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(54) **Traction device**

(57) A device includes a stationary housing having a guidance. A carriage is slidable mounted on the guidance and at least one corrugated diaphragm mechanism is housed in the housing and connectable to the carriage. The corrugated diaphragm is structured to elastically ex-

pand and retract, depending on an application of pressure, to extend and retract, respectively, the carriage along the guidance relative to the stationary housing. A manifold is provided to connect the corrugated diaphragm to a pump system a connection system is used to connect to the diaphragm.

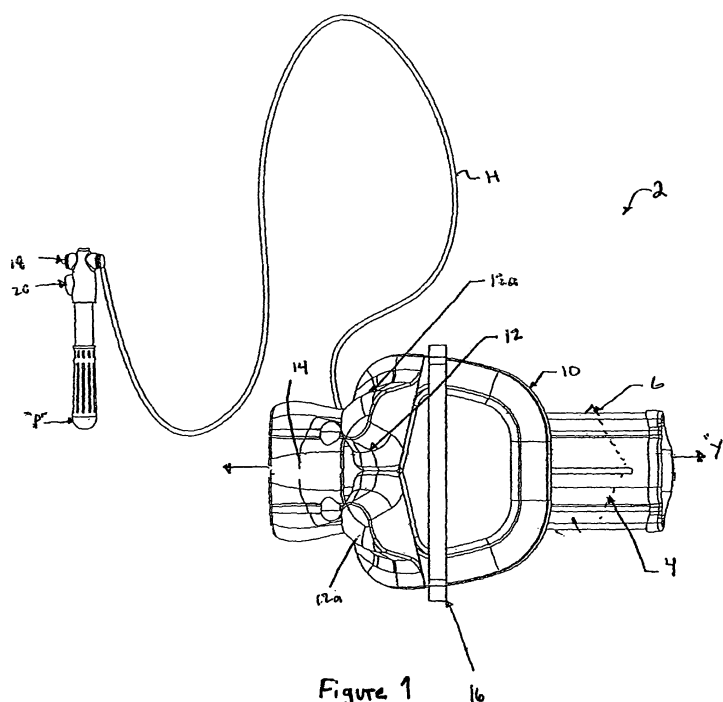


Figure 1

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Description

Field of the Invention

[0001] The invention generally relates to a cervical and/or lumbar traction device, and more particularly, to a cervical and/or lumbar traction device having a diaphragm.

Discussion of Background Information

[0002] Traction devices are used to relieve pressure on inflamed or enlarged nerves. Cervical and lumbar or spinal traction devices are the most common type of these devices. When correctly used, the traction devices can relieve pain in the neck and the spine by, for example, straightening the curvature of the spine or stretching of the spinal and cervical musculature.

[0003] Portable traction devices are now becoming very popular for in home use. These devices allow patients to perform traction therapy without leaving their homes, or expending large sums of money for a health-care provider or physical therapist. Under the proper guidance and instruction, these portable devices are becoming ever more common, especially in today's age of rising health care costs.

[0004] Additionally, known portable lumbar traction devices, currently manufactured and sold, are cumbersome and difficult to transport. These lumbar traction devices are basically a large board of approximately 3 or more feet in length.

[0005] In one known portable lumbar traction device, two flat separate boards are assembled in order to form the platform for the device. To make such assembly, hooks extending from one flat board are aligned with holes in the other flat board. This is accomplished, most typically, by lifting and aligning the board with the hooks and then inserting the hooks into the holes. During this assembly, a piston rod of a pneumatic device remains attached to one board and the cylinder housing of the pneumatic cylinder remains attached to the other board, making for a very awkward assembly. To disassemble the traction device, the hooks must be removed from the holes, which is an awkward process, especially in view of the piston rods and cylinders remaining attached between the separated boards.

SUMMARY OF THE INVENTION

[0006] In a first aspect of the invention, a device includes a frame and a carriage slidable mounted on the frame. At least one diaphragm mechanism is connectable to the carriage. The diaphragm is structured to elastically expand and retract, depending on an application of pressure, in order to extend and retract, respectively, the carriage. A manifold is coupled between the at least one diaphragm and a pump system. The manifold includes at least one port coupled to a neck of the at least

one diaphragm and a neck communicating with the pump system.

[0007] In another aspect of the invention, the device includes a frame for accommodating at least one corrugated diaphragm device. The at least one corrugated diaphragm device has a retractable spring force such that, upon release of pressure within the at least one corrugated diaphragm device, the at least one corrugated diaphragm device retracts and moves the carriage towards an initial position. A manifold is connectable between the least one corrugated diaphragm device and a pneumatic system. The manifold includes at least one port and at least one neck. The at least one port is connectable to a neck of the least one corrugated diaphragm device and the at least one neck is connectable to a hose of the pneumatic system.

[0008] In another aspect of the invention, a manifold device includes a body having at least one port and one neck having a channel therein in fluid communication with the at least one port. The neck includes a sealing projection. An adapter is configured to be insertable into the at least one port. The adapter comprises a varied cross section with a major diameter of at least one portion of the varied cross section being larger than an inner diameter of the at least one port at least in one location.

[0009] In an embodiment of the invention the at least one diaphragm has an approximate length of 10.5 inches in the extendable position.

[0010] In an embodiment of the invention the at least one diaphragm has an approximate length of 6.5 inches at a starting position.

[0011] In an embodiment of the invention a stroke length of the at least one diaphragm from a starting position to an extendable position is approximately 4 inches.

[0012] In an embodiment of the invention the at least one diaphragm is two or three diaphragms.

[0013] In an embodiment of the invention the device further comprises at least one restraining mechanism to releasably restrain a portion of a person's body to the slidable carriage.

[0014] In an embodiment of the invention the device further comprises a wedge system that is only linearly adjustable relative to the carriage.

[0015] In an embodiment of the invention the locking system includes a spring arm or a hook, and notches or holes associated with a guidance on the stationary frame which are structured to accommodate the spring arm or the hook.

[0016] In an embodiment of the invention the pinch spring arm mechanism includes at least one ratchet guide and one or more spring arms extending from each wedge and engaging the at least one ratchet guide at different positions via a tabbed or protruding portion.

[0017] In an embodiment of the invention the device further comprises an anti-rotation device to prevent rotation of wedges of the wedge system.

[0018] In an embodiment of the invention the traction system is one of a lumbar traction system and a cervical

traction system.

[0019] In an embodiment of the invention the at least one port is two ports extending along a length of the manifold.

[0020] In an embodiment of the invention the two ports are coupled to two diaphragms.

[0021] In an embodiment of the invention an outermost diameter of at least one of the outward extending barbs is slightly larger than an inner circumference of the hose to minimize any leakage between the hose and the manifold.

[0022] In an embodiment of the invention the adapter is configured to be insertable into the at least one port and the at least one diaphragm.

[0023] In an embodiment of the invention the at least one port includes at least one detent about a circumference or portion thereof and a neck of the at least one diaphragm includes at least one corresponding barb.

[0024] In an embodiment of the invention the at least one detent and corresponding barb is configured to secure the at least one diaphragm to the manifold during curing of a glue or epoxy applied to secure the at least one diaphragm to the at least one port.

[0025] In an embodiment of the invention the at least one diaphragm and the at least one port are ultrasonic or thermal welded together.

[0026] In an embodiment of the invention the manifold includes a pressure release valve.

[0027] In an embodiment of the invention the device further comprises an adapter having a plurality of barbs, the adapter being insertable into the at least one port.

[0028] In an embodiment of the invention the varied cross section includes a plurality of barbs extending circumferentially about a body, each of the barbs is configured to prevent disengagement of the at least one corrugated diaphragm device from the adapter and the adapter from the manifold.

[0029] In an embodiment of the invention the manifold is a resilient type material softer than that of the adapter.

[0030] In an embodiment of the invention the at least one port includes at least one detent about a circumference or portion thereof and a neck of the at least one corrugated diaphragm includes at least one corresponding barb, wherein the at least one detent and corresponding barb is configured to secure the at least one corrugated diaphragm to the manifold.

[0031] In an embodiment of the invention the at least one corrugated diaphragm and the at least one port are glued, ultrasonic or thermal welded together.

[0032] In an embodiment of the invention the manifold includes pressure release valve.

[0033] In an embodiment of the invention the mounting carriage assembly includes a mounting structure having at least one mounting connection.

[0034] In an embodiment of the invention the mounting structure connects to a boss of the carriage.

[0035] In an embodiment of the invention the connecting disk includes a slot having a shoulder and portions

which are configured to be mountable between the flanges.

[0036] In an embodiment of the invention the at least one diaphragm includes a "T" shaped projection mating with the slot and shoulder of the connecting disk.

[0037] In an embodiment of the invention the opposing flanges include tapered end walls and the connecting disk is mountable between the opposing flanges.

[0038] In an embodiment of the invention the connecting disk includes a slot having a shoulder and at least one recessed portion which is configured to interface with at least one flange of the flanges.

[0039] In an embodiment of the invention the at least one corrugated diaphragm device includes a "T" projection configured to mate with a slot and shoulder of the connecting disk.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] The present invention is further described in the detailed description which follows, wherein:

Figure 1 shows a top view of a cervical traction device in accordance with the invention;

Figures 2a and 2b show side views of the cervical traction device in an extended and retracted position, respectively, in accordance with the invention;

Figure 3 shows a cut-away view of the cervical traction device in accordance of the invention;

Figure 4 shows an exploded view of the cervical traction device in accordance with the invention;

Figures 4a and Figure 4b (cross section) show a connection mechanism in accordance with the invention;

Figure 5 shows a bottom view (with a bottom housing removed) of the cervical traction device in accordance with the invention;

Figure 5a shows a top view (with cushion wedges removed) of the cervical traction device in accordance with the invention;

Figure 6 shows a lumbar traction device in accordance with the invention;

Figure 7 shows an exploded view of the lumbar traction device in accordance of the invention

Figure 8 shows a perspective view of a corrugated diaphragm and manifold, in accordance with the invention;

Figure 9 shows a cutaway of the corrugated diaphragm and manifold along line 9-9 of Figure 8, in accordance with the invention;

Figure 10 shows a perspective view of a barb adapter in accordance with the invention;

Figure 11 shows another embodiment of the corrugated diaphragm and manifold, in accordance with the invention;

Figure 12 shows a manifold with pressure release valve in accordance with the invention;

Figure 13 shows a cross section of the manifold

along line 12-12 of Figure 12;

Figure 14 shows an exploded, perspective view of the carriage (mount) of Figure 5, in accordance with the invention;

Figure 15 shows a connector disk in accordance with the invention;

Figure 16 shows a perspective view the connector disk connected to the diaphragm in accordance with the invention; and

Figure 17 shows a cutaway view of the connector disk and diaphragm along line 11-11 of Figure 16, in accordance with the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0041] The invention is directed to a cervical and/or a lumbar traction device. The traction device includes a corrugated diaphragm which is structured and adapted to move a carriage in a linear fashion. The diaphragm includes a certain spring force which is capable, upon the release of pressure therein, to move the carriage towards its original position and, in embodiments, substantially to its original position. In addition to its own spring force, a roll spring or other spring or resilient type mechanism may be used in combination with the diaphragm, to retract the carriage towards its original position. The diaphragm is devoid of any moving components. The cervical and/or a lumbar traction device, using the diaphragm and related components, is lighter and includes less parts than devices using pneumatic cylinders.

[0042] Figure 1 shows an embodiment of the cervical traction device. The cervical traction device is generally denoted as reference numeral 2. The traction device 2 includes a stationary housing (e.g., frame) 4 having a moveable stand 6 which is structured and adapted so that several angles can be achieved relative to a flat surface, e.g., a floor or other surface where a user may use the device 2. The cervical traction device 2 further includes a movable headrest 10 having an occiput wedge system 12, which is mounted to a sliding carriage 14. A strap or other restraining device 16 for restraining a user's head is attached to the movable head-rest system 10.

[0043] The occiput wedge system 12 includes separate wedges 12a that may have a concave engaging surface. The occiput wedge system 12, with the head-rest 10, may be slidably movable along a longitudinal axis "Y" of the housing 4 by a corrugated diaphragm type device (shown more clearly in FIG. 3). The occiput wedge system 12 is designed to apply a therapeutic traction force to the occipital areas on a patient's head, while the housing 4 remains stationary. This is accomplished, in one aspect of the invention, by pressure being applied by a pump P via a hose H, to the diaphragm type device. Thus, upon pressurization, the corrugated diaphragm type device will move or slide the carriage 14 and thus the head-rest 10 and occiput wedge system 12. The pump P may have a manual pressure relief mechanism 18, as well as

a gauge 20 to show a force which is produced by the diaphragm type device.

[0044] Figures 2a and 2b show the cervical traction device 1 positioned at an angle of, for example, 10 degrees relative to a flat surface, e.g., a floor or other surface where the user may use the device 2. It should be understood that other angles of adjustment, e.g., 15 degrees, 20 degrees, etc. with relation to the supporting surface, are also contemplated by the invention, and that the angles shown herein are provided for illustrative purposes. In the examples of Figures 2a and 2b, the adjustment can be accomplished via movement of the moveable stand 6 in either direction "A" or "B", along the longitudinal axis of the device 2.

[0045] Still referring to Figures 2a and 2b, the housing 4 includes a guidance 24 which has turned ends that form rails 26. The rails 26 are structured to accommodate the stand 6. In one embodiment, the rails 26 include a plurality of notches 22 for locking or positioning of the stand 6 at a predetermined position. The notches 22 may also be apertures or holes. In embodiments, the stand 6 may be locked into place by use of a spring arm, hook or other type of mechanism 6a that engages the notches 22 positioned along the stand 6 of the housing 4.

