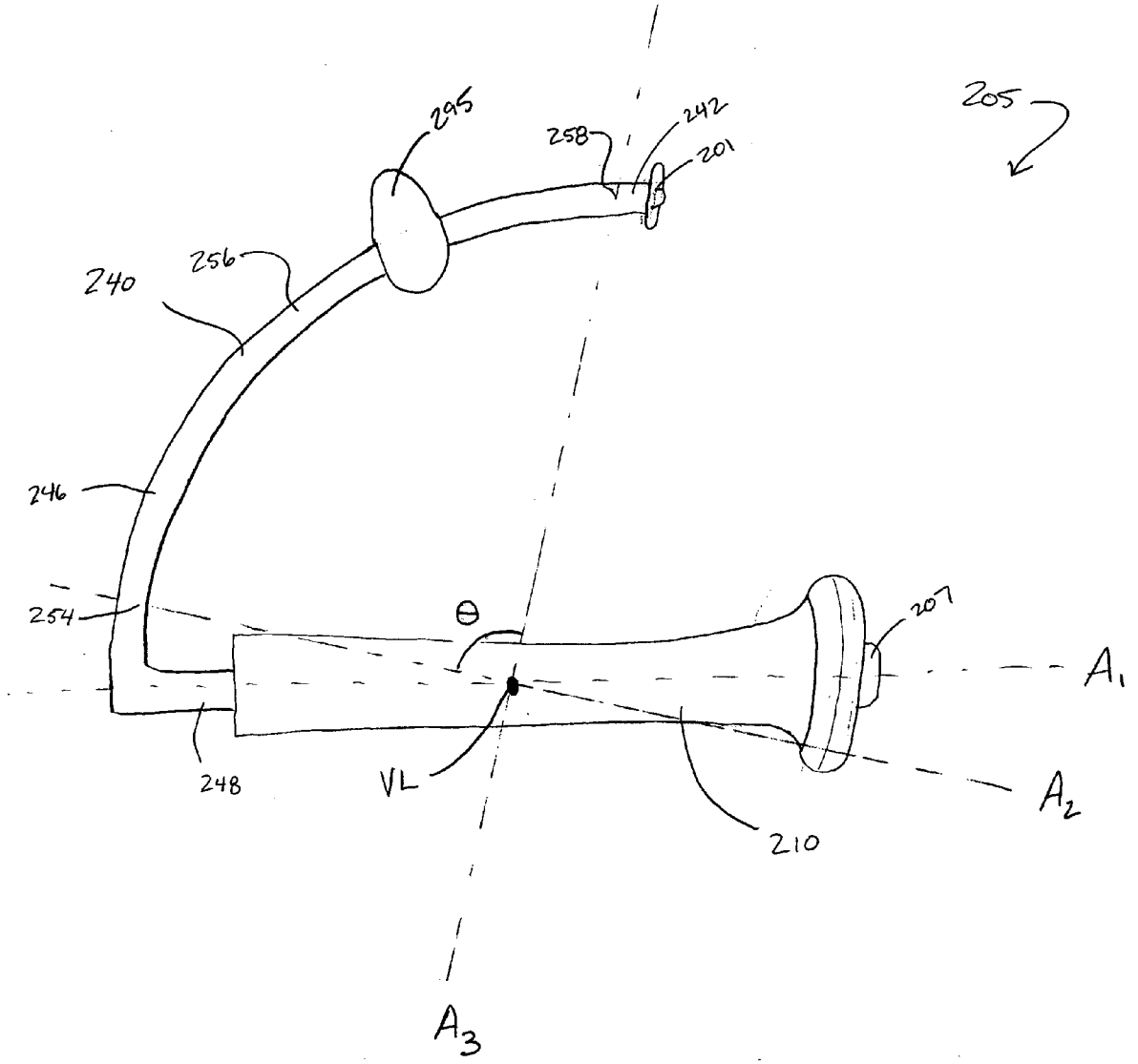

FIGURE 5

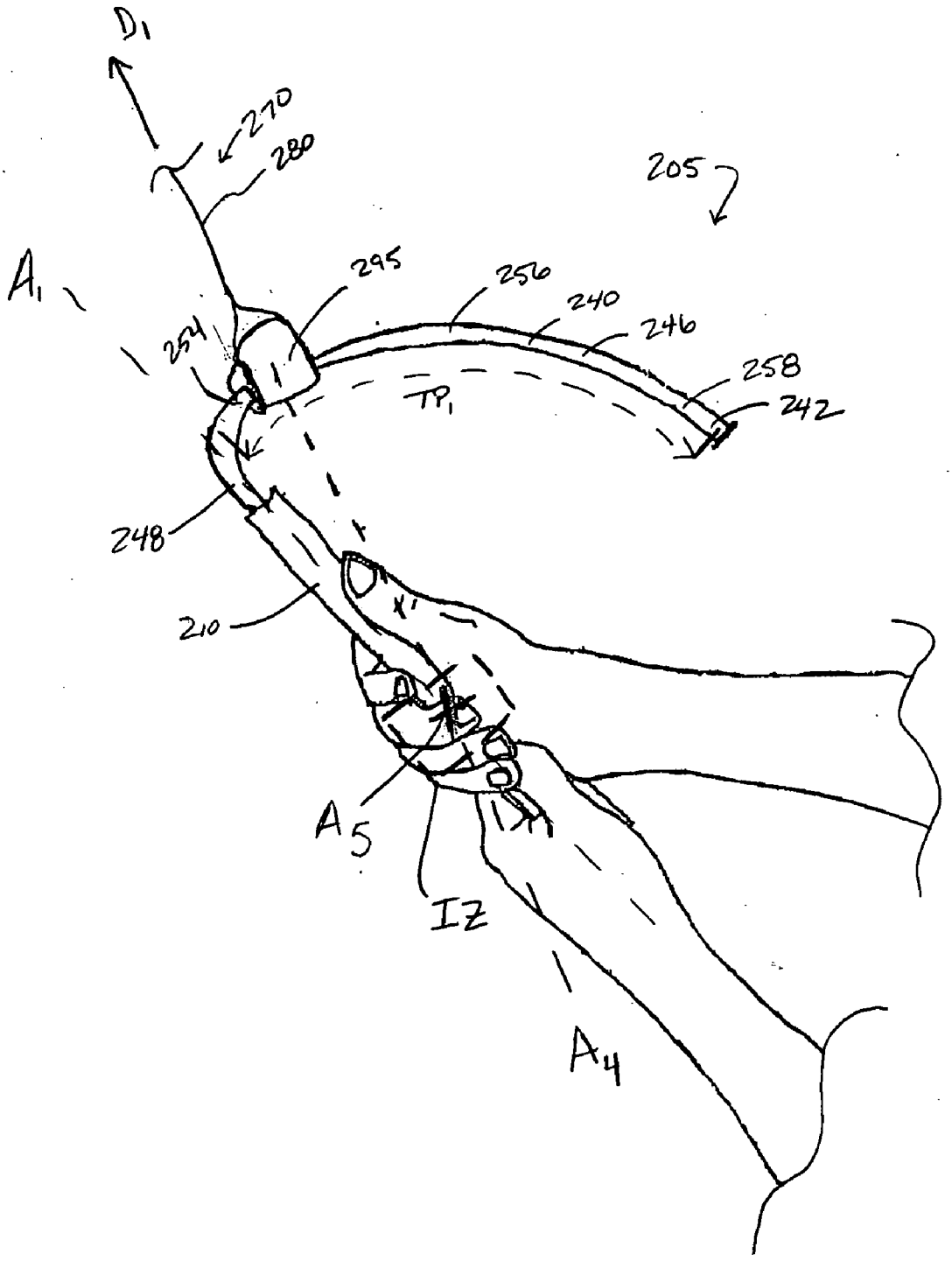

FIGURE 6

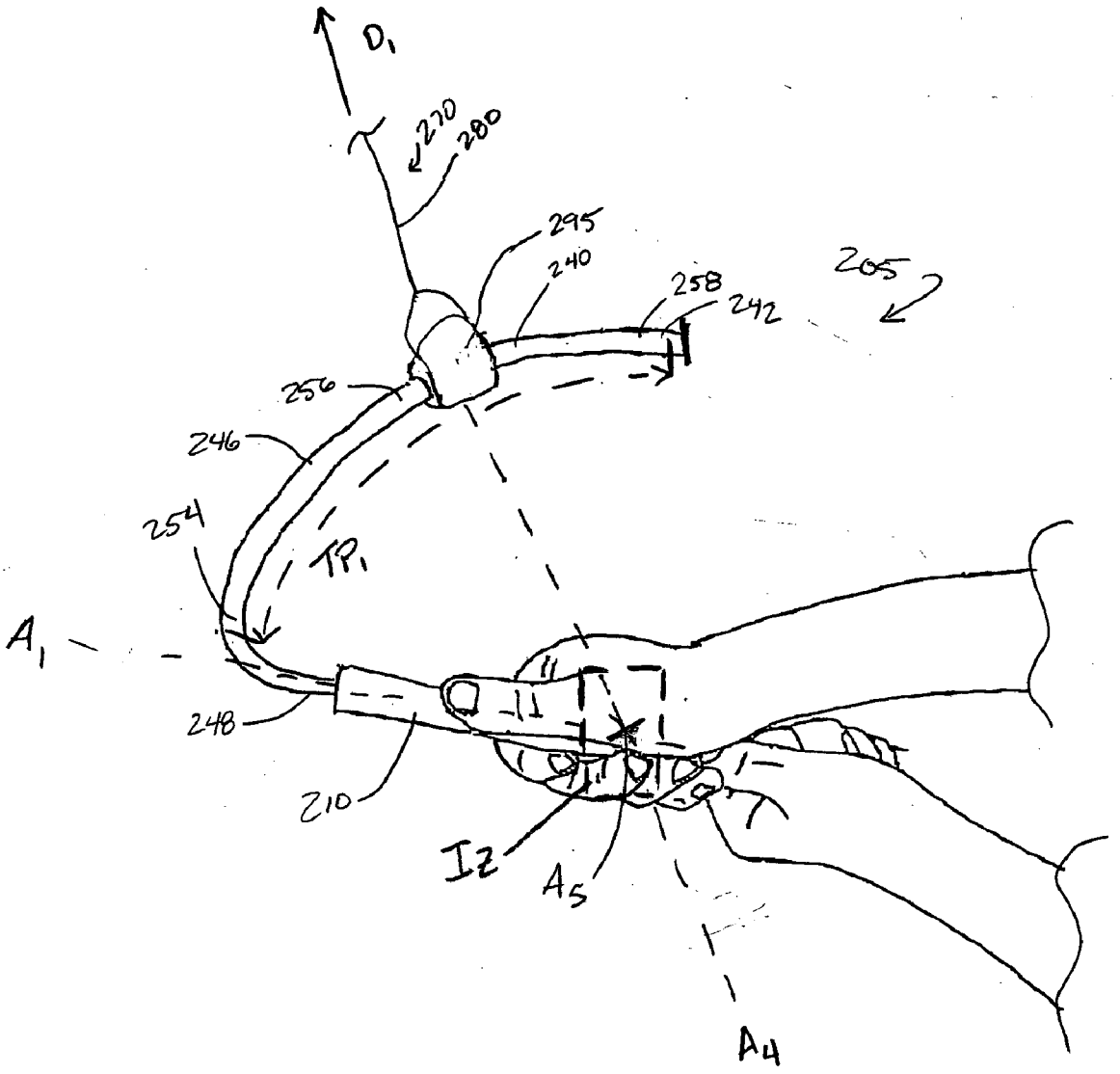

FIGURE 7

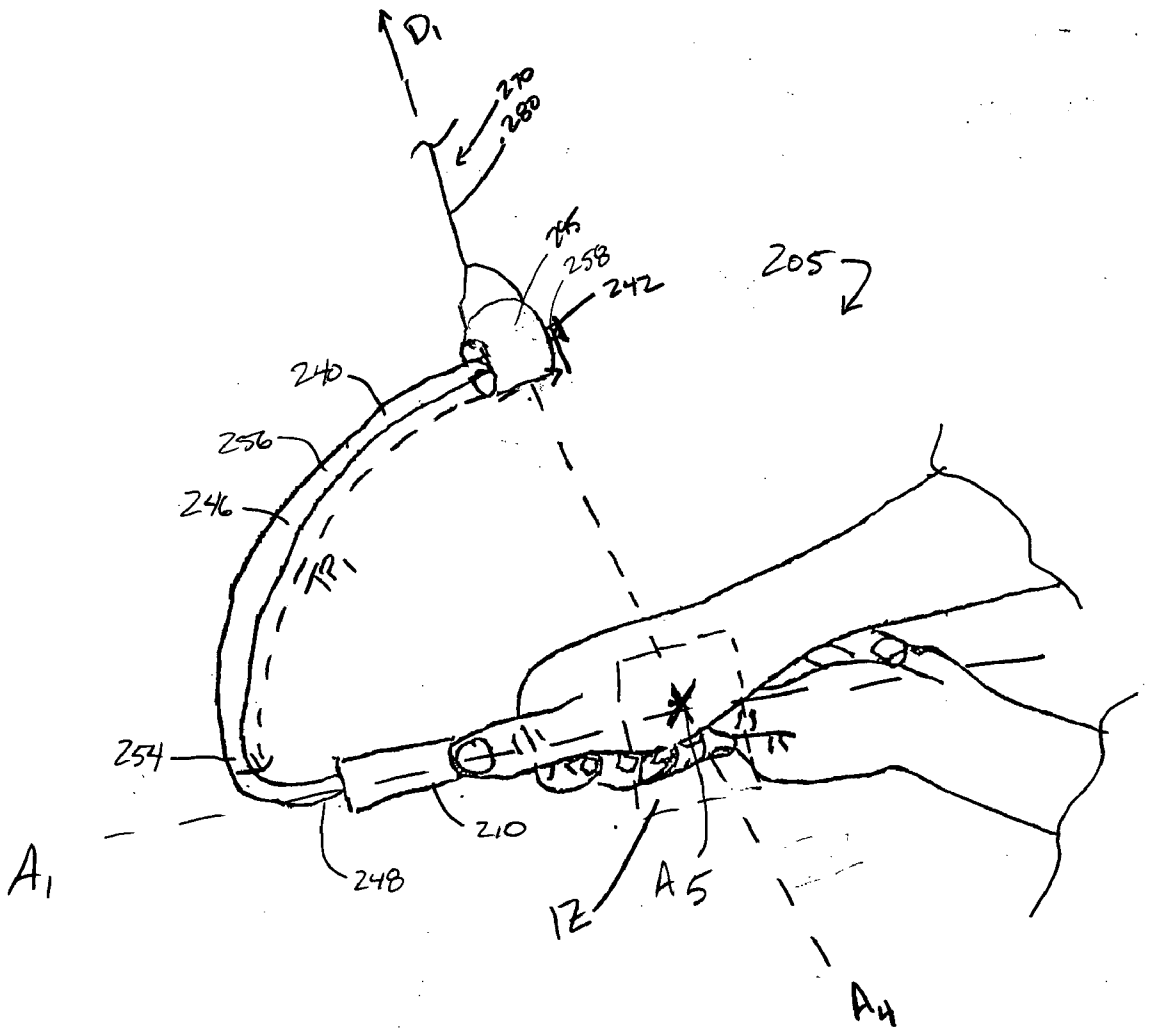

FIGURE 8

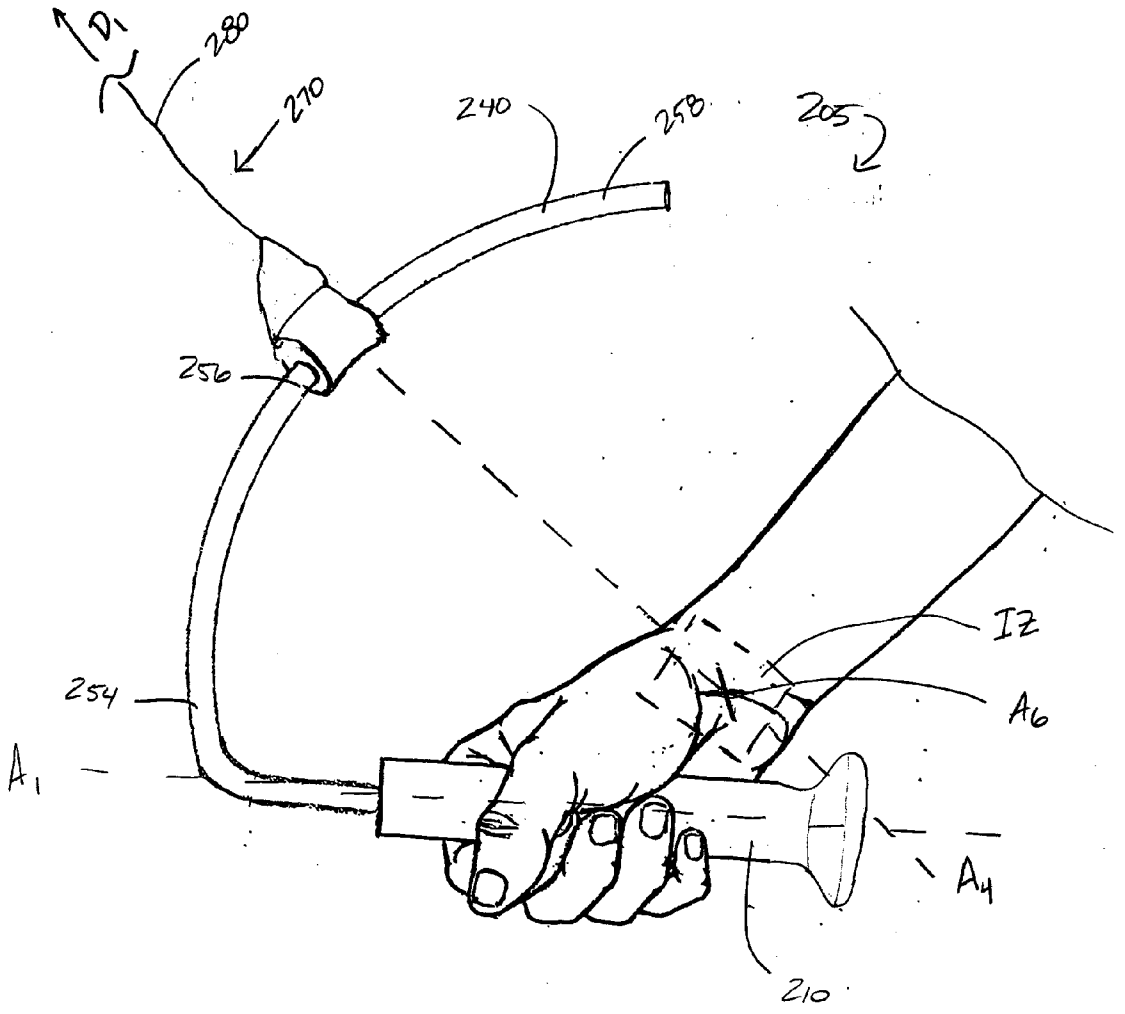

FIGURE 9

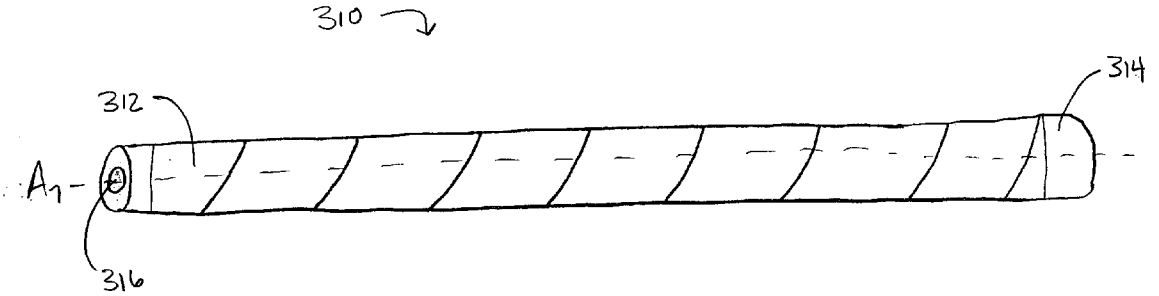

FIGURE 10

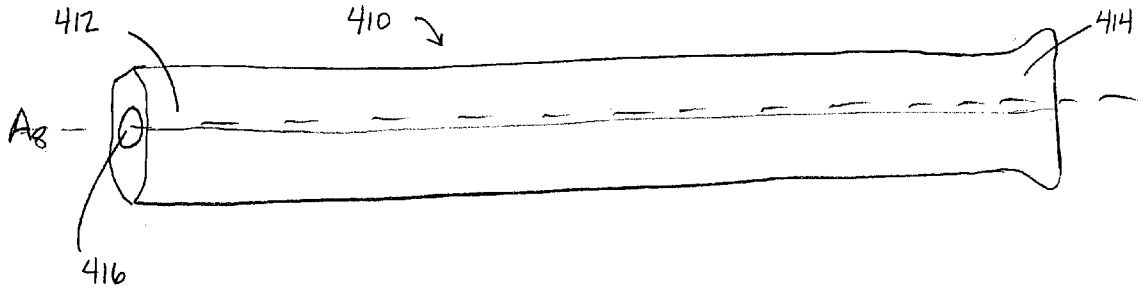

FIGURE 11

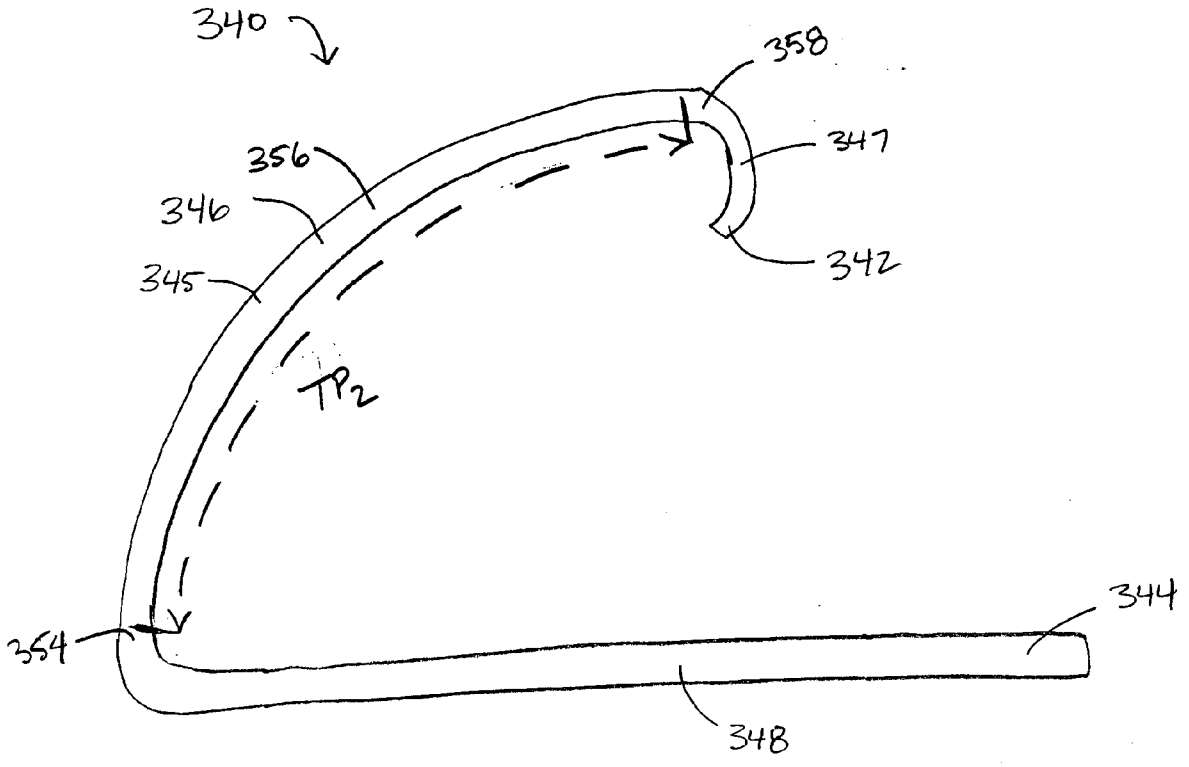

FIGURE 12

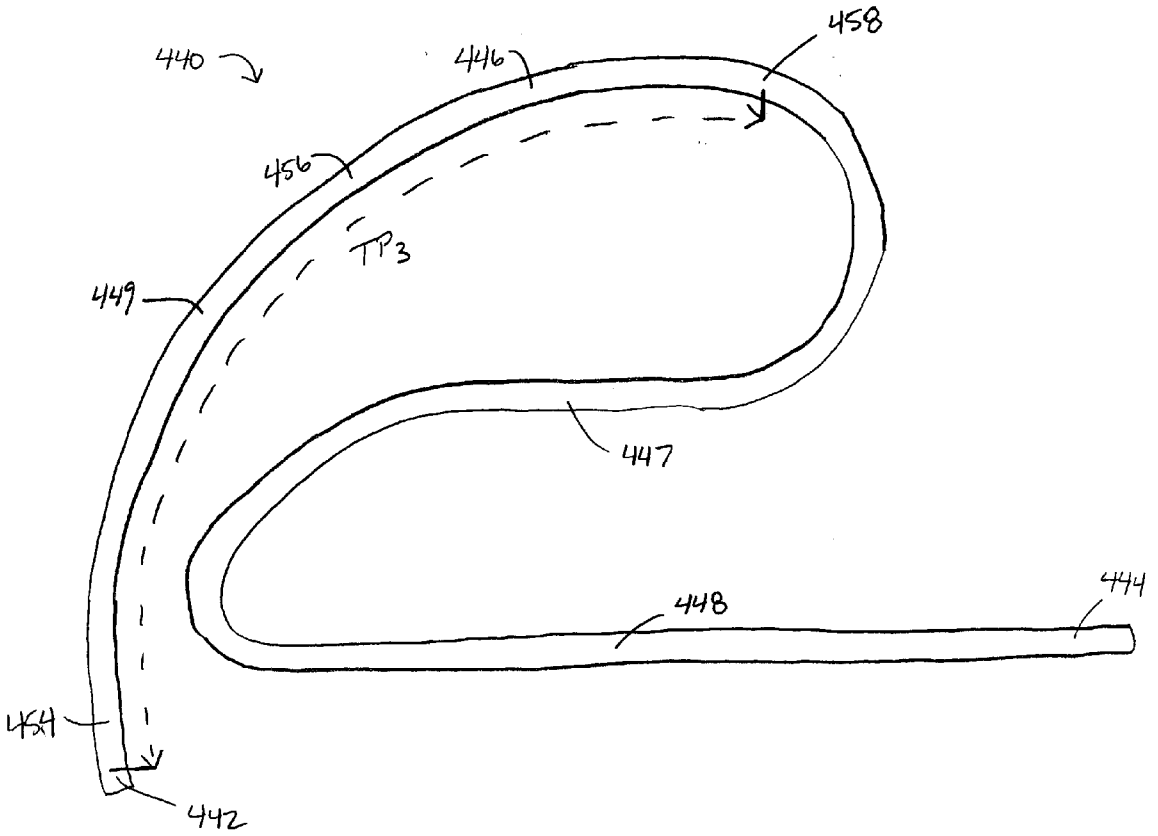

FIGURE 13

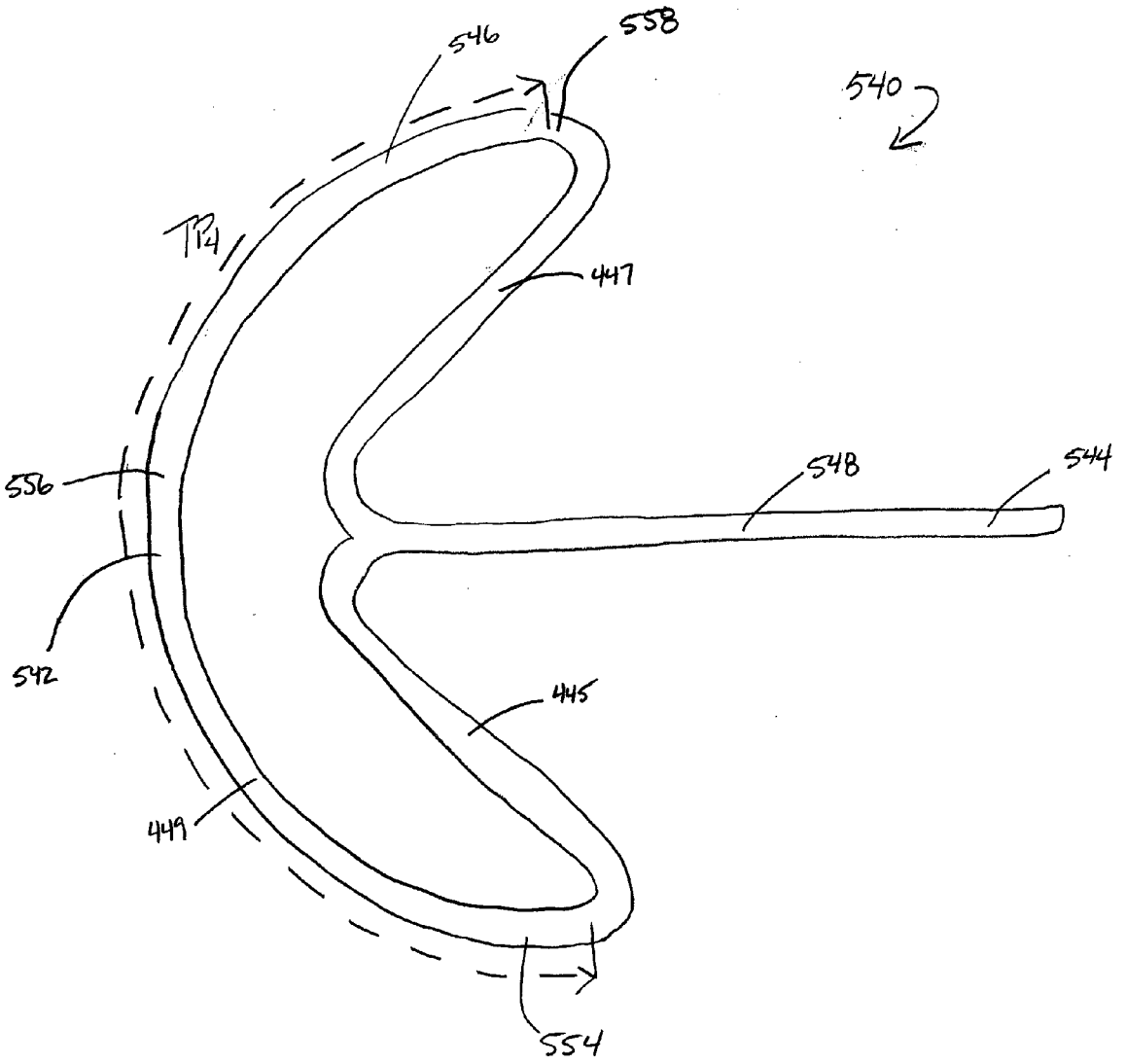

FIGURE 14

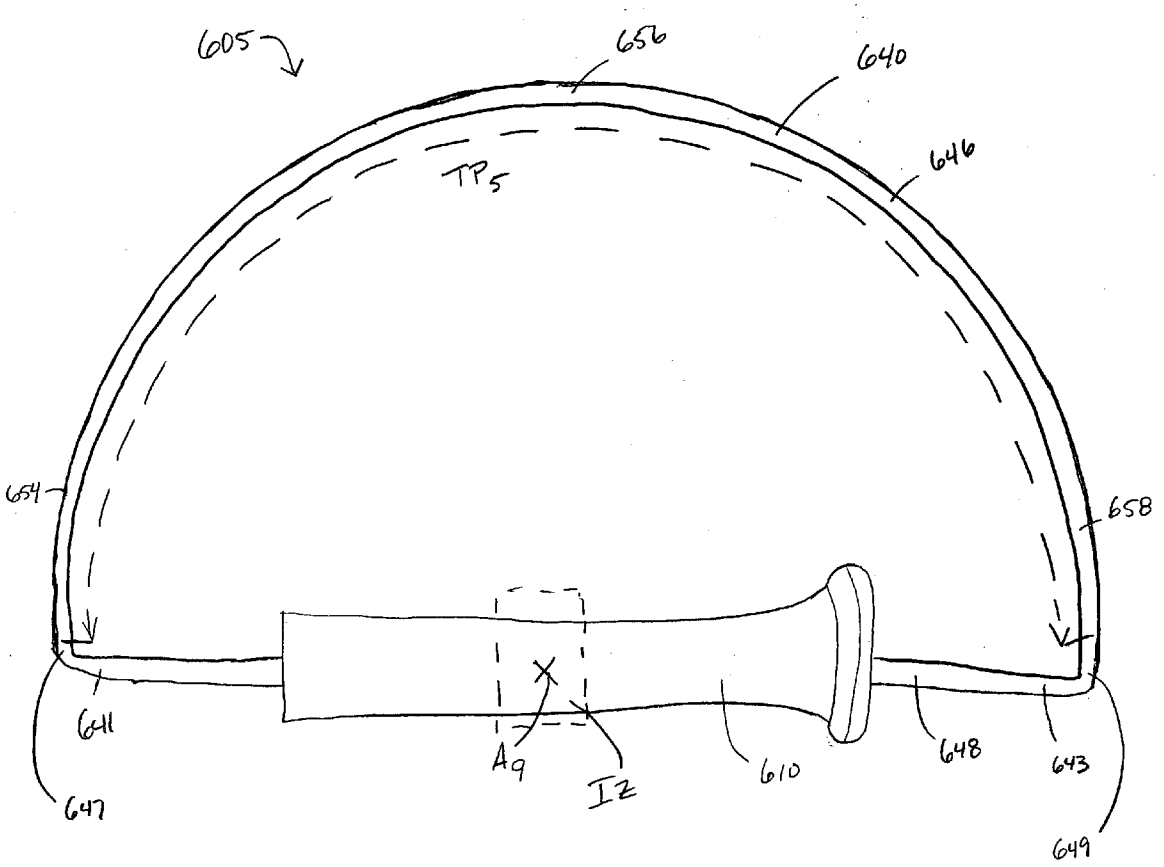

FIGURE 15

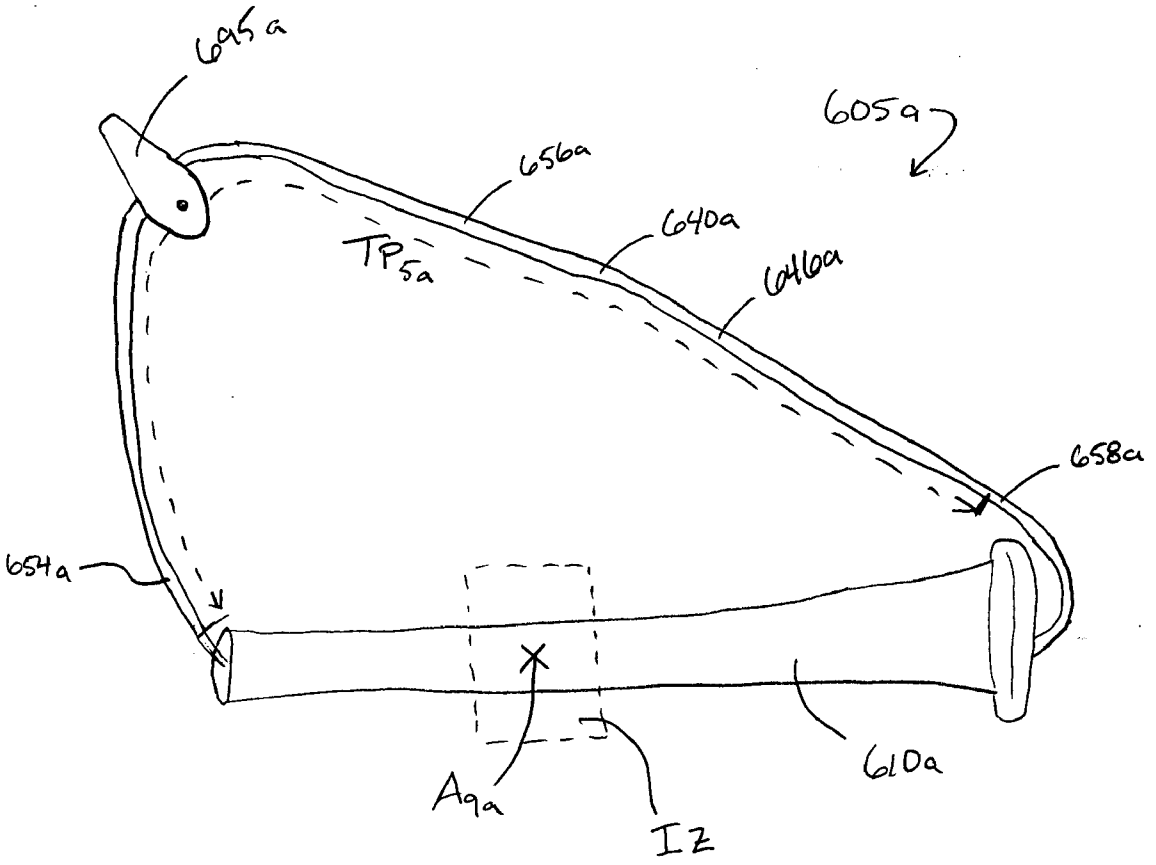

FIGURE 15A

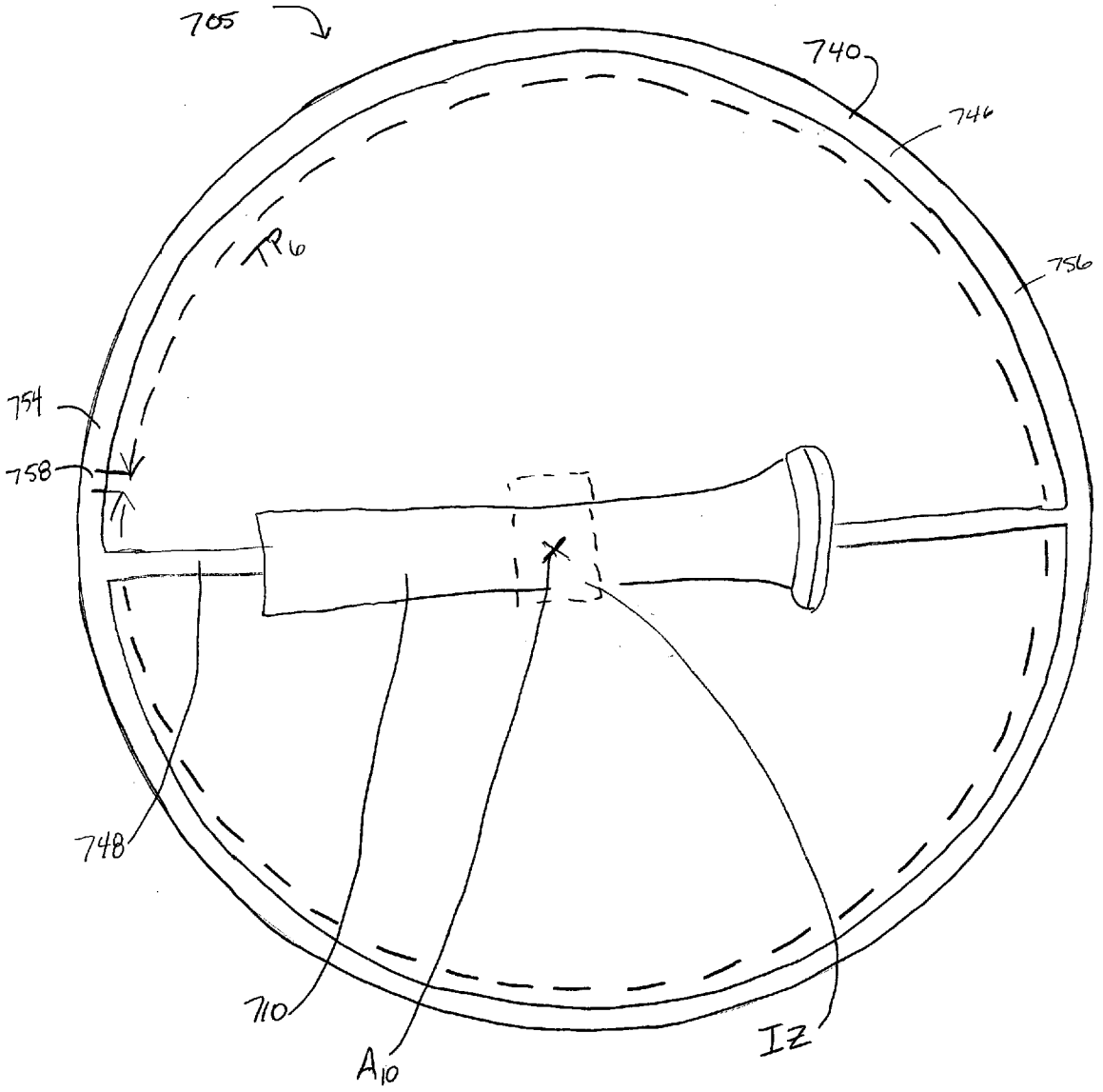

FIGURE 16

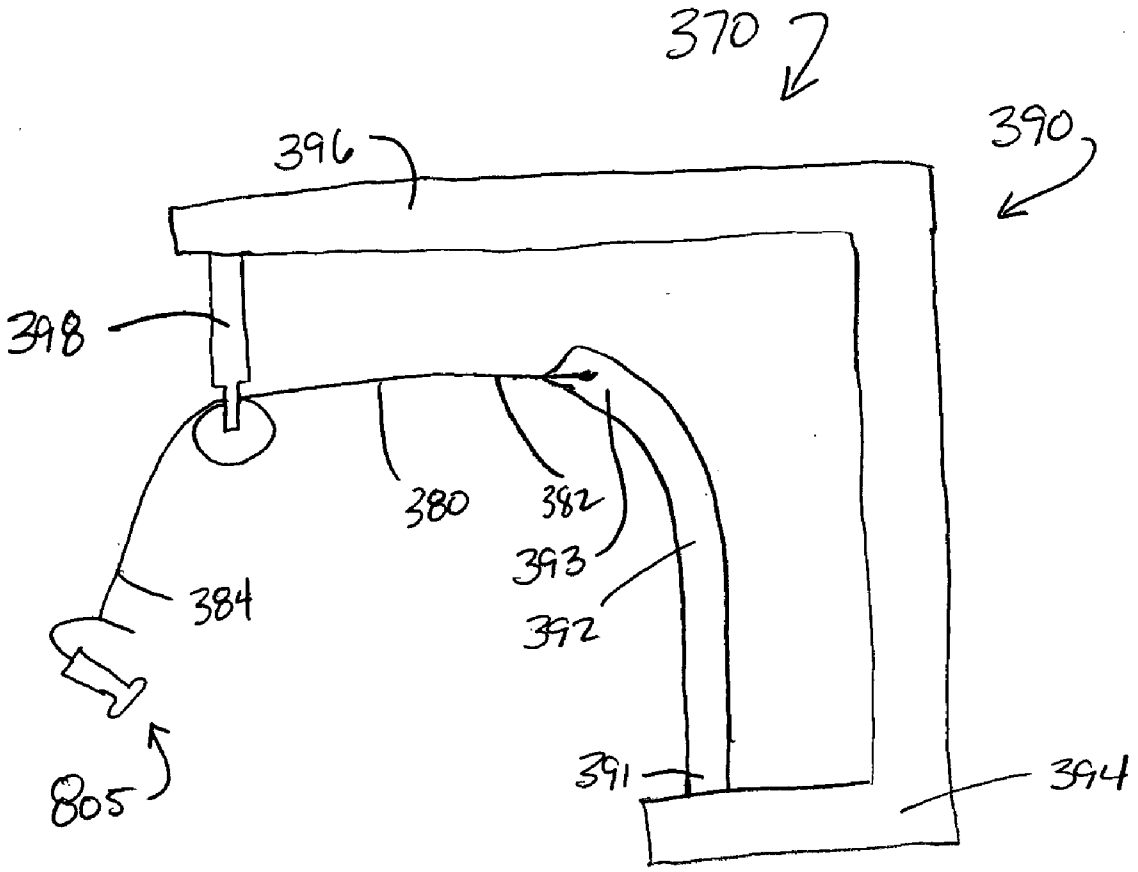

FIGURE 17

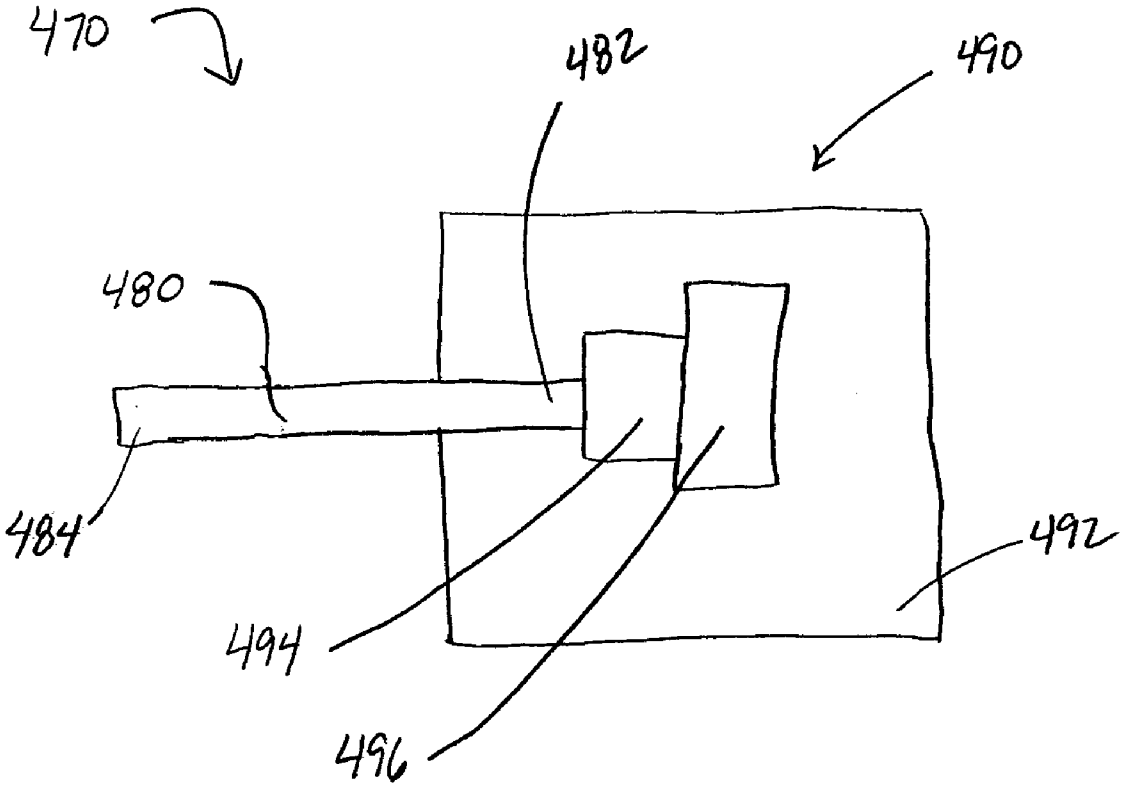

FIGURE 18

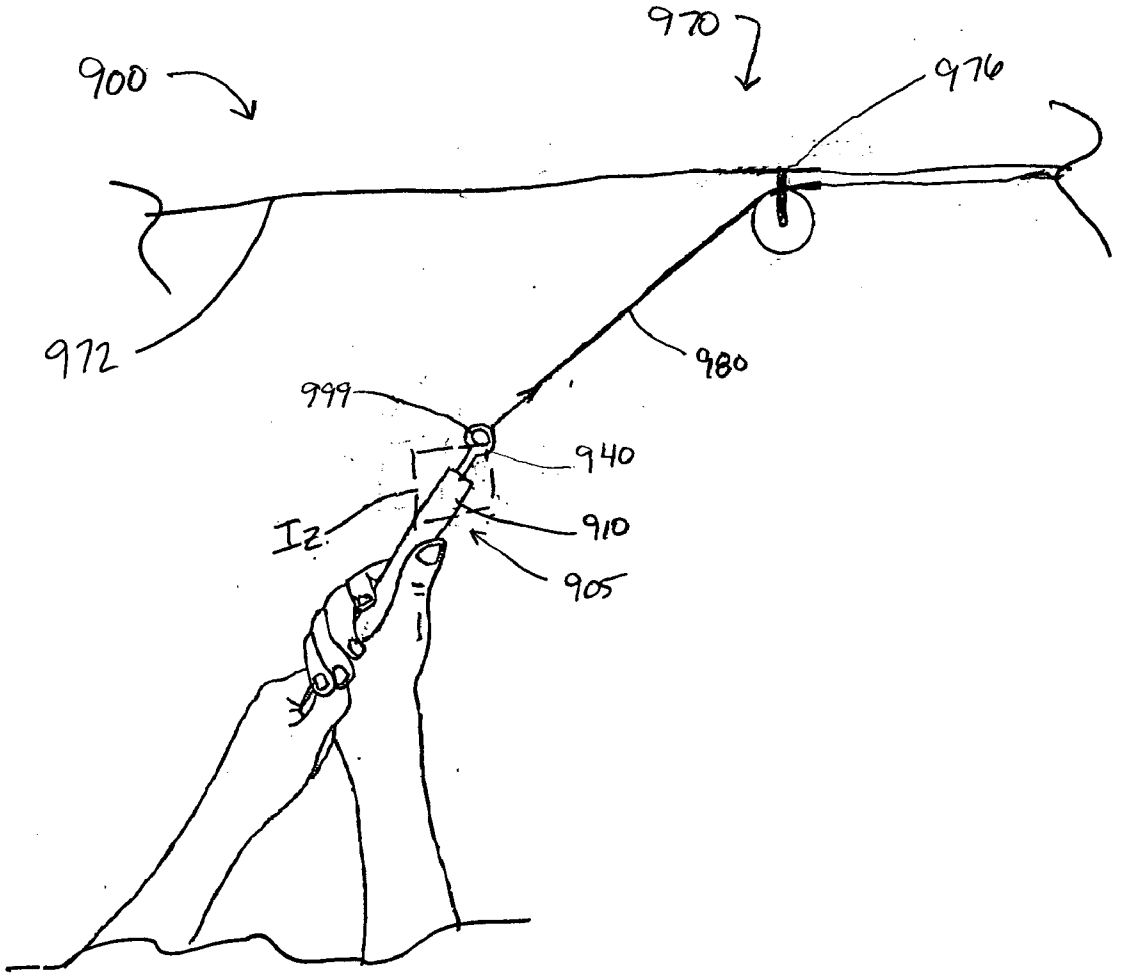

FIGURE 19

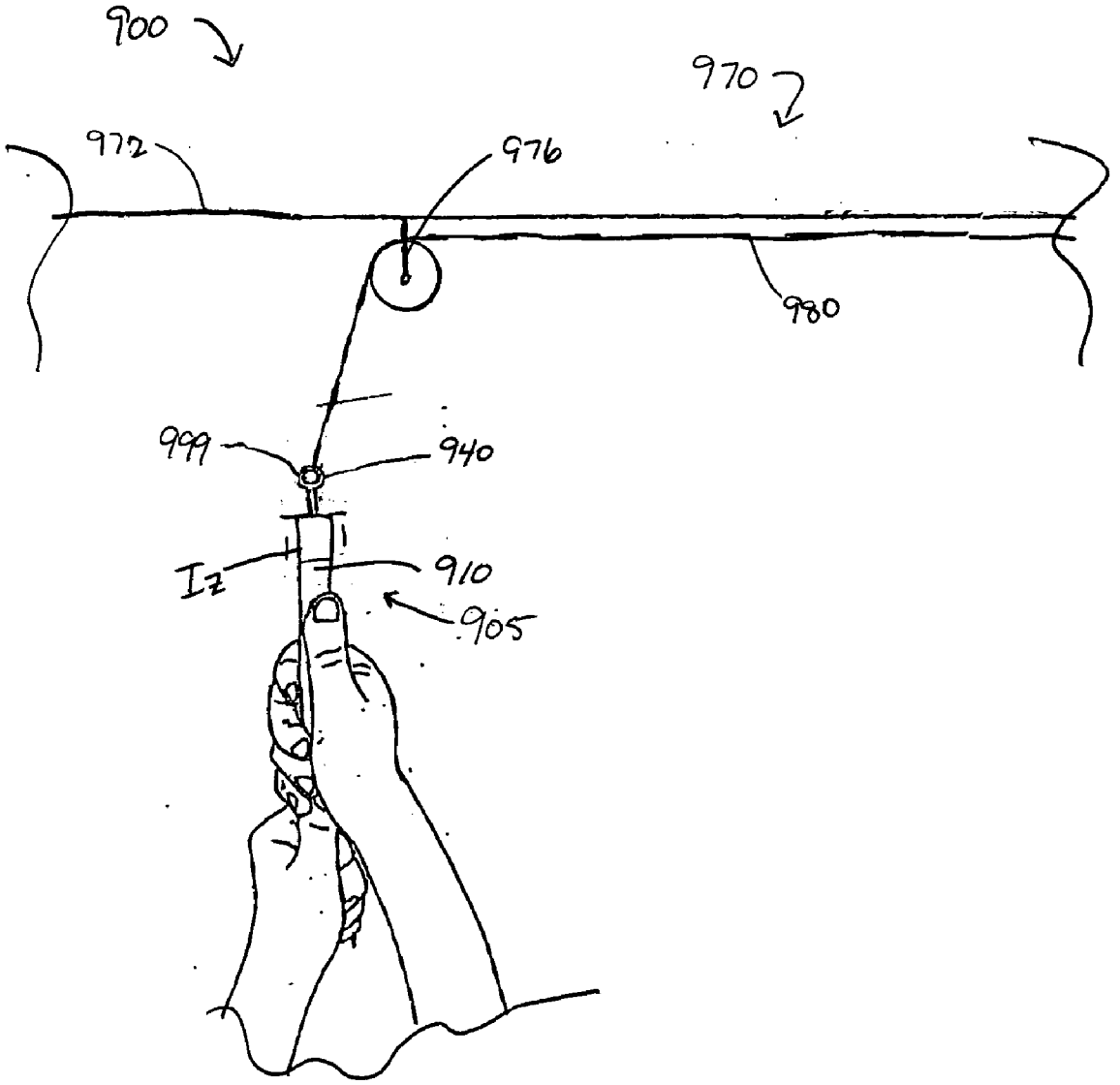

FIGURE 20

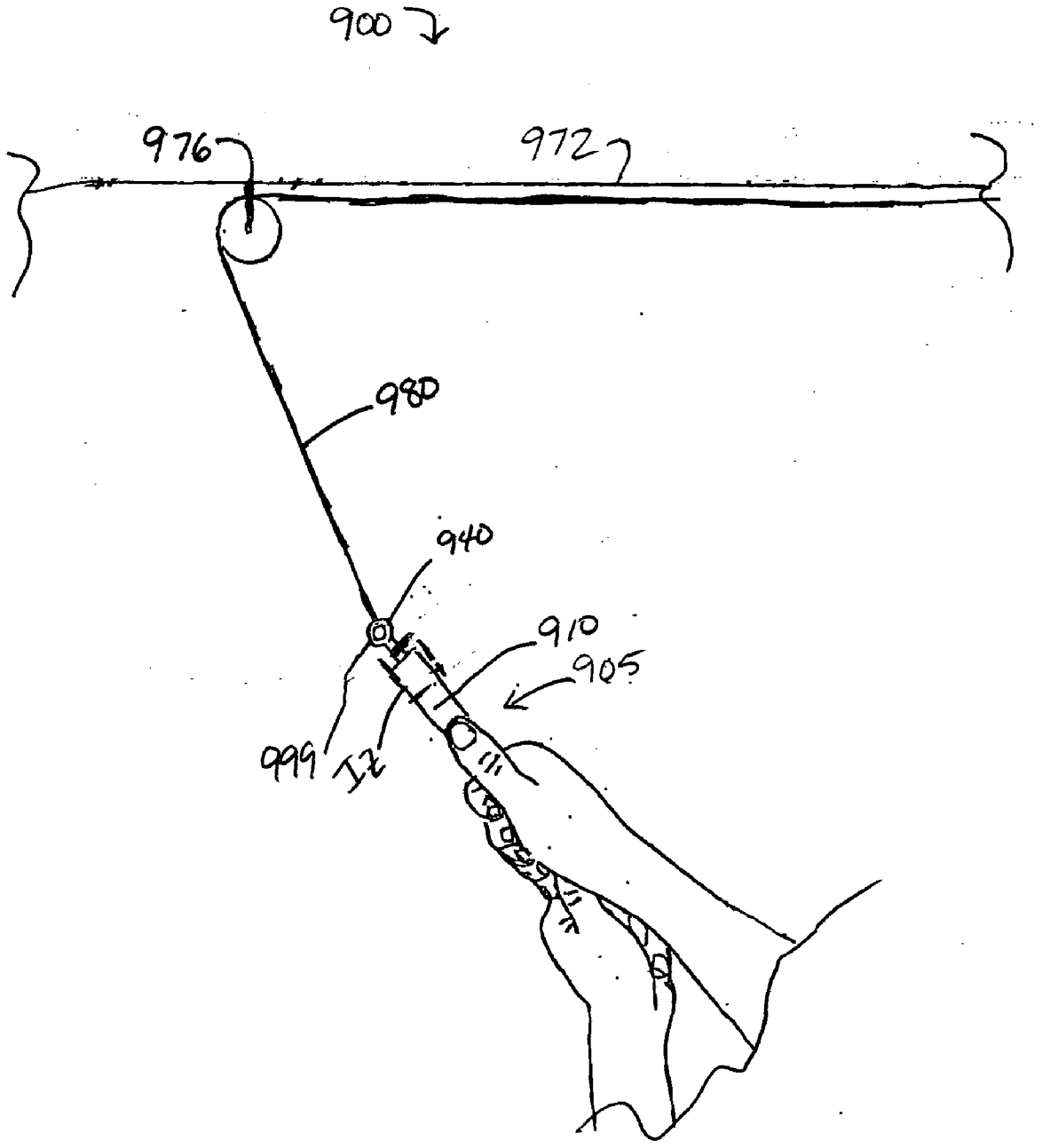

FIGURE 21

RECONFIGURABLE ATTACHMENT FOR REHABILITATION EQUIPMENT

BACKGROUND

[0001] This invention relates generally to handle members for rehabilitation equipment and/or exercise equipment, and in particular to handle members for rehabilitation equipment and/or exercise equipment that may be used throughout a range of motion.

[0002] Known handle members for rehabilitation equipment and/or exercise equipment are configured to be coupled to a tension member of the rehabilitation equipment and/or exercise equipment. The tension member generally applies a force to the handle member. Accordingly, a user can grasp the handle member and can move the handle member through a range of motion against the force that is applied to the handle member by the tension member. This action allows the user to develop and/or strengthen different muscles.

[0003] Known handle members, however, do not allow the tension member to apply a constant and/or stable torque to the handle members throughout the range of motion of the handle members. In other words, the torque applied to the known handle members varies or changes throughout the range of motion of the handle members. For example, in some known handle members, the amount of torque applied to the handle member by the tension member varies throughout the range of motion of the handle member. This causes the user to experience inconsistent and/or unrealistic torque throughout the range of motion of the handle member.