[0046] As discussed in greater detail below, in Figure 2a, the traction device is in an extended position; whereas, in Figure 2b, the traction device is in a retracted position. The extended position is achievable by pressurizing the diaphragm shown in Figure 3. The retracted position is achievable, at least in part, by a return spring force of the diaphragm. That is, upon release of pressure, the spring force of the diaphragm is capable of moving the carriage towards its original position and, in embodiments, substantially to its original position.

[0047] Figure 3 shows a cutaway view of the traction device in accordance with the invention. The traction device 2 includes a corrugated diaphragm type device 30 that is mounted within or mounted to the housing 4. In embodiments, the corrugated diaphragm type device 30 is mounted to a support structure 32 of the housing 4 and the movable carriage 14. In one implementation, at least one boss 34 extends from the moveable carriage 14, via a slot 36 extending substantially along a length of the housing 4, into an interior space of the housing 4, which is connected to a mounting carriage 35. In this embodiment, the corrugated diaphragm type device 30 is attached to the at least one boss 34 via a mounting carriage 35 adapted and configured to slide within the housing 4 and preferably a profile 35a of the housing 4 that is configured to house the corrugated diaphragm type device 30. Upon pressurization of the corrugated diaphragm type device 30, the corrugated diaphragm type device 30 will move the carriage 14 to apply a traction force.

[0048] The corrugated diaphragm type device 30 is connected to an air inlet or manifold 38 provided at an end of the housing 4, proximate to the support structure 32. The manifold 38 is connected to one or more of the diaphragm type devices 30 and is structured to allow

pressurized air from the pump "P" to pass into the corrugated diaphragm type device 30.

[0049] Still referring to Figure 3, the corrugated diaphragm type device 30 acts as a spring, e.g., has its own spring force, to retract the carriage in both a cervical and lumbar traction system from an expanded position. In one exemplary illustration, the corrugated diaphragm type device 30 can be expanded to approximately 10.5 inches in the expanded position, and in one embodiment may have a starting position of about 6.5 inches in length (with an original neutral length of approximately 8 inches). It is also contemplated that other starting and expanded positions are provided by the invention. In one implementation, a stroke length of the corrugated diaphragm type device 30 is approximately 4 inches; although other stroke lengths are also contemplated by the invention.

[0050] Figure 4 shows an exploded view of the traction device in accordance with the invention. The traction device includes, for example, the headrest 10 and occiput wedge system 12 connected to the carriage 14. The carriage 14, in turn, is connected to the boss 34 which extends through the slot 36 along the housing 4 and more specifically a cover plate 4a of the housing 4. The housing 4 further includes a lower frame portion 4b, which includes an interior portion 40 for housing the corrugated diaphragm type device 30.

[0051] The housing 4 further includes the support structure 32, which may include an extending portion 32a for resting on a supporting surface. A cover 32b may be used, in conjunction with the extending portion 32a, to form an interior space, which accommodates the manifold 38. The extending portion 32a may be held in place by a nut 400 having a projection 400b, as shown in Figures 4a and 4b. In this implementation, the nut will be bolted via the hole 400c and the projection 400b will communicate with a slot 400a in the frame portion to prevent rotation of the extending portion 32a and to ensure a connection therebetween. Alternatively, the extending portion 32a may be connected or mated with the frame by any known, conventional manner such as a screw, nut and bolt system, etc. An end cap 42 may be connected to the housing 4, opposing the extending portion 32a. Thus, the combination of the end cap 42, top plate 4a, bottom frame 4b and support structure forms an interior housing for the corrugated diaphragm type device 30. In alternate embodiments, the corrugated diaphragm type device 30 is mounted or attached to the mounting carriage 35 which has at least one extending boss 34 adapted and configured to slide within a guide of the housing 4 and connectable to the sliding carriage 14.

[0052] Figure 5 shows a bottom view (with a bottom portion of the housing removed) of the traction device 2 in accordance with the invention. In this example, the wedges 12 are designed to move in a lateral direction, e.g., do not rotate. In this embodiment, the wedges 12 can be adjustable by a pinch spring arm mechanism 50. The pinch spring arm mechanism 50 includes a ratchet

type guidance 52 in/on the moveable carriage 14. The pinch spring arm mechanism 50 further includes spring arms 54 which may engage the ratchet guide 52 at different positions via opposing protruding portions 56. The opposing protruding portions 56 have tabs 56a so that the user can squeeze them together to disengage from a ratchet portion of the ratchet guide 52, and then move the wedges in an inward position or an outward position. The movement of the wedges may be in a somewhat linear manner across the carriage 14. The at least one boss 34, in one implementation, is attached to or in contacted to a carriage (or mount) which slides in the housing. With this configuration, upon pressurization of the corrugated diaphragm type device 30, the carriage (or mount) will move which, in turn, will move the carriage 14.

[0053] Still referring to Figure 5 and additionally Figure 5a, the wedge system 12 may also include an anti-rotation rib 58 and corresponding slot or groove 60 for preventing rotation of the wedge 12. The slot 60 can be part of the carriage 14 and is, in one implementation, proximate to the ratchet guide 52. The rib 58 communicates with the slot 60 while allowing the wedges 12 to slide in and out.

[0054] Figure 6 shows an embodiment of a lumbar traction device 100 in accordance with the invention. Similar to the traction device shown and described with reference to Figures 1-5, a corrugated diaphragm type device is used to apply a traction type force. In the lumbar traction device 100, three corrugated diaphragm type devices may also be used to provide the traction force. Integrally molded frame members 102A and 102B are hingedly attached via a hinge type mechanism 104 (which may be an alternating type hinge mechanism having at least four parts) to form a portable, foldable device. In the closed position, for example, the frame members 102A and 102B face one another; whereas, in the open state, the frame members 102A and 102B extend along a longitudinal axis in a single plane. Thus, the design of the traction device of Figure 6 allows for the easy closing and opening of the lumbar traction device 100 without the requirement for aligning any parts, lifting any of the parts or separating any of the parts. The lumbar traction device 100 also includes integrally formed handles 108, for example, molded on sides or the ends thereof.

[0055] Still referring to Figure 6, the frame members 102A and 102B are designed to house or mount thereon many of the components of the lumbar traction device 100, such as the corrugated diaphragm type device 30. By way of illustration, the lumbar traction device 100 may include guides 112 positioned on opposing sides of the frame member 102A and/or frame member 102B. The guides 112 are designed to seat thereon a slidable lumbar carriage 114. The lumbar carriage 114 is slidably moveable along the longitudinal axis of the frame 102A and 102B to provide a traction force such that, upon pressurization or release thereof, the corrugated diaphragm type device moves the slidable lumbar carriage 114 in directions "A" and "B". In one embodiment, the lumbar

carriage 114 includes a support pad 116 for the comfort of a user. A pair of belts or other restraining device 120 can be mounted to the support pad 116 and/or the frame member(s). The slidable lumbar carriage 114 may also be seated within a recessed portion 118 of the frame.

[0056] Referring to Figure 7, the slidable lumbar carriage 114 is connected to the corrugated diaphragm type device 30 in order to provide a traction force. Much like discussed above, the corrugated diaphragm type device 30 is mounted within a housing or recess 122 formed by the frame member and a cover plate 124. In embodiments, the lumbar traction device may include two or three corrugated diaphragm type devices 30, corresponding to the number of recesses and/or the required application of traction force.

[0057] The corrugated diaphragm type device 30 is connected to the manifold 126 which, in turn, is housed inside support structure 132, which, in turn, is mounted to support structure 128. The manifold 126 includes an air intake/exhaust 132 connected to a hose "H" of the hand pump "P". The corrugated diaphragm type device 30 is also connected to the slidable lumbar carriage 114 via at least one boss 134. In one implementation, the at least one boss 134 extends from the slidable lumbar carriage 114, via a slot or cutout 136 extending substantially along a length of the plate 124. In this embodiment, the corrugated diaphragm type device 30 is attached to the at least one boss 134 and, upon pressurization of the corrugated diaphragm type device(s) 30, will move the slidable lumbar carriage 114 to apply a traction force. The support pad 116 may be mounted to the slidable lumbar carriage 114 via a plate 114a (and fasteners, e.g., screws, rivets, etc.)

[0058] Still referring to Figure 7, the corrugated diaphragm type device 30 acts as a spring, e.g., has its own spring force, to retract the carriage in both a cervical and lumbar traction system from an expanded position. In addition to its own spring force, a roll spring or other spring or resilient type mechanism may be used in combination with the diaphragm, to retract the carriage towards its original position which is represented schematically with the diaphragm. In one exemplary illustration, the corrugated diaphragm type device 30 can be expanded to approximately 10.5 inches in the expanded position, and in one embodiment may have a starting position of about 6.5 inches in length. It is also contemplated that other starting and expanded positions are provided by the invention. In one implementation, a stroke length of the corrugated diaphragm type device 30 is approximately 4 inches; although other stroke lengths are also contemplated by the invention.

[0059] Figures 8 and 9 show a corrugated diaphragm and manifold system. For purposes of this discussion, reference will be made to the manifold 38; although, it should be understood that the discussion herein is equally applicable to the manifold 126. In embodiments, two corrugated diaphragms 30 (with only one shown for illustrative purposes) are coupled to or mated with the man-

ifold 38 via ports (e.g., hollow necks) 44 extending along a length of a body 46. In other embodiments, the manifold 38 may include more or less than two ports in order to couple or mate more or less than two corrugated diaphragms, depending on the desired or required forces needed to move and/or retract the carriage of the traction device. For example, a spring force of one corrugated diaphragm may be designed to move the traction device to the retracted position.

[0060] In embodiments, the ports 44 are in fluid communication with the hollow body 46 which, in turn, is in fluid communication with a neck 48 positioned at one end of the manifold 38; although, it should be understood that the neck 48 may be placed at any location along the hollow body 46. The neck 48 includes one or more outward extending barbs 48a, 48b, e.g., conically shaped protrusions which facilitate the engagement of the hose "H" to the manifold 38.

[0061] In embodiments, the hose "H" is mated to the neck 48 and held securely in place via the one or more barbs 48a, 48b; that is, the hose "H" is placed about the neck 48 and is securely attached thereto by the use of the barbs 48a, 48b. In embodiments, the barb 48a includes a tapered end in order to facilitate the placement of the hose "H" over the neck 48. In further embodiments, an outermost diameter of at least one of the barbs is slightly larger than an inner circumference of the hose "H" such that air leakage is minimized between the hose "H" and the manifold 38. Additionally, as should be understood by those of skill in the art, the direction of the barbs, facing toward the body 46, facilitates easy installation of the hose "H", while ensuring that the hose "H" will not disengage from the neck 48. In embodiments, the hose "H" is made of a flexible and/or resilient material such that it slightly deforms as it is moved over the barbs of the neck 48, minimizing any leakage between the hose "H" and the neck 48.

[0062] Still referring to Figures 9 and 10, in one embodiment, the corrugated diaphragm 30 can be secured to the port 44 via a glueless mechanism (e.g., a barb adapter 50). For example, as discussed in more detail below, the barb adapter 50 provides an outward force such that the outer wall of the neck 30a remains engaged to the inner circumference of the port 44. In this configuration, leakage is minimized between the major diameter of the barb adaptor and the inner diameter of the neck of the diaphragm and more specifically a barb feature on the barb adapter.

[0063] The connection mechanism 50 (e.g., barb adapter) includes a channel 50a and a varied cross section, generally depicted as reference numeral 52. In more specificity, the varied cross section includes a plurality of outward projections or barbs 52a, 52b, 52c and 52d, extending circumferentially about the body 52. The barbs 52a, 52b, 52c and 52d each include a ledge or shoulder 52a₁, 52b₁, 52c₁ and 52d₁ (hereinafter referred to as a shoulder) which is configured to prevent disengagement of the corrugated diaphragm from the barb adapter,

amongst other features. In the embodiment of Figure 10, the shoulders 52a₁ and 52b₁ are configured in the same orientation (e.g., facing in a same direction) and the shoulders 52c₁ and 52d₁ are configured in the same orientation (e.g., facing in a same direction). In further embodiments, the shoulders 52a₁ and 52b₁ are configured in a different orientation than that of the shoulders 52c₁ and 52d₁, e.g., the shoulders 52a₁ and 52b₁ face the shoulders 52c₁ and 52d₁.

[0064] The barbs 52a, 52b, 52c and 52d are configured and designed to couple the corrugated diaphragm 30 to the manifold 38, as well as ensure that the barb adapter 50 remains securely coupled to the manifold 38. By way of example, in embodiments, a major diameter of at least one of the barbs 52c and 52d, and preferably both of the barbs 52c and 52d, is larger than the inner diameter of the port 44, thus ensuring that the barb adapter 50 remains securely coupled to the manifold 38. Such a configuration (orientation and size) also minimizes leakage between the barb adapter 50 and the manifold 38 at designed pressures used in traction devices, i.e., at a pressure which are known to those of ordinary skill in the art. For example, a cervical traction device may be designed for pressures between 0 and 35 PSI; whereas, a lumbar traction device may be designed for pressure between 0 and 75 PSI. It should further be realized by those of skill in the art that the orientation of the barbs 52c and 52d ensures that the barb adapter cannot be easily removed from the manifold.

[0065] In further embodiments, the manifold 38 is made of a resilient type material, capable of slight deflection. In one preferred embodiment, the material of the manifold is softer than that of the barb adapter 50. For example, the material of the manifold 38 may include thermoplastic polyester elastomer; whereas, the material of the barb adapter 50 may be brass or other alloys or plastic materials. This minimizing any leakage between the barb adapter 50 and the manifold 38. The corrugated diaphragm 30 may also be of a softer material than the barb adapter 50.

[0066] Moreover, in embodiments, the combination of the major diameter (OD) of the barbs 52a and 52b and the thickness of the material of the neck of the corrugated diaphragm is larger than the inner diameter of the port 44. Thus, air leakage is minimized between the major diameter of the barb adaptor and the inner diameter of the neck of the diaphragm and more specifically a barb feature on the barb diaphragm. It should further be recognized that the orientation of the barbs 52a, 52b, 52c and 52d facilitates installation of the barb adapter 50 into the neck 44, as well as the neck 30a of the corrugated diaphragm 30 about the barb adapter 50. Likewise, the orientation of the barbs 52a, 52b, 52c and 52d prevent the removal of the barb adapter 50 from the neck 44, as well as the neck 30a of the corrugated diaphragm 30 from the barb adapter 50.

[0067] Figure 11 shows another embodiment in accordance with invention. In this embodiment, the port 44

includes detents or grooves 44a about the entire circumference or portion thereof. In addition, the neck 30a of the corrugated diaphragm includes barbs 30b. The combination of the grooves 44a and barbs 30a are designed to secure the corrugated diaphragm 30 to the manifold 38 during curing of a glue or epoxy. For example, in one embodiment, in the assembled state, the barbs 30b mate with the one or more detents 44a to stabilize the assembly during the curing stage. The corrugated diaphragm 30 may also be secured to the inner wall of the port 44 by way of ultrasonic or thermal welding. It should be recognized that the adapter barb 50 may also be used in combination with the embodiment of Figure 11.

[0068] Figure 12 shows a manifold with pressure release valve in accordance with the invention and Figure 13 shows a cross section of the manifold along line 12-12 of Figure 12. The pressure release valve generally denoted as reference numeral 60 includes a spring 62 that keeps a valve 64 closed under normal operating pressure. When excessive pressure occurs inside of the pneumatic system that exceeds the spring resistance, the valve 64 opens to allow the release of air until the pressure is reduced to within safe operating conditions. Thus, the pressure release valve ensures that a user cannot exceed a designed traction force, thus maintaining safe use conditions of the traction device. When the pressure reaches a value less than the spring resistance, the valve automatically closes.

[0069] Figure 14 shows an exploded, perspective view of a mounting carriage in accordance with the invention. In this view it is shown that the mounting carriage 35 is designed and configured to accommodate two corrugated diaphragms 30 (although only one corrugated diaphragm is shown for illustrative purposes). It should be realized by those of skill in the art that the mounting carriage 35 may be designed to accommodate more or less than one corrugated diaphragm, depending on the particular application.

[0070] Still referring to Figure 14, the mounting carriage 35 is adapted to slide within the housing 4. Accordingly, the mounting carriage 35, in one preferred embodiment, will have a cross section similar to that of the housing 4 and more preferably the countoured profile 35a of the housing 4. The housing 4, in one implementation, may be molded to include the countoured profile 35a. In the embodiment of Figure 14, the mounting carriage 35 includes two sides 35b, each substantially identical to one another and connected to each other by a mounting plate 135. The mounting plate 135 includes mounting connections 137, e.g., projections which can accommodate screws or other fastening means. The mounting connections 137 may be used to connect the at least one boss 34 to the carriage 35. In embodiments, when only a single mounting plate is contemplated by the invention, the mounting plate 135 may be positioned at any surface of the mounting carriage, facing the boss.

[0071] In embodiments, the mounting carriage 35 includes end plates 139 having a cross section substan-

tially matching the cross section of the corrugated diaphragm 30. The cross section of the mounting carriage 35, though, may also be different than that of the corrugated diaphragm 30, but should remain configured to allow mounting of the corrugated diaphragm thereon. The end plates 139 each include flanges 141, which are configured to accommodate a connector disk 143 used to connect the corrugated diaphragm 30 to the mounting carriage 35. In embodiments, the flanges 141 have at least portions which are opposing one another in order to secure the connector disk 143 thereto. It should be noted that the connection from the diaphragm to the carriage does not require a connector disk and that the carriage could have a slot configuration which would accommodate the "T" shaped projection of the diaphragm for connection thereto, therefore eliminating the connector disk. In this scenario, the flanges may also be eliminated.

[0072] In embodiments, the flanges 141 have an inner surface 141 a which is substantially flat; although, other surface contours are also contemplated by the invention. The flanges 141 may have a slightly tapered outer surface 141 b and end walls 141 c and, in embodiments, are mounted to or molded on the end plates 139 at a slight inward angle towards each other. In embodiments, the inward angle is such that the connector disk 143 is press fit between the flanges 141 and remains secured therebetween, as shown in Figure 14. It should be recognized by those of skill in the art that the inward angle of the flanges 141 and the tapered end walls 141c may vary, depending on the contours and shape of the mounting disk, any of which can be obtained without undue experimentation.

[0073] In embodiments, the inward angle alone or in combination with the tapered end walls 141 c can be used to securely fit the connector disk 143 between flanges 141 and hence securely fit the corrugated diaphragm to the mounting carriage 35. Alternatively, the tapered end walls 141 alone, in embodiments, can be used to securely fit the connector disk 143 between the opposing flanges 141 and hence securely fit the corrugated diaphragm to the mounting carriage 35.

[0074] Figure 15 shows the connector disk 143 in accordance with the invention. The connector disk 143 includes a slot 145 having a shoulder 147 running along its length. It should be recognized by those of skill in the art that the shoulder 147 does not have to run the entire length of the slot 147, and may be intermittently or singularly placed at a predetermined location along the slot 145. As discussed with reference to Figures 16 and 17, the slot 147 is designed and configured to mate with a "T" shaped projection extending from an end of the corrugated diaphragm 30.

[0075] The connector disk 143 further includes recessed sides 149 which are configured to mate with the inner surface 141 a of the flanges 141. The recessed sides 149, in one embodiment, may have a flat surface; although other surface shapes and contours are also contemplated by the invention, all of which are configured

to fit between the opposing flanges 141. In embodiments, the recessed sides 149 may be tapered to substantially match the slight inward angle of the opposing flanges 141. Additionally, in embodiments, end walls 149a of the recessed sides 149 may be tapered or angled to substantially match the taper of the tapered end walls 141c of the flanges 141. Again, the configuration of the connector disk 143 and the corresponding configuration of the flanges 141 facilitates a secure attachment between the connector disk and the mounting connector.

[0076] Figure 16 shows a perspective view the connector disk mounted to the corrugated diaphragm in accordance with the invention. Figure 17 shows a cutaway view of the connector disk and diaphragm along line 11-11 of Figure 16. As shown in these views, the corrugated diaphragm includes a "T" shaped projection, extending from an end thereof. The "T" shaped projection slides within the slot 145 of the connector disk 143 and more specifically is securely held within the slot by the mating between the "T" shaped projection and the shoulder 147 of the connector disk 143. Although it is shown that the connector disk 143 has substantially a same cross section (except for the recessed portions) as the corrugated diaphragm, it should be recognized that other shapes are also contemplated by the invention. In embodiments, for example, the cross sectional shape of the connector disk 143 matches and not be larger than that of the end plate 139 of the mounting carriage 35.

[0077] As should now be understood in view of the above description, the corrugated diaphragm 30 is securely fitted to the connector disk 143 by way of the mating between the "T" shaped projection and slot 145. The connector disk 143 is securely fitted to the mounting carriage 35 by mating of the flanges 141 and the recessed portions 149. Thus, by virtue of these connections, the corrugated diaphragm 30 is securely attached to the mounting carriage 35. Also, by virtue of the at least one boss being connected to the mounting carriage 35, pressurization of the corrugated diaphragm will move the moveable carriage and hence provide traction to the patient.

Operation of the Traction Device

[0078] To use the traction devices, the corrugated diaphragm type device 30 is initially at atmospheric pressure. With a cervical traction device, prior to use, the patient or user can adjust the angle of the cervical traction device by adjusting the positioning of the stand. The back of the user is placed on a support surface so that the wedges cradle the patient's neck. The wedges can also be adjusted but preferably remain substantially stationary during use of the device. The restraining device may be used about the patient's head to ensure the user remains substantially stationary during treatment of cervical traction device. In the lumbar device, the patient would strap the restraining device about his/her mid section.

[0079] Once properly positioned, the patient then

pumps air into the corrugated diaphragm type device by way of the pneumatic circuit described above. The patient increases the traction force by manually operating the pump or decreases the traction force by manually pressing the pressure relief mechanism. As air is pumped into the corrugated diaphragm type device, the corrugated diaphragm type device will expand and move the carriage to apply a traction force. The entire structure of the cervical traction device, though, remains constant, during the application of the traction force.

[0080] When excessive pressure occurs inside of the pneumatic system, the pressure release valve will allow the release of air until the pressure is reduced to within safe operating conditions. Thus, the pressure release valve ensures that a user cannot exceed a designed traction force, thus maintaining safe use conditions of the traction device. When the pressure reaches a value less than the spring resistance, the valve automatically closes.

[0081] While the invention has been described in terms of embodiments, those skilled in the art will recognize that the invention can be practiced with modification.

[0082] A device includes a stationary housing having a guidance. A carriage is slidably mounted on the guidance and at least one corrugated diaphragm mechanism is housed in the housing and connectable to the carriage. The corrugated diaphragm is structured to elastically expand and retract, depending on an application of pressure, to extend and retract, respectively, the carriage along the guidance relative to the stationary housing. A manifold is provided to connect the corrugated diaphragm to a pump system a connection system is used to connect to the diaphragm.

Claims

1. A device, comprising:

a stationary frame;
a carriage slidably mounted on the stationary frame; and
at least one diaphragm mechanism connectable to the carriage, the diaphragm mechanism is structured to elastically expand and retract, depending on an application of pressure, respectively, and to move the carriage along the guidance relative to the stationary frame.

2. The device according to claim 1, wherein the at least one diaphragm is a corrugated diaphragm.

3. The device according to claim 1, wherein the at least one diaphragm has a spring force that retracts and moves the carriage toward an initial position upon the release of pressure.

4. The device according to claim 1, wherein the at least

one diaphragm is in communication with a manifold in communication with a pump system, wherein the pump system includes a pressure relief mechanism to manually release the pressure in the at least one diaphragm and a gauge indicating an amount of traction force from the device.

5. The device according to claim 1, wherein the device is a cervical traction device or a lumbar traction system.

6. The device according to claim 1, further comprising a stand slidably mounted to the stationary frame, the stand providing different adjustable angles for the stationary frame relative to a supporting surface.

7. The device according to claim 6, further comprising a locking system which locks the stand at a plurality of different locations on the stationary frame.

8. The device according to claim 1, further comprising a wedge system that is only linearly adjustable relative to the carriage, wherein each wedge of the wedge system is adjustable by a pinch spring arm mechanism.

9. A device comprising a frame forming a housing for accommodating at least one corrugated diaphragm device which is expandable and retractable by application and release of pressure, respectively, the at least one corrugated diaphragm device having a retractable spring force such that, upon release of pressure within the at least one corrugated diaphragm device, the at least one corrugated diaphragm device retracts and moves the carriage towards an initial position.

10. The device according to claim 9, wherein;

the frame includes a first frame member and a second frame member, the first frame member includes rails for slidably mounting the moveable carriage;
the second frame member is attached to the first frame member by a fixed hinged member such that the first frame member and the second frame member are foldable between an open position and a closed position;
the first frame member and the second frame member include handle portions such that, when in the folded position, the handle portions are aligned; and
the handle portions are formed at least in one of the side and end portions of the first and second frame member.

11. The device according to claim 9, wherein the frame is a stationary frame with respect to the at least one

corrugated diaphragm device.

12. A device comprising a stationary frame having a housing for accommodating at least one corrugated diaphragm device which is expandable and retractable by application and release of pressure, respectively, the at least one corrugated diaphragm device being mounted to a moveable carriage which is slidable along the stationary frame between an initial position and a fully extended position, wherein an overall length of the device remains constant upon the application of pressure to the corrugated diaphragm device and movement of the slidable carriage to any position along the stationary frame.
13. The device according to claim 12, wherein upon release of pressure within the at least one corrugated diaphragm device, the at least one corrugated diaphragm device begins to retract moving the moveable carriage towards an initial position.
14. The device according to claim 12, wherein the at least one corrugated diaphragm device has a spring force to move the moveable carriage towards an initial position upon the release of pressure therein.
15. The device of claim 1, further comprising a manifold coupled between the at least one diaphragm and a pump system, the manifold comprising at least one port coupled to a neck of the at least one diaphragm and a neck communicating with the pump system.
16. The device of claim 15, wherein the neck is in fluid communication with the at least one port via a hollow body.
17. The device of claim 15, wherein the neck includes one or more outward extending barbs configured to secure a hose of a pump system to the neck, wherein an end barb of the one or more outward extending barbs includes a tapered end to facilitate placement of a hose over the neck.
18. The device of claim 15, wherein the at least one diaphragm is secured to the at least one port via a glueless mechanism.
19. The device of claim 18, wherein the glueless mechanism is an adapter configured to minimize leakage between the at least one diaphragm and the at least one port.
20. The device of claim 19, wherein the adapter includes a varied cross section which is configured to minimize any leakage between the at least one diaphragm and the at least one port.
21. The device of claim 20, wherein the varied cross section includes a plurality of barbs extending circumferentially about the body, each of the barbs is configured to prevent disengagement of the at least one diaphragm from the adapter and the adapter from the manifold.
22. The device of claim 19, wherein the manifold is a resilient type material softer than that of the adapter.
23. The device of claim 9, further comprising a manifold connectable between the least one corrugated diaphragm device and a pneumatic system, the manifold including at least one port and at least one neck, the at least one port connectable to a neck of the least one corrugated diaphragm device and the at least one neck connectable to a hose of the pneumatic system.
24. The device of claim 23, wherein the neck includes one or more outward extending barbs configured to secure a hose of the pump system to the neck, an end barb of the one or more outward extending barbs includes a tapered end to facilitate the placement of the hose over the neck and an outermost diameter of at least one of the outward extending barbs is slightly larger than an inner circumference of the hose minimizing any leakage between the hose and the manifold.
25. The device of claim 23, further comprising an adapter configured to minimize leakage between the at least one corrugated diaphragm device and the at least one port.
26. The device of claim 1, further comprising a mounting carriage assembly, wherein the at least one diaphragm is connectable to the carriage by the mounting carriage assembly.
27. The device of claim 26, wherein the mounting carriage assembly includes at least one end plate having flanges.
28. The device of claim 27, wherein the mounting carriage assembly includes at least one end plate having a slot which communicates with a projection of the diaphragm for connection thereto.
29. The device of claim 28, further comprising a connecting disk mountable between the flanges.
30. The device of claim 26, wherein the mounting carriage assembly comprises:
 - inwardly angled flanges and tapered end walls; and
 - a connector disk having recesses which interface with the flanges, the connector disk further

having a slot which corresponds with a projection extending from the at least one diaphragm.