[0004] Thus, a need exists for a handle member for rehabilitation equipment and/or exercise equipment that allows the tension member of the rehabilitation equipment and/or exercise equipment to apply a constant or desired torque to the handle member throughout the range of motion of the handle member.

SUMMARY OF THE INVENTION

[0005] An apparatus includes a handle member that has a grip portion and a coupling portion. In one embodiment, the grip portion is removably coupled to the coupling portion. The coupling portion is configured to be slidably coupled to a tension member such that the tension member may slide with respect to the coupling portion from a first portion of the coupling portion to a second portion of the coupling portion. In one embodiment, the travel distance of the tension member from the first portion of the coupling portion to the second portion of the coupling portion is greater than 2 inches (5 cm). In another embodiment, the grip portion includes a vertex location. A first axis is defined by the handle member and extends from the vertex location to the first portion of the coupling portion. A second axis is defined by the handle member and extends from the vertex location to the second portion of the coupling portion. In one embodiment, the angle defined by the first axis and the second axis is greater than 5 °.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] **FIG. 1** is a schematic illustration of a handle member coupled to a tension member in accordance with an embodiment of the invention.

[0007] **FIG. 2** is a side view of a handle member coupled to a tension member in accordance with the invention.

[0008] **FIG. 3** is a perspective view of a coupler of the handle member of **FIG. 2**.

[0009] **FIG. 4** is an exploded view of the handle member of **FIG. 2**.

[0010] **FIG. 5** is a side view of the handle member of **FIG. 2**.

[0011] **FIG. 6** is a perspective view of the handle member of **FIG. 2** coupled to the tension member in a first position.

[0012] **FIG. 7** is a perspective view of the handle member of **FIG. 2** coupled to the tension member in a second position.

[0013] **FIG. 8** is a perspective view of the handle member of **FIG. 2** coupled to the tension member in a third position.