- 31.** The device of claim 12, further comprising a connecting assembly including at least a connecting disk connectable between a body of the connecting assembly and the at least one corrugated diaphragm device and a mounting structure for connecting to the moveable carriage.
- 32.** The device of claim 31, wherein the connecting assembly includes at least one end plate having opposing flanges.

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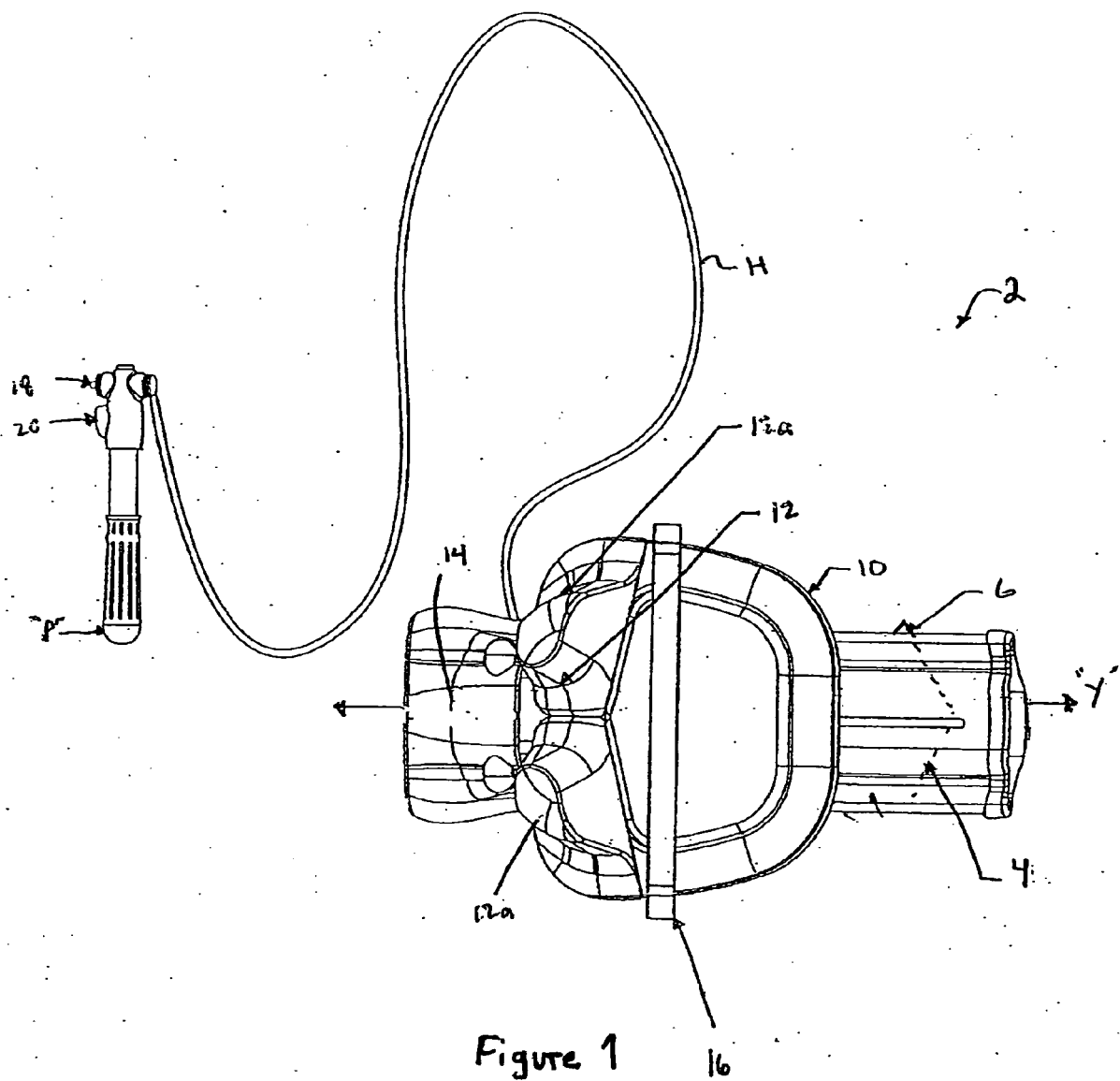
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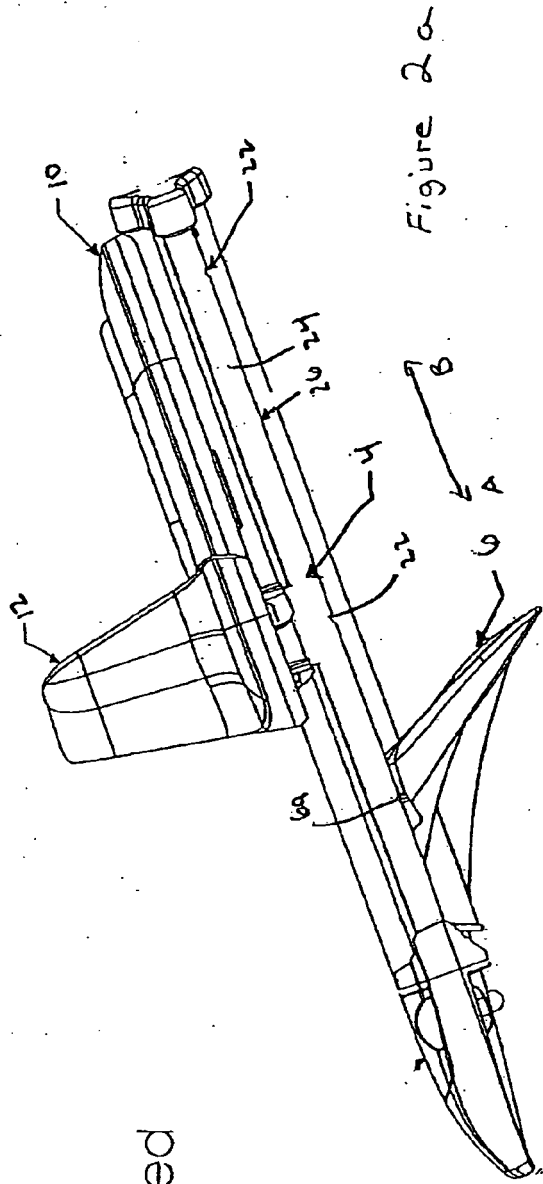
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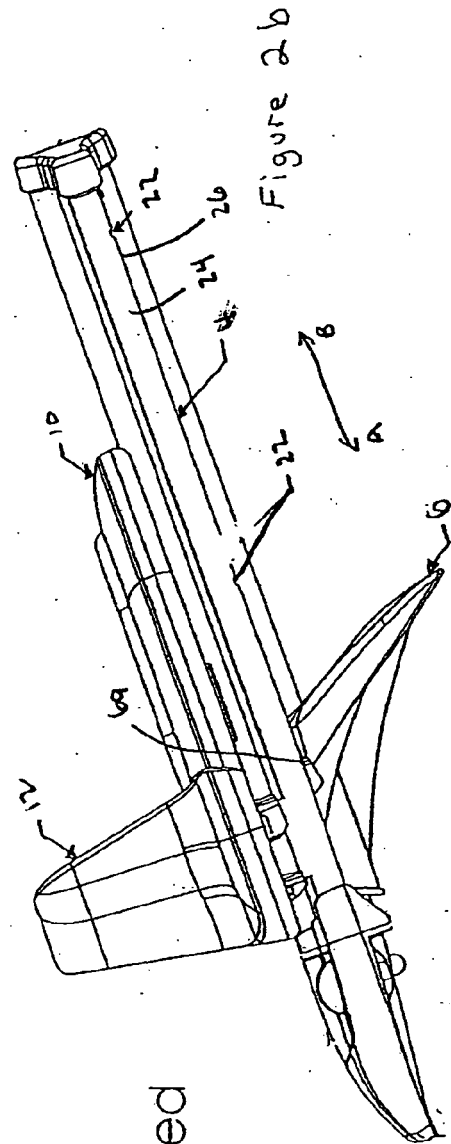
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Extended