[0014] **FIG. 9** is a perspective view of the handle member of **FIG. 2** coupled to the tension member in another position.

[0015] **FIGS. 10 and 11** are side views of other embodiments of a grip portion of the handle member in accordance with the invention.

[0016] **FIGS. 12 through 14** are side views of other embodiments of a coupling portion of the handle member in accordance with the invention.

[0017] **FIGS. 15, 15*a*** and **16** are side views of other embodiments of the handle member in accordance with the invention.

[0018] **FIG. 17** is a side view of a handle member coupled to another tension member in accordance with the invention.

[0019] **FIG. 18** is a schematic illustration of another tension member in accordance with the invention.

[0020] **FIG. 19** is a top view of another apparatus in a first position in accordance with the invention.

[0021] **FIG. 20** is a top view of the apparatus of **FIG. 19** in a second position.

[0022] **FIG. 21** is a top view of the apparatus of **FIG. 19** in a third position.

DETAILED DESCRIPTION

[0023] **FIG. 1** is a schematic illustration of an apparatus **100** including a handle member **105** coupled to a tension member **170** in accordance with an embodiment of the invention. The tension member **170** has a cable **180** that is coupled to a force-generating mechanism **190**.

[0024] The handle member **105** has a grip portion **110** and a coupling portion **140**. In one embodiment, the grip portion **110** is coupled to the coupling portion **140**. In another embodiment, the grip portion **105** and the coupling portion **140** are unitarily or monolithically formed.

[0025] The coupling portion **140** of the handle member is configured to be coupled to the tension member **170**. Specifically, the coupling portion **140** is configured to be coupled to the cable **180** of the tension member **170**. Accordingly, the force-generating mechanism **190** is configured to apply a force to the handle member **105** (through the cable **180**).

[0026] The grip portion **110** of the handle member **105** is configured to be grasped by a user. The user may move the handle member **105** against the force applied by the force-generating mechanism **190**. Accordingly, the apparatus **100** may be used to strengthen and/or develop muscles.

[0027] **FIG. 2** illustrates an embodiment of an apparatus **200** according to an embodiment of the invention. The apparatus **200** includes a handle member **205** and a tension member **270**. The tension member **270** includes a cable **280** and a force-generating mechanism **290**. The cable **280** has a first end portion **282** and a second end portion **284** opposite the first end portion **282**. The first end portion of **282** the cable **280** is coupled to the force-generating mechanism **290**.

[0028] The force-generating mechanism **290** is configured to apply a force to the cable **280** and, accordingly, to any object that is coupled to the cable **280**. In the illustrated embodiment, the force-generating mechanism **290** includes a weight **292**. When the weight **292** is lifted from a support surface **294**, the gravitational force acting on the weight **292** is transferred to the cable **280**. In the illustrated embodiment, the force-generating mechanism **290** includes several weights **292**. Thus, any number of weights may be coupled to the first end portion **282** of the cable **280**.

[0029] Although the force-generating mechanism **290** is described and illustrated as including a weight **292**, it is not required that the force-generating mechanism include a weight. For example, in one embodiment, the force-generating mechanism is a brake or clutch controlled device as described in U.S. Pat. No. 4,471,957 to Engalitcheff, Jr., issued on Sep. 18, 1984 and entitled "Method and Apparatus for Rehabilitation of Damaged Limbs" and U.S. Pat. No. 4,768,783 to Engalitcheff, Jr., issued on Sep. 6, 1988, and entitled "Apparatus for the Rehabilitation of Damaged Limbs" the disclosures of which are incorporated herein by reference in their entirety

[0030] In the illustrated embodiment, the tension member **270** includes a housing **272**, a support arm **274**, a first pulley assembly **276**, and a second pulley assembly **278**. The housing **272** is configured to house or store the weights **292**. The support arm **274** extends from the housing **272**. The first pulley assembly **276** and the second pulley assembly **278** are coupled to and supported by the support arm **274**. The cable **280** is supported by and movably coupled to the first pulley assembly **276** and to the second pulley assembly **278**. The cable **280** extends from the handle member **205** to the weight **292** and cooperates with the first pulley assembly **276** and the second pulley assembly **278**. Accordingly, the cable **280** may be moved with respect to the first pulley assembly **276** and the second pulley assembly **278** to move the weight **292**.