Figure 2a



Retracted

Figure 2b

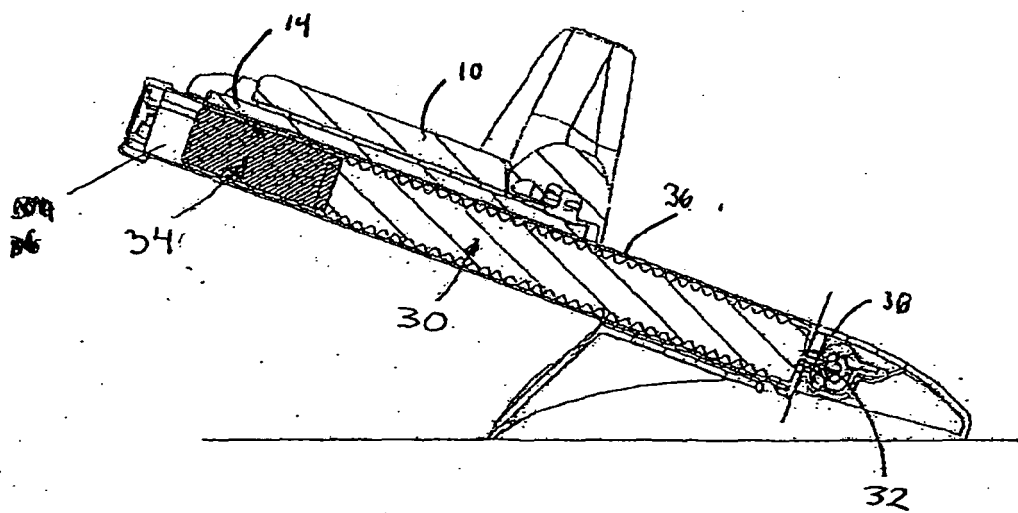


Figure 3

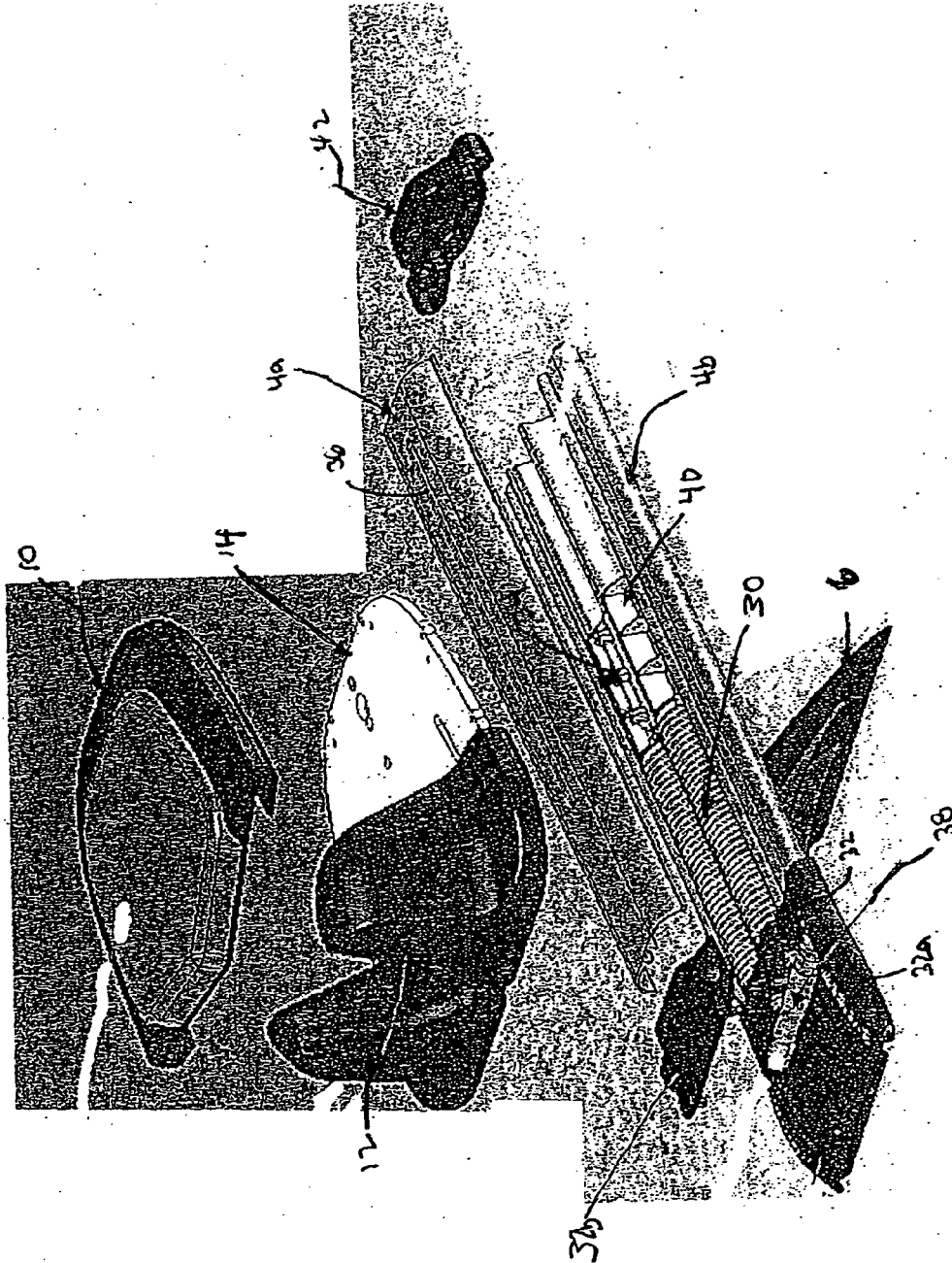


Figure 4

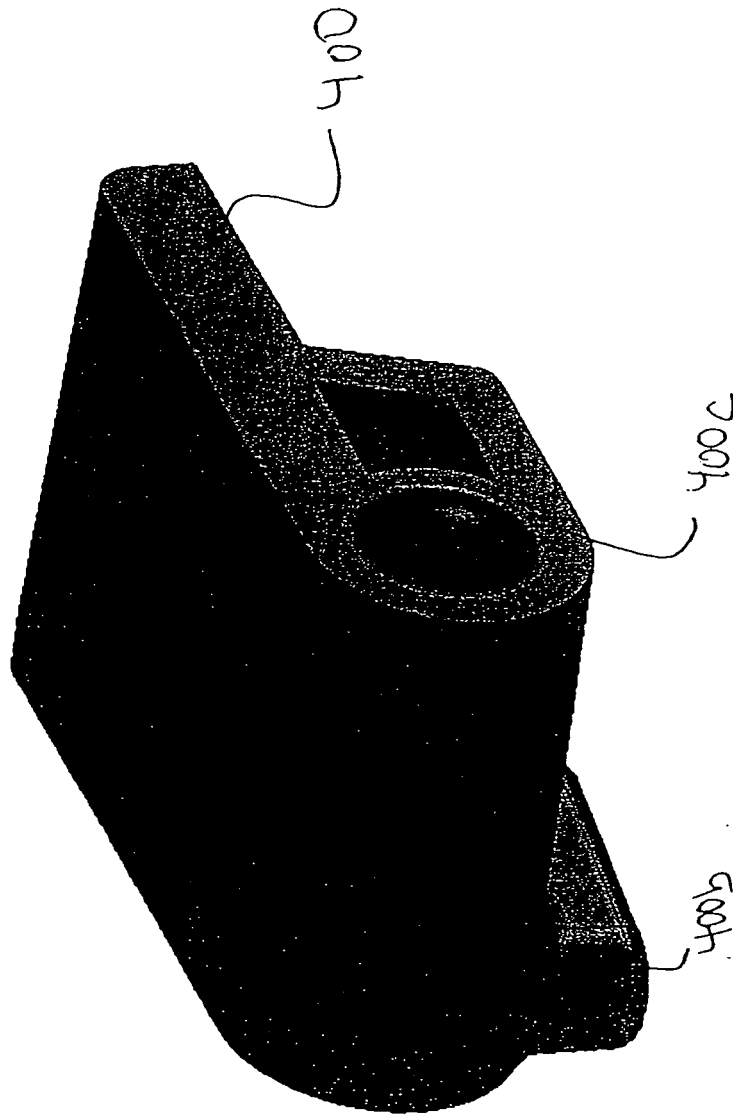


Figure 49

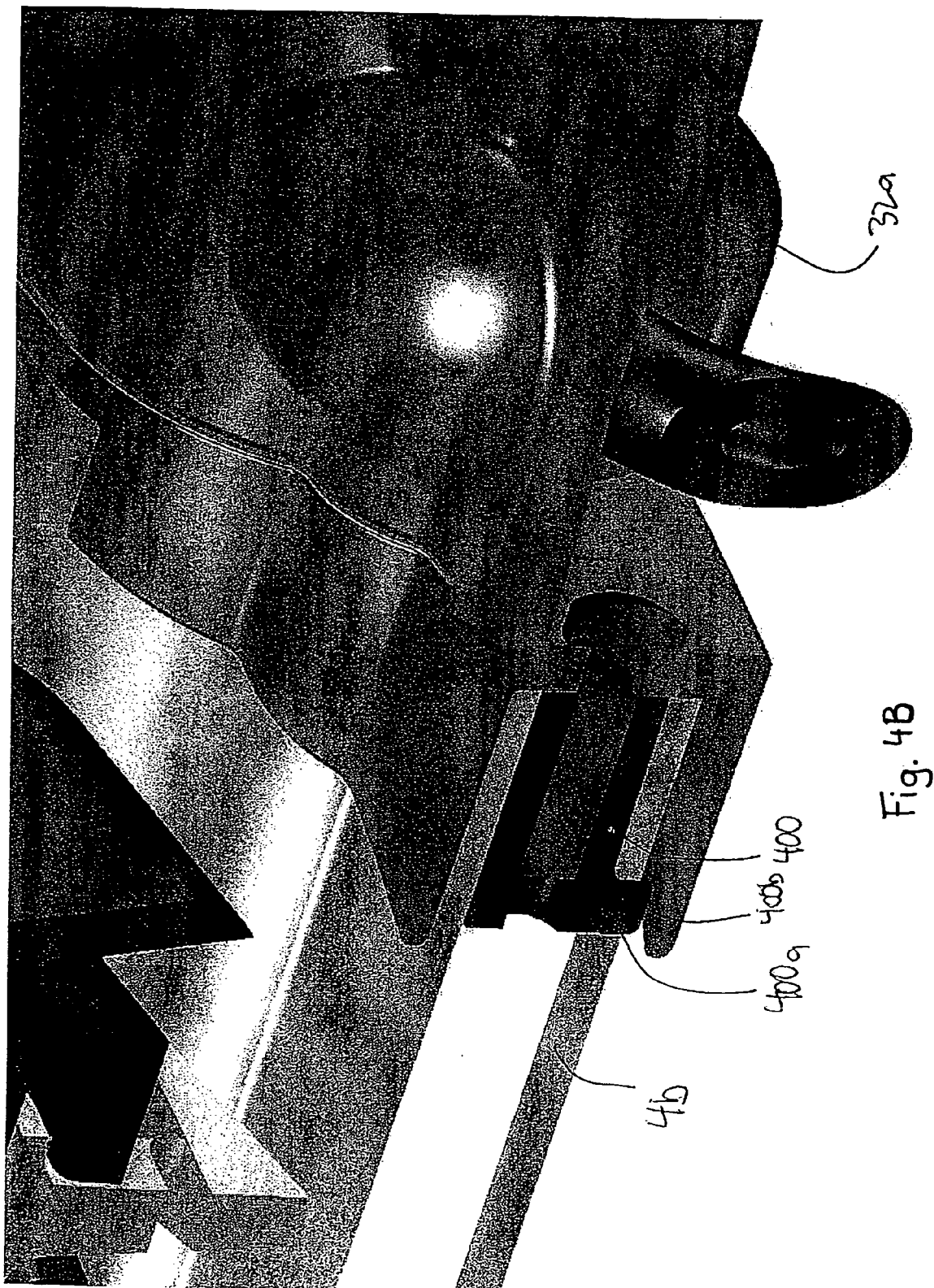


Fig. 4B

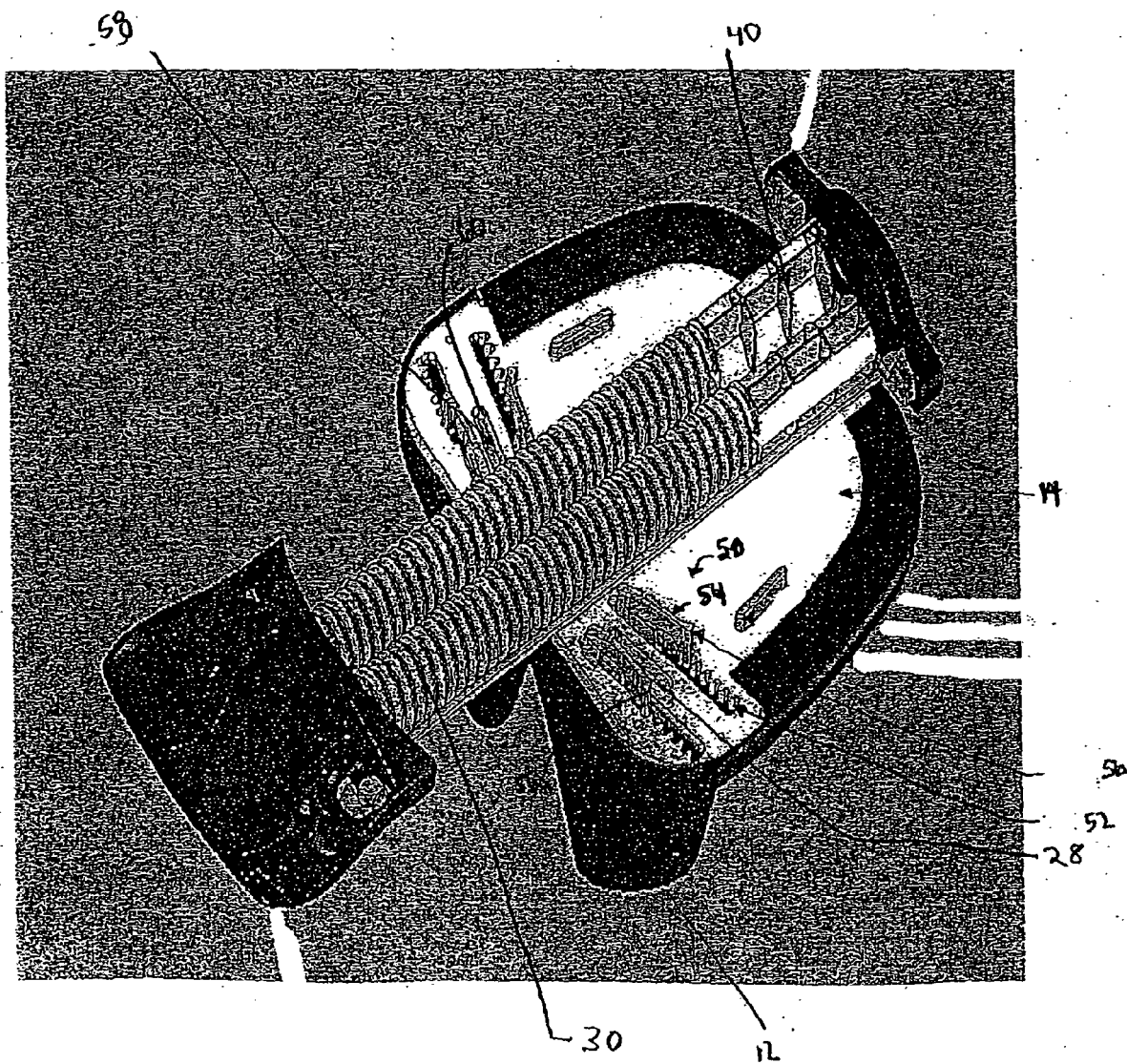
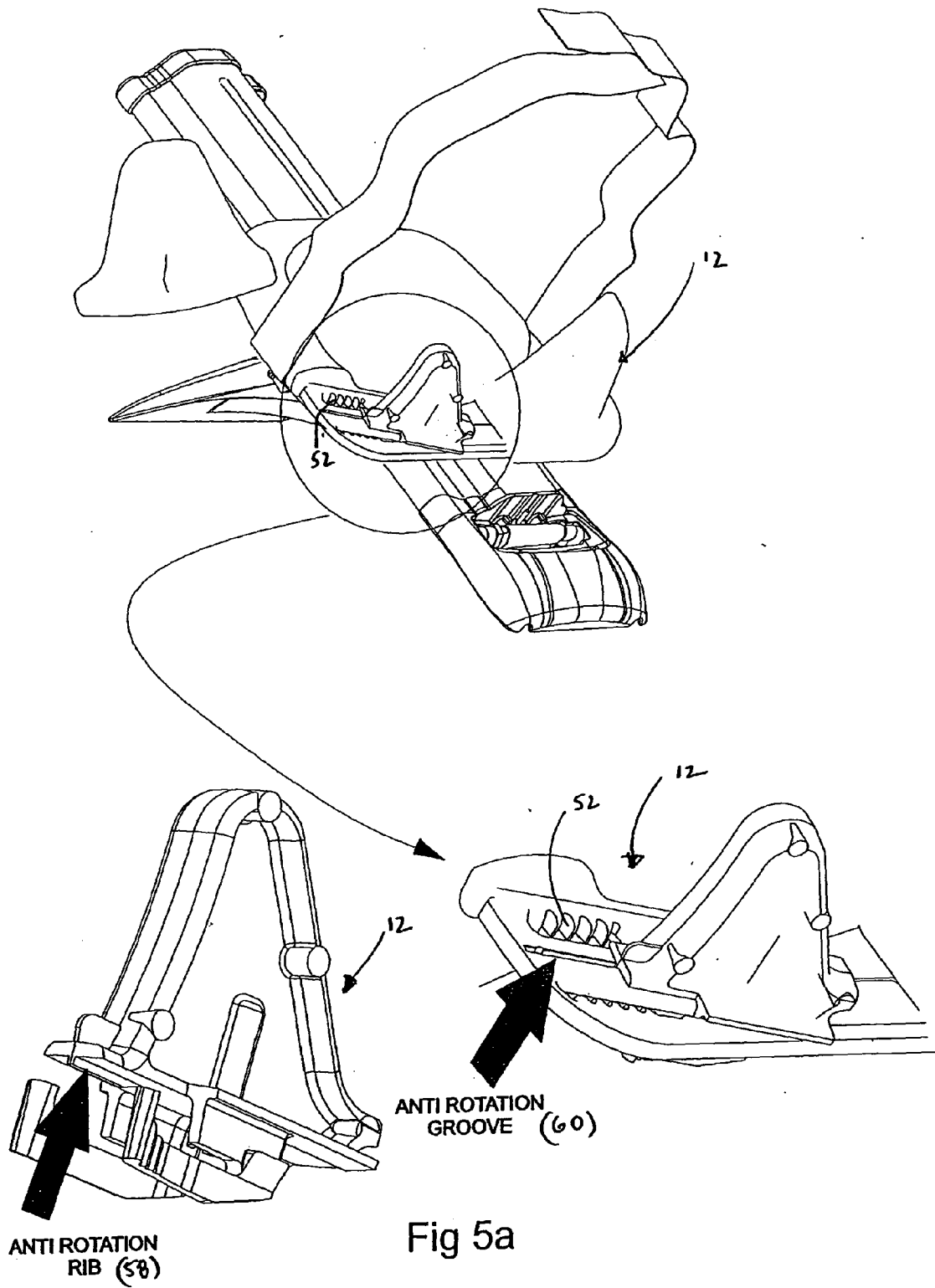