[0031] The handle member **205** includes a grip portion **210** and a coupling portion **240**. The coupling portion **240** of the handle member **205** is configured to be coupled to the tension member **270**. Specifically, the coupling portion **240** is configured to be coupled to the second end portion **284** of the cable **280**. Accordingly, the force applied by the force-generating mechanism **290** to the cable **280** is transferred to the handle member **205**. Thus, the handle member **205** may be moved to raise or lower the weight **292** of the tension member **270**.

[0032] In the illustrated embodiment, the second end portion **284** of the cable **280** is slidably coupled to the coupling portion **240** of the handle member **205**. In other words, the second end portion **284** of the cable **280** may slide or otherwise move with respect to the handle member **205**. In the illustrated embodiment, the second end portion **284** of the cable **280** is slidably coupled to the coupling portion **240** of the handle member **205** via a coupler **295**. As best illustrated in **FIG. 3**, the coupler **295** includes a lumen **296** that is configured to slidably receive the coupling portion **240** of the handle member **205**. The coupler **295** also includes an attachment portion **297**, which includes a lumen **299**, that is configured to be attached to the second end portion **284** of the cable **280**.

[0033] In another embodiment, the second end portion of the cable is slidably coupled to the handle member via another known coupling mechanism. In yet another embodiment, the second end portion of the cable is coupled directly to the handle member. For example, the second end portion of the cable may be tied or secured around the handle member such that the second end portion may slide with respect to the handle member. Alternatively, the second end portion of the cable may include a loop portion that is configured to receive a portion of the coupling portion of the handle member to slidably couple the cable to the handle member.

[0034] The handle member **205** is best illustrated in **FIGS. 4 through 9**. **FIG. 4** is an exploded view of the handle member **205**. As discussed above, the handle member **205** includes a grip portion **210** and a coupling portion **240**. In the illustrated embodiment, the handle member **205** also includes coupler **207** and a stop member **201**.

[0035] In the illustrated embodiment, the coupling portion **240** of the handle member **205** includes a first end portion **242** and a second end portion **244** disposed opposite the first end portion **242**. The coupling portion **240** also has a curved portion **246** disposed proximate the first end portion **242** of the coupling portion **240** and a substantially linear portion **248** disposed proximate the second end portion **244** of the coupling portion **240**.

[0036] Although the coupling portion is described and illustrated as including a curved portion and a substantially linear portion, the coupling portion may be of any shape. For example, the coupling portion may include a curved portion that is more or less curved than the illustrated coupling portion. Additionally, the coupling portion may not include a substantially linear portion. Similarly, the coupling portion may not include a curved portion.

[0037] The grip portion **210** of the handle member **205** is configured to be grasped by a user. For example, the grip portion **210** may be grasp by a user with one hand or with two hands. The grip portion **210** includes a first end portion **212** and a second end portion **214** opposite the first end portion **212**, and extends along an axis A_1 (best illustrated in **FIG. 5**). The grip portion **210** also includes a lumen **216** that extends from the first end portion **212** of the grip portion **210** to the second end portion **214** of the grip portion **210**. The lumen **216** of the grip portion **210** is configured to receive the substantially linear portion **248** of the coupling member **240** to removably and rotatably couple the grip portion **210** to the coupling portion **240**. Specifically, the grip portion **210** is configured to rotate with respect to the coupling portion **240** about axis A_1.

[0038] In another embodiment, the grip portion and the coupling portion are not removably coupled. For example,

the grip portion may be fixedly coupled to the coupling portion. In yet another embodiment, the grip portion and the coupling portion are unitarily or monolithically formed.

[0039] Although the grip portion **210** is illustrated and described as including a lumen that receives a portion of the coupling portion **240** of the handle member **205** to couple the grip portion **210** to the coupling portion **240**, the grip portion **210** does not need to be coupled to the coupling portion **240** in such a manner. In other embodiments, other mechanisms and/or methods can be used to couple the grip portion to the coupling portion. For example, in one embodiment, a joint, such as a ball and socket joint, can be used to couple the grip portion to the coupling portion. In another embodiment, an adhesive may be used to coupled the grip portion to the coupling portion.

[0040] In the illustrated embodiment, the grip portion **210** is configured to simulate a baseball bat handle. In other embodiments, the grip portion is configured to simulate handles of other devices, such as a handle of a golf club (as illustrated in **FIG. 10** and described in detail below), a handle of a tennis racquet (as illustrated in **FIG. 11** and described in detail below), a handle of a racquetball racquet, and a handle of a yard tool. In one embodiment, the various grip portions are interchangeable. In other words, a grip portion that simulates a baseball bat may be coupled to the coupling portion and used in conjunction with the tension member. Subsequently, the grip portion that simulates a baseball bat may be removed from the coupling portion, and a grip portion that simulates a handle of another device, such as a handle of a golf club, may be coupled to the coupling portion. In yet a further embodiment, the grip portion is not configured to simulate a handle of a device.

[0041] The first end portion **242** of the coupling member **240** includes a cavity or opening **250**. The cavity or opening **250** includes threads (not illustrated) disposed on the inner surface of the cavity or opening **250**. The stop member **201** includes a coupling portion **203** and a stop portion **204**. The coupling portion **203** of the stop member **201** has a projection **202** that has threads **206** that are configured to interact with the threads (not illustrated) of the cavity **250** of the coupling portion **240** when the projection **202** is disposed within the cavity **205**. Accordingly, the stop member **201** may be secured or otherwise coupled to the first end portion **242** of the coupling member **240** to help retain the coupler **295** coupled to the coupling portion **240**. In other words, the stop member **201** helps prevent the coupler **295** from sliding off of the coupling portion **240** of the handle member **205**. Although in the illustrated embodiment the stop member and the first end portion of the coupling member include complementary threads, it is not necessary that the stop member and the coupling member have such threads. In another embodiment, the stop member is press fit into the cavity to secure or couple the stop member to the coupling portion of the handle member. In yet a further embodiment, the handle member does not include a stop member.

[0042] The second end portion **244** of the coupling member **240** includes a cavity or opening **252**. The cavity or opening **252** includes threads (not illustrated) disposed on the inner surface of the cavity or opening **252**. The coupler **207** includes a projection **208** that has threads **209** that are configured to interact with the threads (not illustrated) of the cavity **252** of the coupling portion **240**. Accordingly, the coupler **207** may be secured or otherwise coupled to the second end portion **244** of the coupling member **240** when the projection **208** is disposed within the cavity **205** to retain the linear portion **248** of the coupling portion **240** within the lumen **216** of the grip portion **210**. Although in the illustrated embodiment the coupler and the second end portion of the coupling member include complementary threads, it is not necessary that the coupler and the coupling member have such threads. In another embodiment, the coupler is press fit into the cavity to secure or couple the coupler to the coupling portion of the handle member. In yet a further embodiment, the handle member does not include a coupler.

[0043] Although the handle member **205** is illustrated as being substantially planar, it is not necessary that the handle member have such a shape. For example, in one embodiment, the handle member has a non-planar, irregular shape.

[0044] As best illustrated in **FIGS. 6 through 8**, the handle member **205** is slidably coupled to the cable **280** of the tension member **270** such that the tension member **270** may slide with respect to the handle member **205** along a travel path TP_1. Specifically, the tension member **270** slides or travels with respect to the handle member from a first portion **254** of the coupling portion **240** of the handle member **205** (see **FIG. 6**), to a second portion **256** of the coupling portion **240** of the handle member **205** (see **FIG. 7**), and to a third portion **258** of the coupling portion **240** of the handle member **205** (see **FIG. 8**). In the illustrated embodiment, the travel distance of the tension member **270** (the linear distance of the travel path TP_1, of the tension member with respect to the handle member) between the first portion **254** of the coupling portion **240** and the third portion **258** of the coupling portion **240** is about 12 inches (30.5 cm).

[0045] In another embodiment, the travel distance of the tension member between the first portion of the coupling portion and the third portion of the coupling portion is less than 12 inches (30.5 cm). For example, in some embodiments, the travel distance of the tension member is between 2 inches (5 cm) and 12 inches (30.5 cm). In another embodiment, the travel distance of the tension member is less than 2 inches (5 cm). In yet another embodiment, the travel distance of the tension member between the first portion of the coupling portion and the third portion of the coupling portion is greater than 12 inches (30.5 cm).

[0046] As best illustrated in **FIG. 5**, the handle member **205** defines an axis A_2 that extends from a vertex location VL disposed on the grip portion **210** to the first portion **254** of the coupling portion **240**. Similarly, the handle member **205** also defines an axis A_3 that extends from the vertex location VL to the third portion **258** of the coupling portion **240**. Axis A_2 and axis A_3 intersect at the vertex location VL and define an angle Θ. The angle Θ defined by axis A_2 and axis A_3 is about 90'0 .

[0047] In another embodiment, the angle Θ defined by axis A_2 and axis A_3 is less than 90°. For example, in one embodiment the angle Θ is between 5 ° and 90°. In another embodiment, the angle Θ is less than 5°. In yet another embodiment, the angle Θ is greater than 90°.

[0048] The term vertex location is used herein to mean a point or a group of adjacent points. For example, the vertex location may be any point or group of adjacent points on the grip portion of the handle member.

[0049] As best illustrated in **FIGS. 6 through 8**, the tension member **270** is configured to apply a force on the handle member in a direction D_1. The force applied by the tension member **270** defines an axis A_4. The handle member **205** may be rotated about an axis A_5 from a first position (see **FIG. 6**), to a second position (see **FIG. 7**), and to a third position (see **FIG. 8**). As shown in **FIGS. 6 through 8**, axis A_5 is orientated as coming out of the page. The axis of rotation A_5 is orthogonal to the axis of force A_4. Additionally, the axis of rotation A_5 is orthogonal to the grip axis A_1.

[0050] As described above, the tension member **270** is configured to slide along the coupling portion **240** of the handle member **205** as the handle member **205** is rotated about axis A_5 from its first position (see **FIG. 6**), to its second position (see **FIG. 7**), and to its third position (see **FIG. 8**). Specifically, when the handle member **205** is in its first position (see **FIG. 6**), the tension member **270** slides with respect to the coupling portion **240** to the first portion **254** of the coupling portion **240**; when the handle member **205** is in its second position (see **FIG. 7**), the tension member **270** slides with respect to the coupling portion **240** to the second portion **256** of the coupling portion **240**; when the handle member **205** is in its third position (see **FIG. 8**), the tension member slides with respect to the coupling portion to the third portion **258** of the coupling portion **240**. Accordingly, the angle defined by the axis of force A_4 and the grip axis A_1 is different when the handle member **205** is in its first position, when the handle member is in its second position, and when the handle member is in its third position.

[0051] In the illustrated embodiment, an intersection zone IZ is associated with the handle member **205**. The axis of force A_4 passes through the intersection zone IZ at each location along the travel path TP_1, of the tension member **270** with respect to the coupling portion **240**. In other words, regardless of where the tension member **270** is located between the first portion **254** of the coupling portion **240** and the third portion **258** of the coupling portion **240**, the axis of force A_4 passes through the intersection zone IZ. Specifically, when the handle member **205** is in its first position, the axis of force A_4 passes substantially through the intersection zone IZ (see **FIG. 6**). Similarly, when the handle member **205** is in its second position, the axis of force A_4 passes substantially through the intersection zone IZ (see **FIG. 7**). Finally, when the handle member **205** is in its third position, the axis of force A_4 passes substantially through the intersection zone IZ (see **FIG. 8**).

[0052] The term intersection zone IZ is used herein to mean a three-dimensional space. In one embodiment, the intersection zone is about as large as the grip portion of the handle member. In another embodiment, the intersection zone is about as large a fist or a hand of a human user. In another embodiment, the intersection zone is a three-dimensional space that is about 8 cubic inches (131 cubic cm). In yet another embodiment, the intersection zone is a three-dimensional space that is less than 8 cubic inches (131 cubic cm), such as 3 cubic inches (49 cubic cm).

[0053] In the illustrated embodiment, the axis of rotation A_5 passes through the intersection zone IZ. Additionally, in the illustrated embodiment, the axis of force A_4 intersects the axis of rotation A_5 when the handle member is in its first position, its second position, and its third position. Specifically, the intersection of the axis of force A_4 and the axis of rotation A_5 occurs within the intersection zone IZ.

[0054] In an another embodiment, the axis of rotation is not disposed within the intersection zone. In such an embodiment, the axis of force passes substantially through the intersection zone when the handle member is in a first position, a second position, and a third position. Accordingly, as the axis of rotation is not disposed within the intersection zone, the axis of force does not intersect the axis of rotation when the handle member is in the first position, the second position, or the third position. In such an embodiment, the different amounts of force or torque (as will be described in detail below) will be applied to the handle member.

[0055] As illustrated in **FIGS. 6 through 8**, the handle member **205** can be rotated about an axis A_5 that intersects the grip axis A_1. Accordingly, the intersection zone IZ is disposed such that a portion of the grip portion **210** is disposed within and axis A_5 passes through the intersection zone IZ. As illustrated in **FIG. 9**, however, the handle member **205** need not be rotated about an axis that intersects the grip axis A_1. **FIG. 9** illustrates an alternative arrangement where the handle member **205** is illustrated as being rotated about an axis A_6 that does not intersect the grip portion **210** of the handle member **205**. Additionally, the intersection zone IZ is disposed such that the grip portion **210** is not disposed within the intersection zone IZ.

[0056] As illustrated in **FIG. 9**, a user may grasp the grip portion **210** of the handle member **205** with a single hand and may rotate the handle member **210** about an axis A_6 that intersects the user's wrist. As shown in **FIG. 9**, axis A_6 is orientate as coming out of the page. As the handle member **205** is rotated about axis A_6, the tension member **270** slides with respect to the handle member **205** from a first portion **254** of the coupling portion **240** to a second portion **256** of the coupling portion **240** and to a third portion **258** of the coupling portion **240**. As illustrated in **FIG. 9**, the intersection zone IZ is disposed such that the grip portion **210** of the handle member **205** is not disposed within the intersection zone IZ. Accordingly, the axis of force A_4, which is defined by the force applied by the tension member **270** to the handle member **205**, passes through the intersection zone IZ when the tension member is disposed at the first portion **254** of the coupling portion **240**, the second portion **256** of the coupling portion **240**, and the third portion **258** of the coupling portion **240**. Additionally, the axis of force A_4 intersects the axis A_6 at a location disposed within the intersection zone IZ.

[0057] As the handle member **205** is rotated or moved through its range of motion from its first position, to its second position, and to its third position, the tension member **270** applies a force and a torque to the handle member **205**. It may be desirable to vary the amount of torque applied to the handle member depending on the activity that is being simulated with the handle member. For example, as a baseball player swings a baseball bat very little, if any, torque is experienced by the baseball player. Thus, it would be desirable to eliminate the torque applied to the handle member when the handle member is used to simulate a baseball swing. Conversely, there may be some activities for which it would be desirable apply a constant or varying amount of torque to the handle member as the handle member is moved through its range of motion.