Figure 5



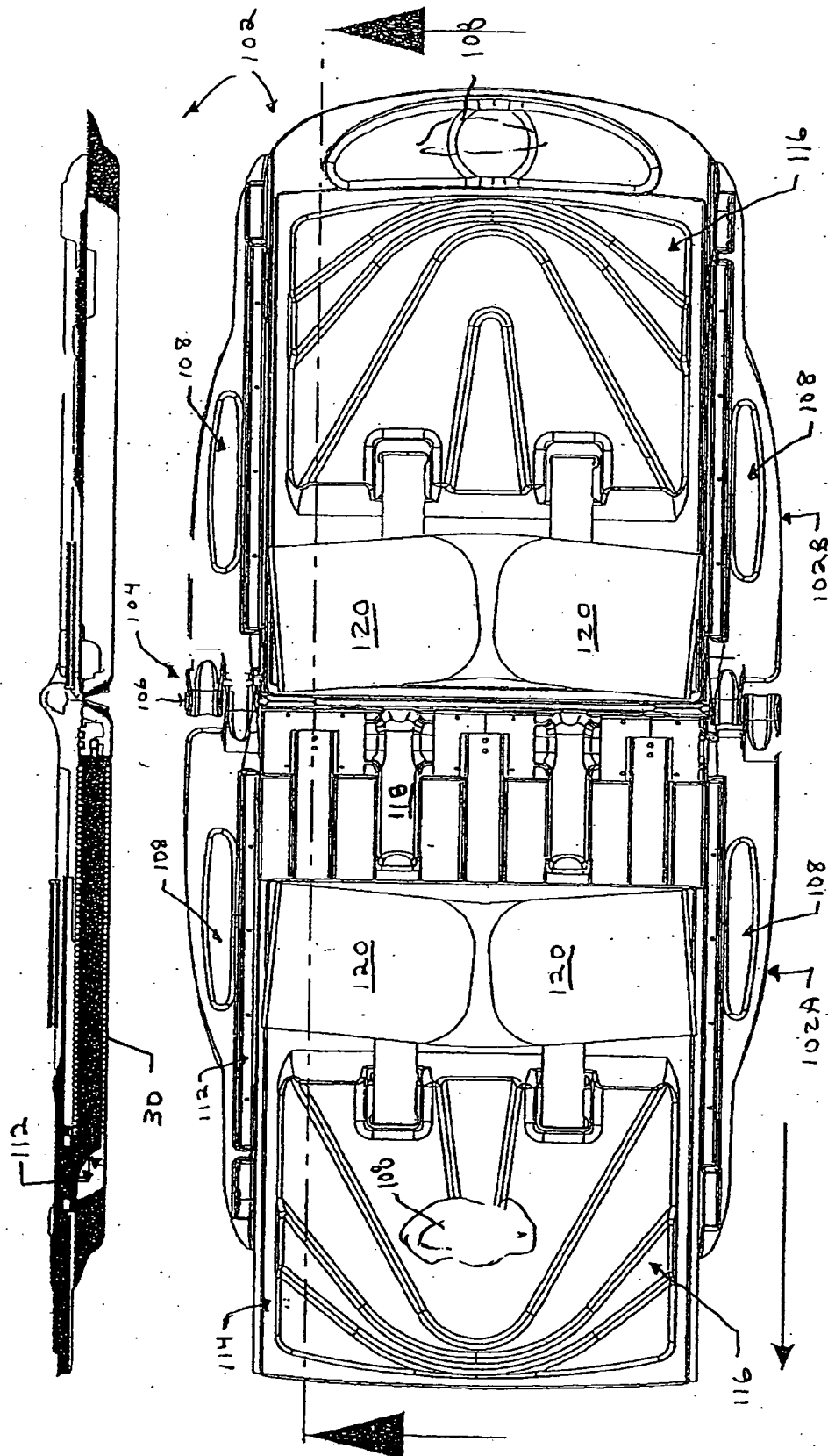
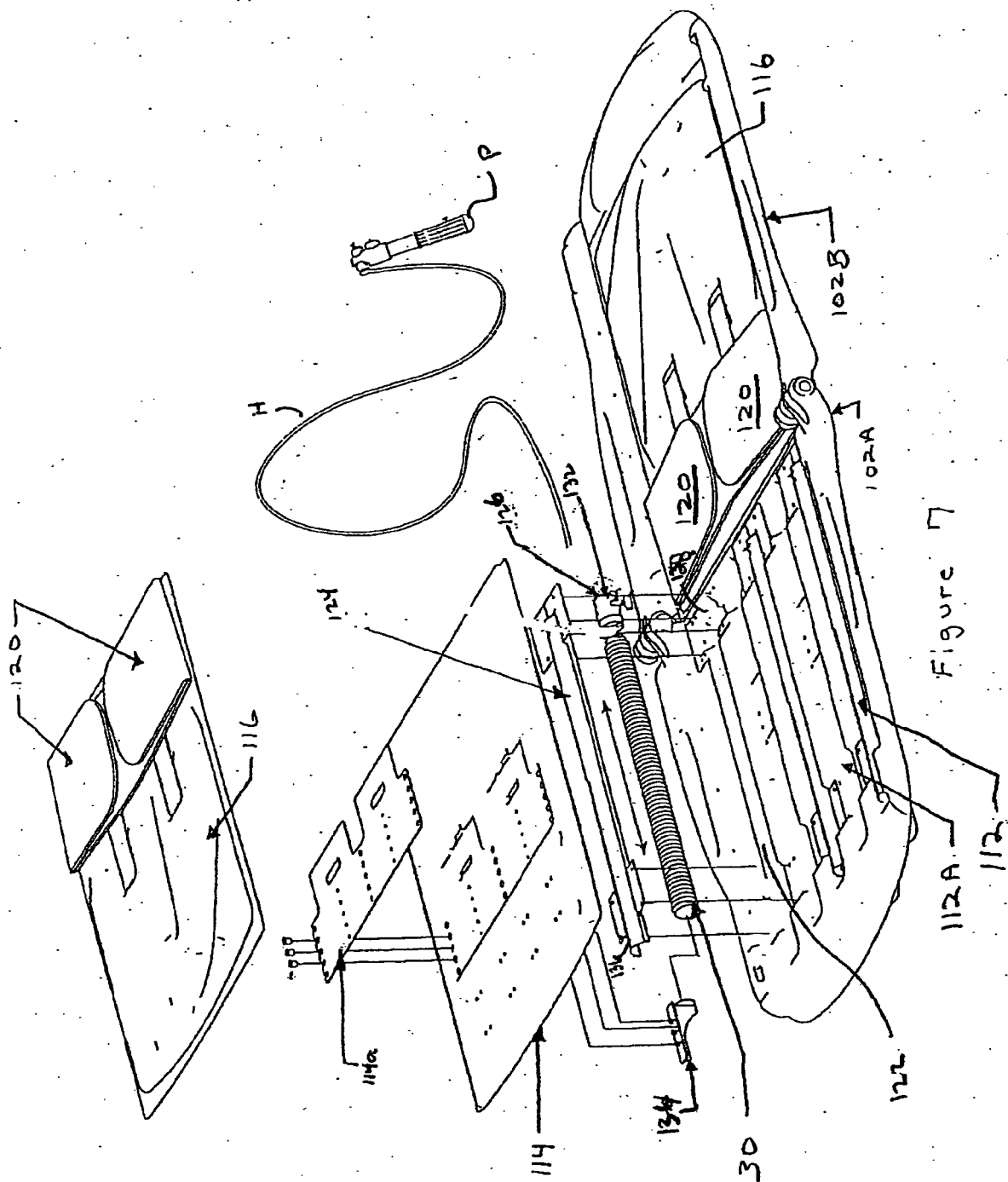


Figure 6



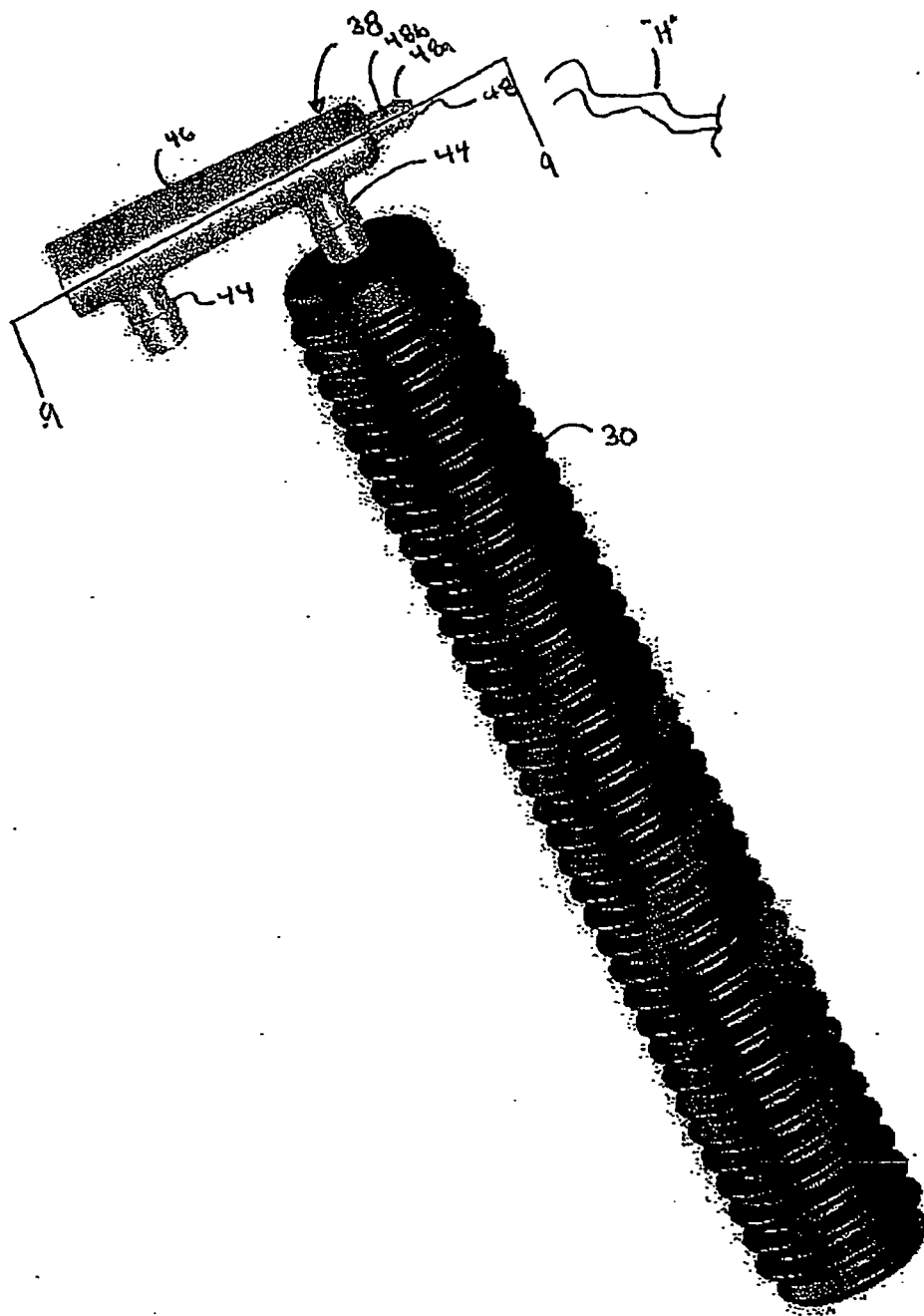
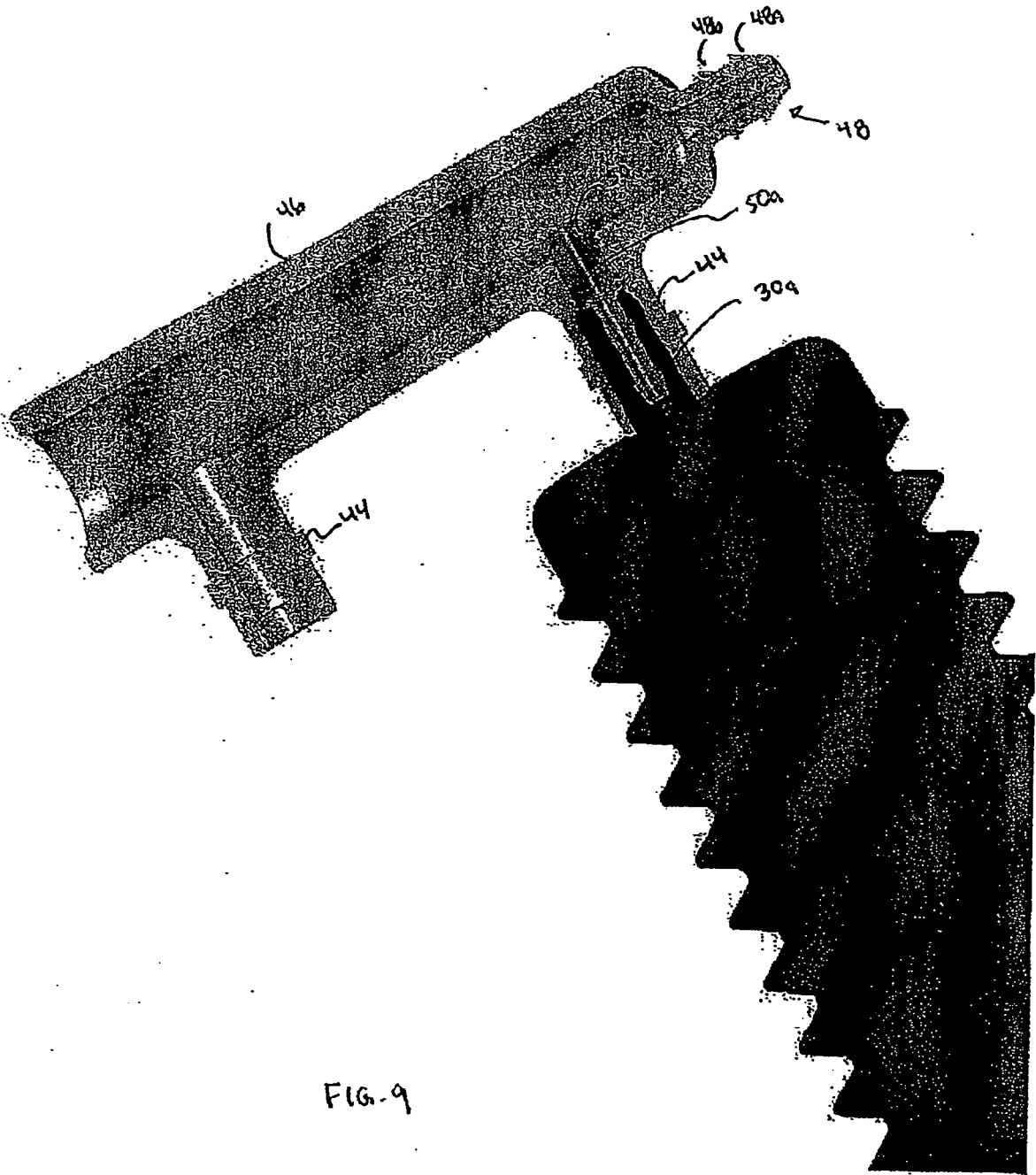


FIG. 8



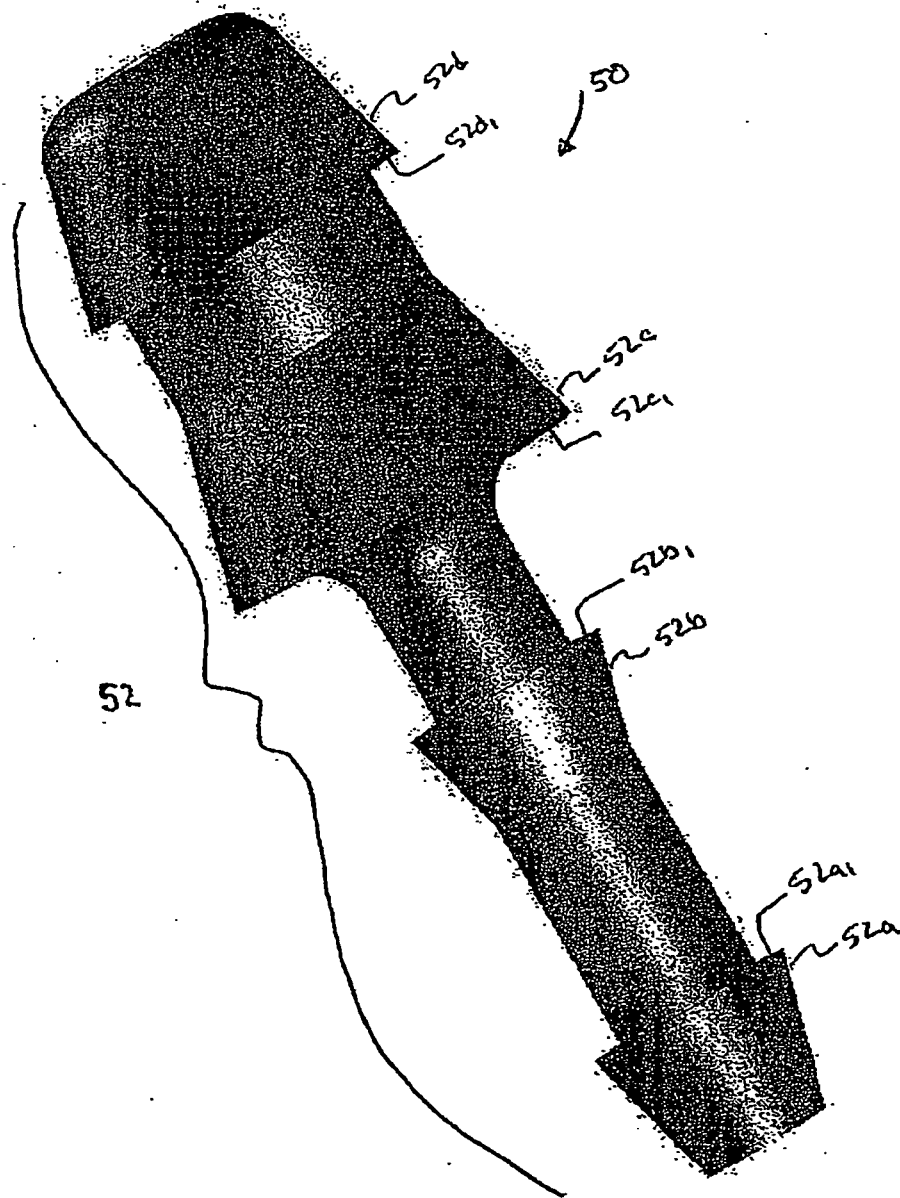


FIG. 10

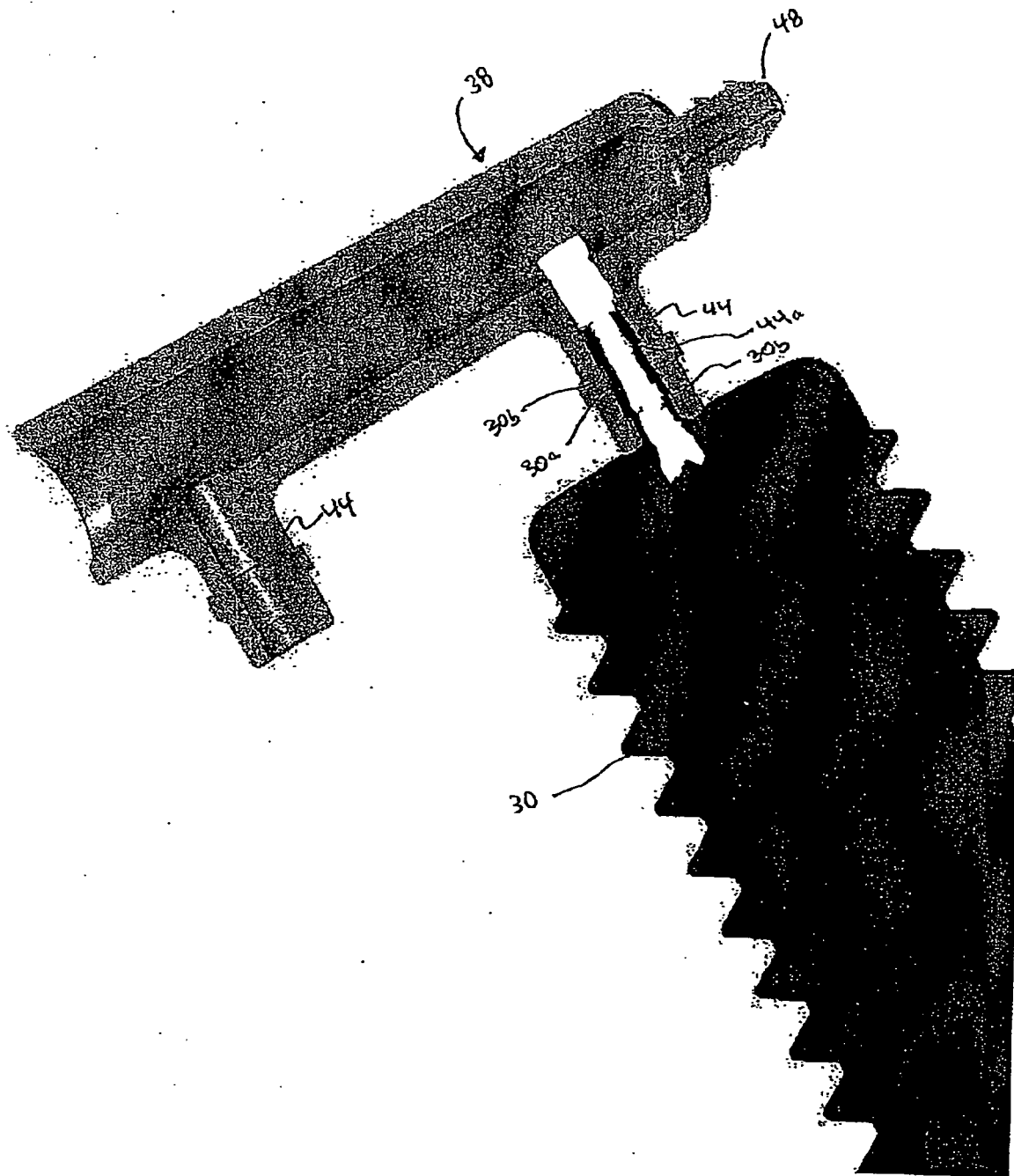


FIG. 11

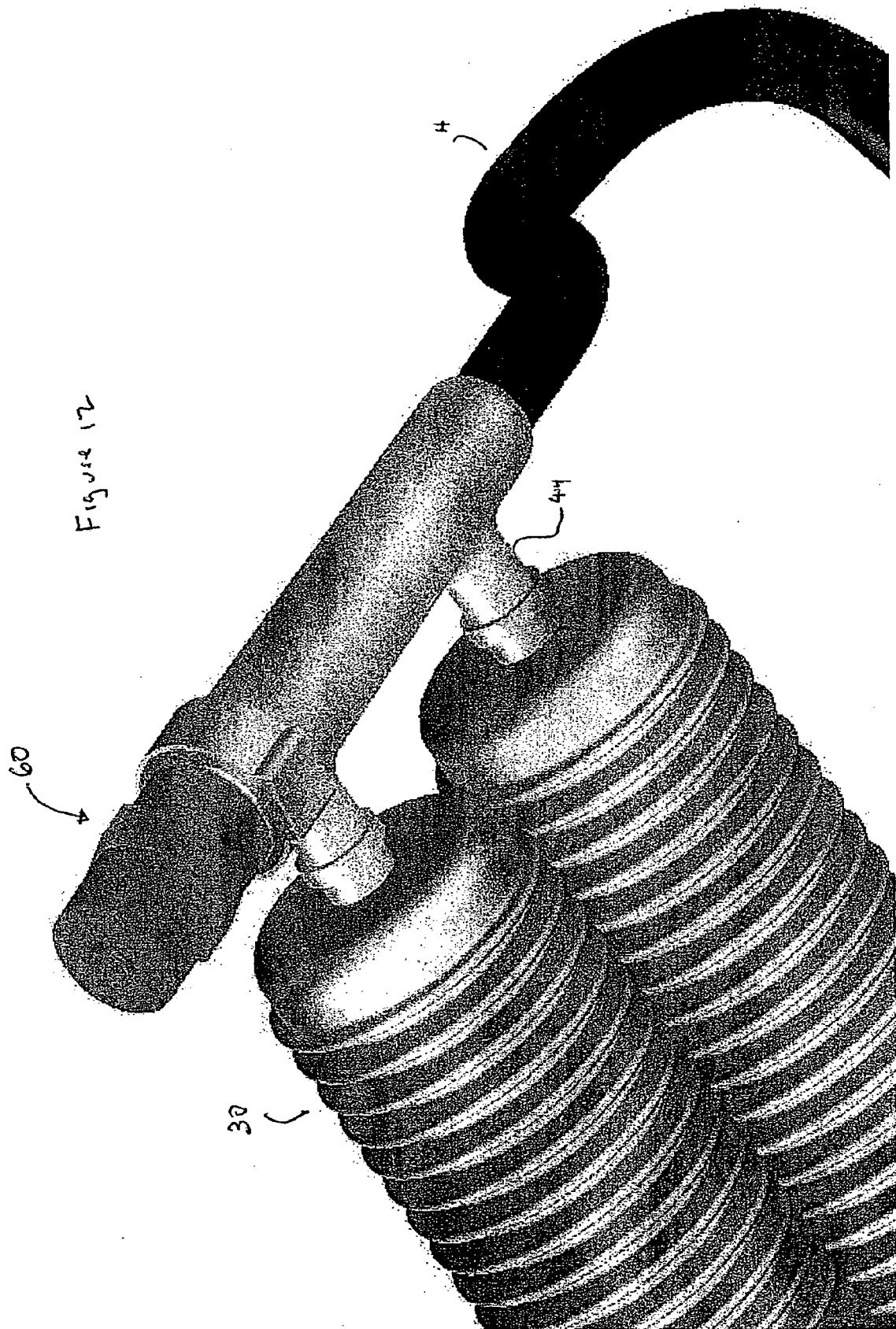