[0058] Torque is measured by the following equation:

$$\text{Torque}=d*F \sin \phi$$

[0059] where d is the distance between the point about which the torque is being measured and the point at which the force is applied, F is the amount of force applied, and ϕ is the angle between the direction of the applied force and the axis extending from the point about which the torque is being measured and the point at which the force is being applied.

[0060] As illustrated in **FIGS. 6 through 8**, the axis of force A_4 intersects the intersection zone (and the axis of rotation A_5) when the handle member is in its first position, its second position, and its third position. Accordingly, the amount of torque applied by the tension member about the intersection zone IZ (and the axis of rotation A_5) is substantially the same when handle member is in its first position, its second position, and its third position. Specifically, in the illustrated embodiment, because the distance between the intersection zone IZ (and the axis of rotation A_5) and the point at which the force is being applied is zero, the amount of torque applied by the tension member about the intersection zone IZ (and the axis of rotation A_5) is zero.

[0061] In another embodiment, the tension member applies a constant amount (other than zero) of torque to a location associated with the handle member. For example, in one embodiment, the coupling member can have frictionless zones and friction zones. Thus, as the handle member is rotated and the tension member slides with respect to the coupling member, the amount of torque applied to a location of the handle member can be constant. Alternatively, the amount of torque applied to a location of the handle member when the handle member is rotated can be selectively controlled.

[0062] **FIGS. 10 and 11** illustrate other embodiments of the grip portion. **FIG. 10** illustrates a grip portion **310** that is configured to simulate a handle of a golf club. The grip portion **310** extends along an axis A_7 and includes a first end portion **312** and a second end portion **314** opposite the first end portion **312**. The grip portion **310** also includes a lumen **316** that extends from the first end portion **312** of the grip portion **310** to the second end portion **314** of the grip portion **310**. The lumen **316** of the grip portion **310** is configured to receive a portion of the coupling member **240** to removably and rotatably couple the grip portion **310** to the coupling portion **240**. Specifically, the grip portion **310** is configured to rotate with respect to the coupling portion **240** about the axis A_7.

[0063] **FIG. 11** illustrates a grip portion **410** that is configured to simulate a handle of a tennis racquet. The grip portion **410** extends along an axis A_8 and includes a first end portion **412** and a second end portion **414** opposite the first end portion **412**. The grip portion **410** also includes a lumen **416** that extends from the first end portion **412** of the grip portion **410** to the second end portion **414** of the grip portion **410**. The lumen **416** of the grip portion **410** is configured to receive a portion of the coupling member **240** to removably and rotatably couple the grip portion **410** to the coupling portion **240**. Specifically, the grip portion **410** is configured to rotate with respect to the coupling portion **240** about the axis A_8.

[0064] **FIGS. 12 through 14** illustrate other embodiments of the coupling portion of the handle member. As illustrated in **FIG. 12**, the coupling portion **340** includes a first end portion **342** and a second end portion **344** disposed opposite the first end portion **342**. The coupling portion **340** also has a curved portion **346** disposed proximate the first end portion **342** of the coupling portion **340** and a substantially linear portion **348** disposed proximate the second end portion **344** of the coupling portion **340**. The curved portion **346** has a first curved segment **345** and a second curved segment **347**. The second curved segment **347** has a radius of curvature that is smaller than the radius of curvature of the first curved segment **345**. Additionally, the second curved segment **347** is disposed between the first curved segment **345** and the first end portion **342** of the coupling portion **340**.

[0065] The coupling portion **340** is configured to be slidably coupled to a tension member (not shown in **FIG. 12**) such that the tension member may slide with respect to the coupling portion **340** along a travel path TP_2. Specifically, the tension member may slide with respect to the coupling portion **340** from a first portion **354** of the coupling portion **340** to a second portion **356** of the coupling portion **340** and to a third portion **358** of the coupling portion **340**.

[0066] As illustrated in **FIG. 13**, the coupling portion **440** includes a first end portion **442** and a second end portion **444** disposed opposite the first end portion **442**. The coupling portion **440** also has a curved portion **446** disposed proximate the first end portion **442** of the coupling portion **440** and a substantially linear portion **448** disposed proximate the second end portion **444** of the coupling portion **440**. The curved portion **446** has an inner curved segment **447** and an outer curved segment **449**.

[0067] The coupling portion **440** is configured to be slidably coupled to a tension member (not shown in **FIG. 13**) such that the tension member may slide with respect to the coupling portion **440** along a travel path TP_3. Specifically, the tension member may slide with respect to the coupling portion **440** from a first portion **454** of the coupling portion **440** to a second portion **456** of the coupling portion **440** and to a third portion **458** of the coupling portion **440**. Although the travel path TP_3 is illustrated as being associated with the outer curved segment, in another embodiment, the travel path is associated with the inner curved segment.

[0068] As illustrated in **FIG. 14**, the coupling portion **540** includes a first end portion **542** and a second end portion **544** disposed opposite the first end portion **542**. The coupling portion **540** also has a curved portion **546** disposed proximate the first end portion **542** of the coupling portion **540** and a substantially linear portion **548** disposed proximate the second end portion **544** of the coupling portion **540**. The curved portion **546** has a first inner curved segment **447**, a second inner curved segment **445**, and an outer curved segment **449**.

[0069] The coupling portion **540** is configured to be slidably coupled to a tension member (not shown in **FIG. 14**) such that the tension member may slide with respect to the coupling portion **540** along a travel path TP_4. Specifically, the tension member may slide with respect to the coupling portion **540** from a first portion **554** of the coupling portion **540** to a second portion **556** of the coupling portion **540** and to a third portion **558** of the coupling portion **440**.

[0070] **FIGS. 15, 15*a*** and **16** illustrate other embodiments of the handle member in accordance with the invention. As

illustrated in **FIG. 15**, the handle member **605** includes a grip portion **610** and a coupling portion **640**. The coupling portion **640** includes a curved portion **646** and a substantially linear portion **648**. In some embodiments, the coupling portion **640** is rigid. In other embodiments, the coupling portion (or a portion of a coupling portion) is not rigid, but is flexible. The curved portion **646** includes a first end portion **647** and a second end portion **649** located opposite the first end portion **647**. The substantially linear portion **648** includes a first end portion **641** and a second end portion **643**. The first end portion **647** of the curved portion **646** is coupled to the first end portion **641** of the substantially linear portion **648**. Similarly, the second end portion **649** of the curved portion **646** is coupled to the second end portion **643** of the substantially linear portion **648**. In the illustrated embodiment, the curved portion **646** and the substantially linear portion **648** are unitarily or monolithically formed. In another embodiment, the end portions of the curved portion are removably coupled to the end portions of the substantially linear portion.

[**0071**] In the illustrated embodiment, the substantially linear portion **648** of the coupling member **640** is configured to be coupled to the grip portion **610**. In one embodiment, the grip portion **610** is removably coupled to the substantially linear portion **648** of the coupling member **640**. For example, the grip portion can be a clam-shell-type structure and can include a hinge that allows the grip portion to be secured around the substantially linear portion **648** of the coupling member **640**. In another embodiment, the grip portion **610** is fixedly coupled to the substantially linear portion **648** of the coupling member **640**. In yet another embodiment, the grip portion **610** is integrally or monolithically formed with the coupling portion **640**.

[**0072**] The coupling portion **640** is configured to be slidably coupled to a tension member (not shown in **FIG. 15**) such that the tension member may slide with respect to the coupling portion **640** along a travel path TP_5. Specifically, the tension member may slide with respect to the coupling portion **640** from a first portion **654** of the coupling portion **640** to a second portion **656** of the coupling portion **640** and to a third portion **658** of the coupling portion **640**.

[**0073**] The handle member **605** may be rotated about an axis A_9. As the handle member **605** is rotated about axis A_9, the tension member slides with respect to the handle member from the first portion **654** of the coupling portion **640** to the second portion **656** of the coupling portion **640** and to the third portion **658** of the coupling portion **640**. As illustrated in **FIG. 15**, the intersection zone IZ is disposed such that the grip portion **610** of the handle member **605** is disposed within the intersection zone IZ. Accordingly, the axis of force (not illustrated), which is defined by the force applied by the tension member to the handle member **605**, passes through the intersection zone IZ when the tension member is disposed at the first portion **654** of the coupling portion **640**, the second portion **656** of the coupling portion **640**, and the third portion **658** of the coupling portion **640**. Additionally, the axis of force intersects the axis A_9 at a location disposed within the intersection zone IZ when the tension member is disposed at the first portion **654** of the coupling portion **640**, the second portion **656** of the coupling portion **640**, the third portion **658** of the coupling portion **640**, and portions therebetween.

[**0074**] As illustrated in **FIG. 15*a***, the handle member **605*a*** includes a grip portion **610*a*** and a coupling portion **640*a***. The coupling portion **640*a*** is flexible or otherwise deformable. For example, in some embodiments, the coupling portion **640*a*** is a cord or a rope. In other embodiments, the coupling portion is another type of flexible member.

[**0075**] In the illustrated embodiment, the coupling portion **640*a*** extends through a lumen (not illustrated) that extends through the grip portion **610*a***. The grip portion may be removably coupled to the coupling portion **640*a***. For example, in one embodiment, the grip portion is a clam-shell-type structure that includes a hinge that allows the grip portion to be secured around the coupling portion. In another embodiment, the coupling portion includes end portions that are fixedly coupled to the grip portion.

[**0076**] The coupling portion **640*a*** is configured to be slidably coupled to a tension member (not shown in **FIG. 15*a***) such that the tension member may slide with respect to the coupling portion **640*a*** along a travel path TP_{5a}. Specifically, the tension member may slide with respect to the coupling portion **640*a*** from a first portion **654*a*** of the coupling portion **640*a*** to a second portion **656*a*** of the coupling portion **640*a*** and to a third portion **658*a*** of the coupling portion **640*a***. In some embodiments, the coupling portion **640*a*** is slidably coupled to the tension member via a pulley assembly **695*a***.

[**0077**] The handle member **605*a*** may be rotated about an axis A_{9a}. As the handle member **605*a*** is rotated about axis A_{9a}, the tension member slides with respect to the handle member **605*a*** from the first portion **654*a*** of the coupling portion **640*a*** to the second portion **656*a*** of the coupling portion **640*a*** and to the third portion **658*a*** of the coupling portion **640*a***. As illustrated in **FIG. 15*a***, the intersection zone IZ is disposed such that the grip portion **610*a*** of the handle member **605*a*** is disposed within the intersection zone IZ. Accordingly, the axis of force (not illustrated), which is defined by the force applied by the tension member to the handle member **605*a***, passes through the intersection zone IZ when the tension member is disposed at the first portion **654*a*** of the coupling portion **640*a***, the second portion **656*a*** of the coupling portion **640*a***, and the third portion **658*a*** of the coupling portion **640*a***. Additionally, the axis of force intersects the axis A_{9a} at a location disposed within the intersection zone IZ when the tension member is disposed at the first portion **654*a*** of the coupling portion **640*a***, the second portion **656*a*** of the coupling portion **640*a***, the third portion **658*a*** of the coupling portion **640*a***, and portions therebetween.

[**0078**] As illustrated in **FIG. 16**, a handle member **705** includes a grip portion **710** and a coupling portion **740**. The coupling portion **740** includes a curved portion **746** and a substantially linear portion **748**. The curved portion **746** substantially defines a circle, and the substantially linear portion **748** is disposed within the circle defined by the curved portion **746**. In the illustrated embodiment, the curved portion **746** and the substantially linear portion **748** are unitarily or monolithically formed. In another embodiment, the substantially linear portion is removably coupled to the curved portion.

[**0079**] In the illustrated embodiment, the grip portion **710** is configured to be coupled to the substantially linear portion **748** of the coupling member **740**. In one embodiment, the

grip portion **710** is removably coupled to the substantially linear portion **748** of the coupling member **740**. For example, the grip portion **710** can be a clam-shell-type structure and can include a hinge that allows the grip portion **710** to be removably secured around the substantially linear portion **748** of the coupling member **740**. In another embodiment, the grip portion **710** is fixedly coupled to the substantially linear portion **748** of the coupling member **740**. In yet another embodiment, the grip portion **710** is integrally or monolithically formed with the coupling portion **740**.

[**0080**] The coupling portion **740** is configured to be slidably coupled to a tension member (not shown in **FIG. 16**) such that the tension member can slide with respect to the coupling portion **740** along a travel path TP_6. Specifically, the tension member can slide with respect to the coupling portion **740** from a first portion **754** of the coupling portion **740** to a second portion **756** of the coupling portion **740** and to a third portion **758** of the coupling portion **740**. As illustrated in **FIG. 16**, as the curved portion **740** substantially defines a circle, the first portion **754** of the curved portion **740** is disposed directly adjacent the third portion **758** of the curved portion **740**. The tension member may be coupled to the curved portion of the coupling member via any known mechanism. For example, in one embodiment, the curved portion of the handle member includes a groove that is configured to receive a portion of a projection of the tension member to slidably couple the tension member to the coupling portion of the handle member.

[**0081**] The handle member **705** may rotated about an axis A_{10}. As the handle member **705** is rotated about axis A_{10}, the tension member slides with respect to the handle member from the first portion **754** of the coupling portion **740** to the second portion **756** of the coupling portion **740** and to the third portion **758** of the coupling portion **740**. As illustrated in **FIG. 16**, the intersection zone IZ is disposed such that the grip portion **710** of the handle member **705** is disposed within the intersection zone IZ. Accordingly, the axis of force (not illustrated), which is defined by the force applied by the tension member to the handle member **705**, passes through the intersection zone IZ when the tension member is disposed at the first portion **754** of the coupling portion **740**, the second portion **756** of the coupling portion **740**, and the third portion **758** of the coupling portion **740**. Additionally, the axis of force intersects the axis A_{10} at a location disposed within the intersection zone IZ when the tension member is disposed at the first portion **754** of the coupling portion **740**, the second portion **756** of the coupling portion **740**, the third portion **758** of the coupling portion **740**, and portions therebetween.

[**0082**] **FIG. 17** illustrates another embodiment of the tension member according to the invention. The tension member **370** includes a cable **380** and a force-generating mechanism **390**. The cable **380** includes a first end portion **382** and a second end portion **384** disposed opposite the first end portion **382**.

[**0083**] In the illustrated embodiment, the force-generating mechanism **390** includes a flexible member **392**, a base member **394**, a support arm **396**, and a pulley assembly **398**. The support arm **396** extends from and is supported by the base member **394**. The pulley assembly **398** is fixedly coupled to the support arm **396**.

[**0084**] The flexible member **392** includes a first end portion **391** coupled to the base member **394** and a second end portion **393** coupled to the first end portion **382** of the cable. The flexible member **392** is made of a resilient material and is configured to flex or otherwise bend along a range of motion that includes a first end position and a second end position when a force is applied to the flexible member **392**. Additionally, when the flexible member **392** is bent or otherwise flexed into its second end position, the flexible member **392** will exert a force as it attempts to return to its first end position.

[**0085**] In the illustrated embodiment, the cable **380** is coupled to the flexible member **392**, extends across the pulley of pulley assembly **398**, and is coupled to a handle member **805**. Specifically, the second end portion **384** of the cable **380** is coupled to the handle member **805**. Accordingly, the handle member **805** may be moved with respect to the flexible member **392** to flex or bend the flexible member **392** along its range of motion. Additionally, once the flexible member **392** is displaced from its first end position, the flexible member **392** will apply a force to the handle member **805** (through the cable **380**).

[**0086**] **FIG. 18** is a schematic illustration of another embodiment of the tension member according to the invention. The tension member **470** includes a cable **480** and a force-generating mechanism **490**. The cable **480** includes a first end portion **482** coupled to the force-generating mechanism **490** (as described in detail below) and a second end portion **484** coupled to a handle member (not illustrated).

[**0087**] The force-generating mechanism includes a housing **492**, a shaft **494**, and a brake **496**. The housing **492** houses the shaft **494** and the brake **496**. The housing can have a variety of shapes and sizes as appropriate for the application, e.g., a medical rehabilitation device and/or an exercise device.

[**0088**] The shaft **494** is coupled to the housing **492** such that the shaft **494** is configured to move with respect to the housing **492**. For example, in one embodiment, the shaft **494** is rotatably coupled to the housing **492** and is configured to rotate with respect to the housing **494**. In another embodiment, the shaft is slidably coupled to the housing and is configured to slide or move in a linear motion with respect to the housing.

[**0089**] The brake **496** of the force-generating mechanism **490** is disposed within the housing **492** and is coupled to the shaft **494**. Although a brake is described and illustrated, a clutch may be used in place of the described brake. Said another way, in another embodiment, the force-generating mechanism does not include a brake, but rather includes a clutch.

[**0090**] The brake **496** is configured to oppose or resist movement of the shaft **494** with respect to the housing **492**. The first end portion **482** cable **480** is coupled to the shaft **494**. For example, in one embodiment, the cable **480** is wrapped around the shaft **494**. Accordingly, as the handle member (not illustrated) is moved with respect to the housing **492**, the cable **480** is moved with respect to the shaft **494** to move or rotate the shaft **494** with respect to the housing **492**. Thus, the brake **496**, which applies a force to the shaft to oppose the movement of the shaft **494**, causes a force to be applied to the handle member (through the cable).

[**0091**] **FIGS. 19 through 21** illustrate another embodiment of the invention. As illustrated in **FIG. 19**, an apparatus

900 includes a handle member **905** and a tension member **970**. The handle member includes a grip portion **910** and a coupling portion **940**. The grip portion **910** is configured to be grasped by a user. In the illustrated embodiment, the grip portion **910** is removably and rotatably coupled to the coupling portion **940**. In another embodiment, the grip portion **910** is fixedly coupled to the coupling portion **940**.

[**0092**] The tension member **970** includes a cable **980** and a force-generating mechanism (not illustrated). One end of the cable **980** is coupled to the force-generating mechanism. Another end of the cable **980** is coupled to the coupling portion **940** of the handle member **905**.

[**0093**] The force-generating mechanism is configured to apply a force to the cable **980** and, accordingly, to any object that is coupled to the cable **980**. For example, in one embodiment, the force-generating mechanism includes a weight (not illustrated). Thus, when the weight is lifted from a support surface (not illustrated), the gravitational force acting on the weight is transferred to the cable **980** and to any object that is coupled to the cable **980**.

[**0094**] The tension member **970** also includes a track **972** and a pulley assembly **976**. The pulley assembly **976** is movably coupled to and supported by the track **972**. In other words, the pulley assembly **976** can move with respect to the track **972**.

[**0095**] In the illustrated embodiment, the cable **980** extends from the handle member **905** to the force-generating mechanism and engages the pulley assembly **976**. Accordingly, when a user grasps the handle member **905** and moves it, the weight is lifted with respect to the support surface. Additionally, once the weight is lifted from the support surface, the force-generating mechanism applies a force to the handle member **905** (through the cable **980**). The force that is applied to the handle member **905** defines an axis.

[**0096**] The apparatus **900** is configured such that a user may move the handle member **905** with respect to the track **972** from a first position (see **FIG. 19**) to a second position (see **FIG. 20**) and to a third position (see **FIG. 21**). The apparatus **900** also includes a sensor **999** that is configured to cooperate with the pulley assembly **976** to cause the axis to pass through an intersection zone IZ when the apparatus **900** is in its first position, its second position, and its third position. Specifically, the sensor **999** is configured to measure the axis of force relative to the intersection zone IZ. The sensor **999** causes the pulley assembly **976** to move with respect to the track **972** when the sensor **999** detects that the axis does not pass through the intersection zone IZ. The movement of the pulley assembly **976** with respect to the track **972** changes or moves the axis with respect to the handle member **905**, for example, to maintain a desired relationship between the axis of force and the intersection zone IZ.

[**0097**] Thus, as the axis of force passes through the intersection zone IZ when the apparatus **900** is in its first position, its second position, and its third position, the torque applied to the handle member **905** about the intersection zone IZ is substantially the same when the apparatus is in its first position, its second position, and its third position. Specifically, as the axis of force passes through the intersection zone IZ when the apparatus is in its first position, its second position, and its third position, the torque applied to the handle member about the intersection zone IZ is substantially zero.

[**0098**] In another embodiment, the sensor is configured to cooperate with the pulley assembly to selectively control the amount of torque applied by the tension member to the intersection zone. Although the track **972** is illustrated as being a linear track, in another embodiment, the track includes a curved portion.

[**0099**] While the invention has been described in detail and with references to specific embodiments thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. An apparatus, comprising:

a handle member having a grip portion and a coupling portion, the coupling portion configured to be slidably coupled to a tension member from a first portion of the coupling portion to a second portion of the coupling portion, the grip portion includes a vertex location,

the handle member defining a first axis extending from the vertex location of the grip portion to the first portion of the coupling portion, the handle member defining a second axis extending from the vertex location of the grip portion to the second portion of the coupling portion, the first axis and the second axis defining an angle formed about the vertex location, the angle being greater than 5 degrees.

2. The apparatus of claim 1, wherein the coupling portion includes a curved portion.

3. The apparatus of claim 1, wherein the grip portion is removably coupleable to the coupling portion.

4. The apparatus of claim 1, wherein the grip portion is in the form of a baseball bat handle.

5. The apparatus of claim 1, wherein the grip portion is in the form of a tennis racquet handle.

6. The apparatus of claim 1, wherein the grip portion is in the form of a golf club handle.

7. The apparatus of claim 1, wherein the grip portion is a first grip portion, the handle member includes a second grip portion, the first grip portion is removably coupleable to the coupling portion, the second grip portion is removably coupleable to the coupling portion.

8. The apparatus of claim 1, wherein the coupling portion includes an end portion, the grip portion includes a cavity configured to receive at least a portion of the end portion of the coupling portion.

9. The apparatus of claim 1, wherein the coupling portion includes an end portion, the grip portion includes a cavity configured to slidably receive at least a portion of the end portion of the coupling portion, the grip portion is configured to rotate about the at least a portion of the end portion of the coupling portion.

10. The apparatus of claim 1, wherein the tension member includes a cable and a force-generating mechanism, the cable having a first end portion coupled to the coupling portion of the handle member and a second end portion coupled to the force-generating mechanism.

11. The apparatus of claim 1, wherein the tension member includes a cable and a force-generating mechanism, the cable having a first end portion coupled to the coupling

portion of the handle member and a second end portion coupled to the force-generating mechanism, the force-generating mechanism is a brake controlled rotation shaft.

12. The apparatus of claim 1, wherein the tension member includes a cable and a force-generating mechanism, the cable having a first end portion coupled to the coupling portion of the handle member and a second end portion coupled to the force-generating mechanism, the force-generating mechanism is a weight suspended above a support surface.

13. The apparatus of claim 1, wherein the tension member includes a cable and a force-generating mechanism, the cable having a first end portion coupled to the coupling portion of the handle member and a second end portion coupled to the force-generating mechanism, the force-generating mechanism is a flexible member configured to be bent from a first position to a second position.

14. An apparatus, comprising:

a handle member having a grip portion and a coupling portion, the coupling portion configured to be slidably coupled to a tension member from a first portion of the coupling portion to a second portion of the coupling portion, the travel distance between the first portion of the coupling portion and the second portion of the coupling portion being at least 5 centimeters.

15. The apparatus of claim 14, wherein the coupling portion includes a curved portion.

16. The apparatus of claim 14, wherein the grip portion is removably coupleable to the coupling portion.

17. The apparatus of claim 14, wherein the grip portion is a first grip portion, the handle member includes a second grip portion, the first grip portion is removably coupleable to the coupling portion, the second grip portion is removably coupleable to the coupling portion.

18. The apparatus of claim 14, wherein the coupling portion includes an end portion, the grip portion includes a cavity configured to receive at least a portion of the end portion of the coupling portion.

19. The apparatus of claim 14, wherein the coupling portion includes an end portion, the grip portion includes a cavity configured to slidably receive at least a portion of the end portion of the coupling portion, the grip portion is configured to rotate about the at least a portion of the end portion of the coupling portion.

20. The apparatus of claim 14, wherein the travel distance is at least 10 centimeters.

21. The apparatus of claim 14, wherein at least a portion of the coupling portion is flexible.

22. An apparatus, comprising:

a handle member including a grip portion and a coupling portion, the grip portion extending along an axis, the coupling portion configured to be coupled to a tension member that applies a force to the handle member along an axis,

the handle member being configured to rotate about an axis of rotation between a first position and a second position, the first position is different than the second position, the axis of rotation is substantially orthogonal to the axis of force, the axis of rotation is substantially orthogonal to the grip portion axis, the axis of force substantially intersects an intersection zone associated with the handle member when the handle member is in its first position, the axis of force substantially intersects the intersection zone when the handle member is in its second position.

23. The apparatus of claim 22, wherein at least a portion of the handle member is disposed within the intersection zone.

24. The apparatus of claim 22, wherein at least a portion of the grip portion of the handle member is disposed within the intersection zone.

25. The apparatus of claim 22, wherein at least a portion of the axis of rotation is disposed within the intersection zone.

26. The apparatus of claim 22, wherein at least a portion of the axis of rotation is disposed within the intersection zone, the axis of force substantially intersects the axis of rotation when the handle member is in its first position, the axis of force substantially intersects the axis of rotation when the handle member is in its second position.

27. The apparatus of claim 22, wherein at least a portion of the coupling portion is flexible.

28. An apparatus, comprising:

a handle member including a grip portion and a coupling portion, the grip portion extending along an axis, the coupling portion configured to be coupled to a tension member that applies a force to the handle member along an axis,

the handle member being configured to rotate about an axis of rotation between a first position, a second position and a third position, the first position is different than the second position and the third position, the second position is different than the third position, the axis of rotation is substantially orthogonal to the axis of force, the axis of rotation is substantially orthogonal to the grip axis, the force applied to the handle member produces an amount of torque on a location on the handle member when the handle member is in its first position, the force applied to the handle member produces substantially the amount of torque on the location on the handle member when the handle member is in its second position, the force applied to the handle member produces substantially the amount of torque on the location on the handle member when the handle member is in its third position.

29. The apparatus of claim 28, further comprising:

a sensor coupled to the handle member and configured to detect the angle between the force axis and the grip axis;

a track; and

a pulley movably coupled to the track,

the tension member includes a cable and a force-generating mechanism, the cable having a first end portion, a second end portion opposite the first end portion, and a medial portion disposed between the first end portion and the second end portion, the first end portion coupled to the handle member, the second end portion coupled to the force-generating mechanism, the medial portion configured to interact with the pulley, the pulley configured to be disposed at a first location on the track when the sensor detects a first angle between the force axis and the grip axis, the pulley configured to move to a second location on the track in response to the sensor detecting a second angle between the force axis and the grip axis.

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