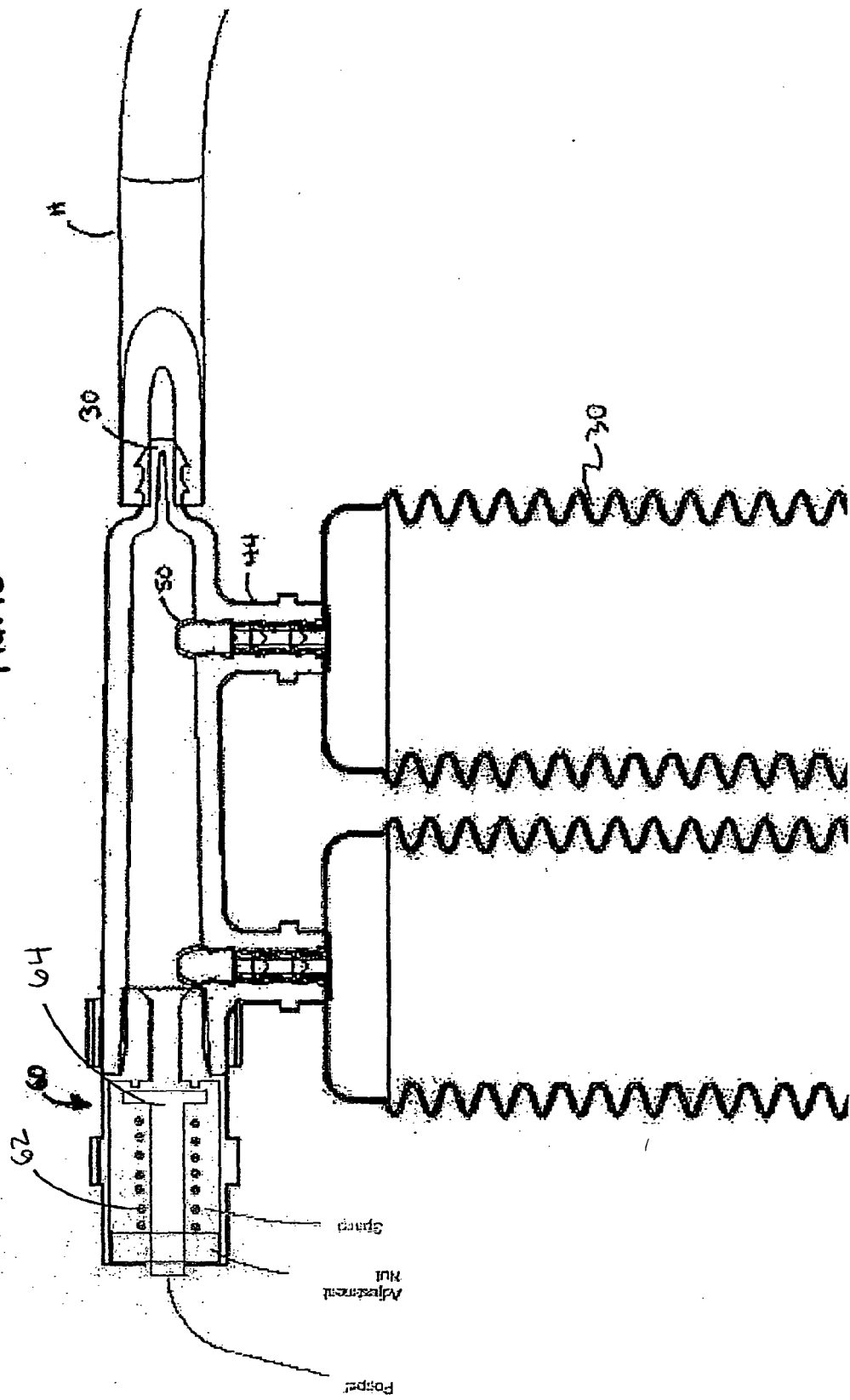
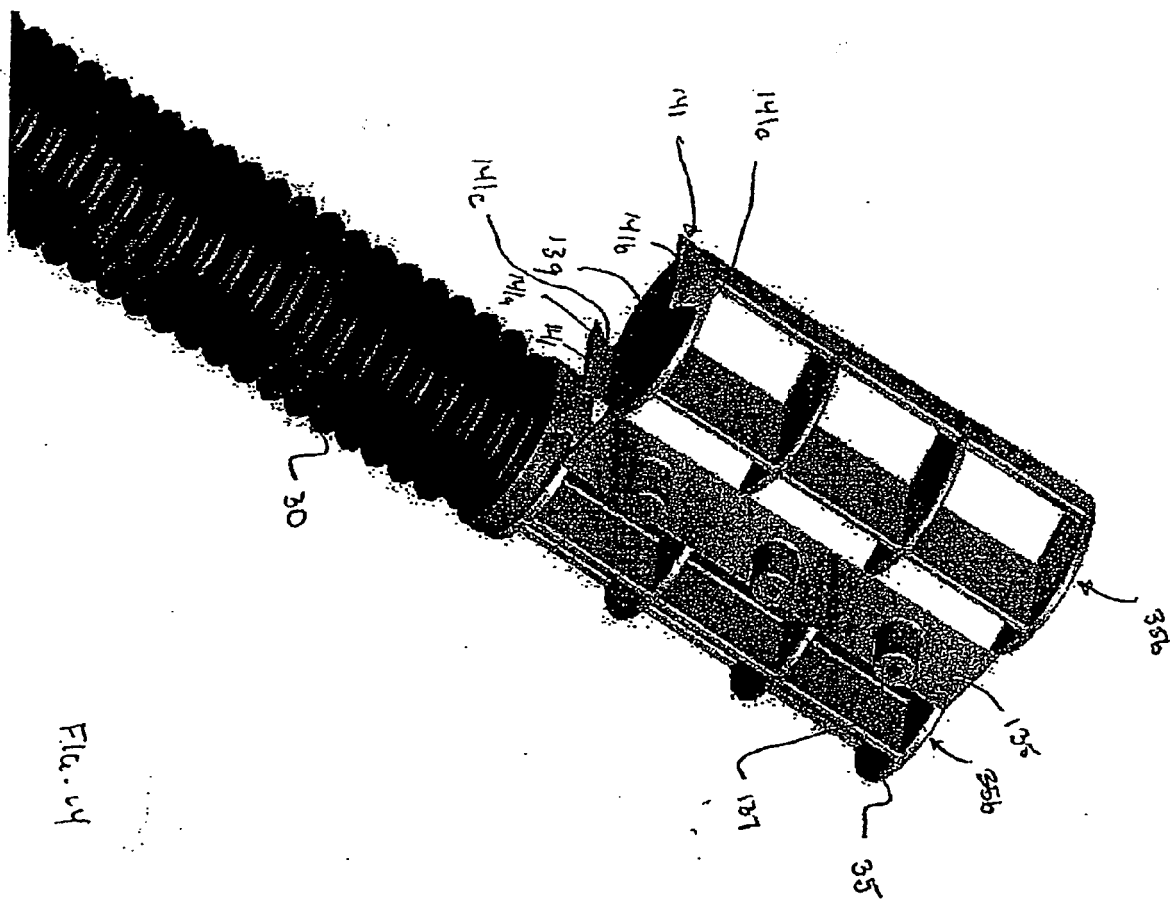


FIG. 13





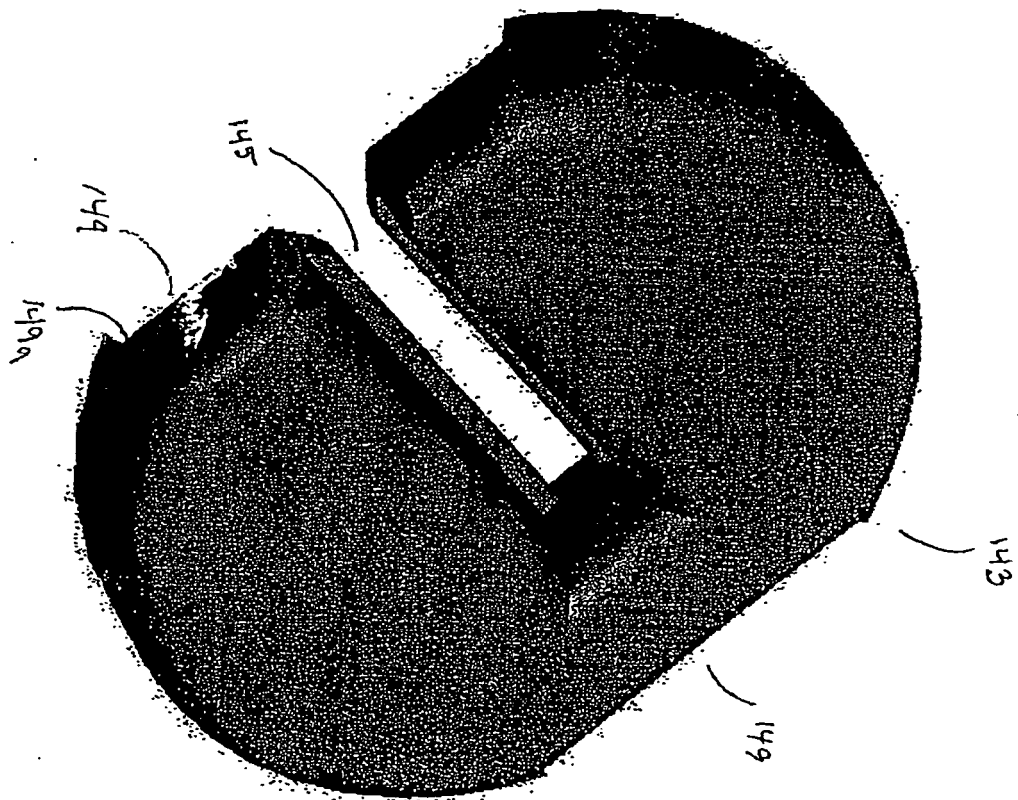


Fig. 15

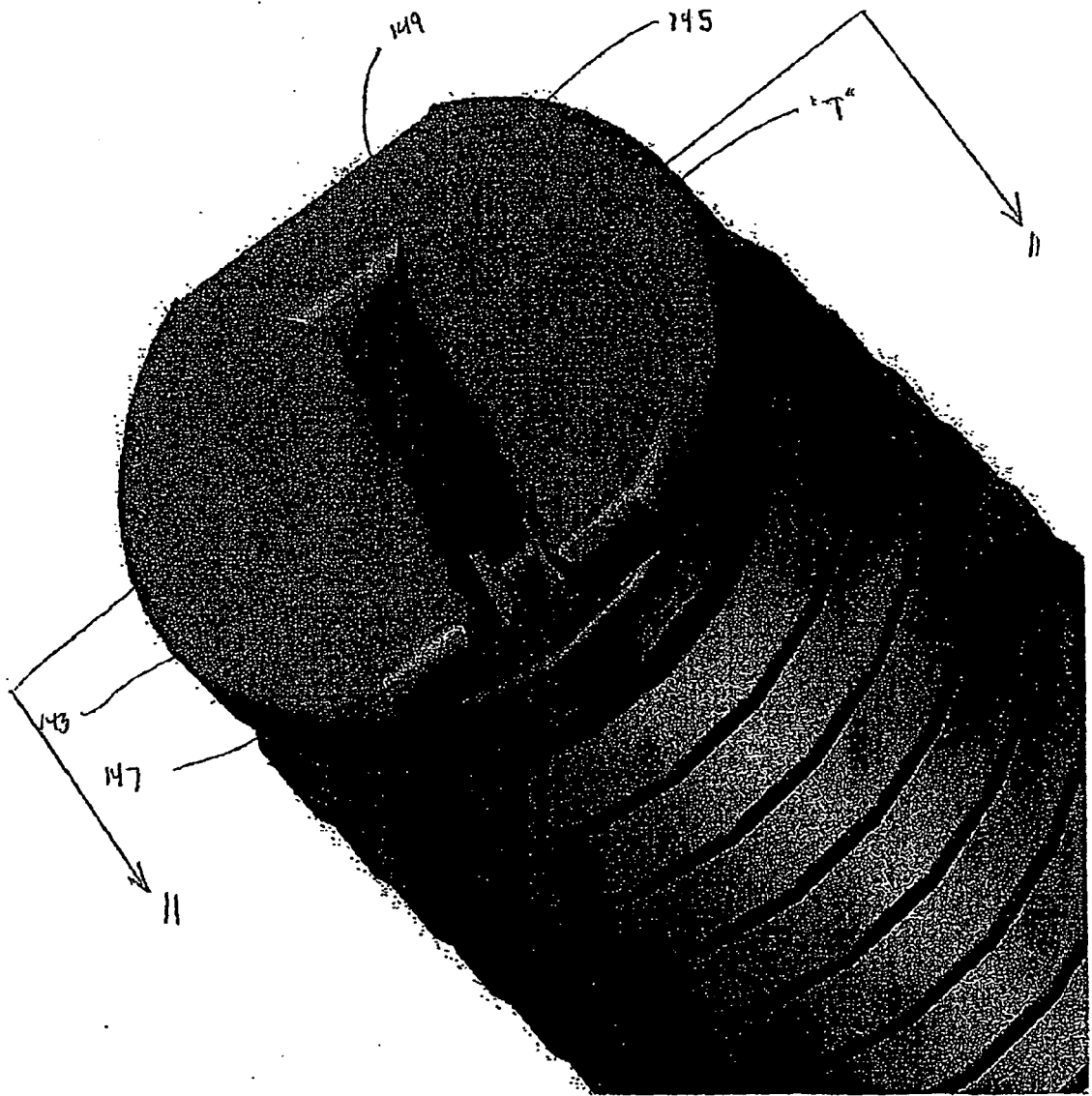
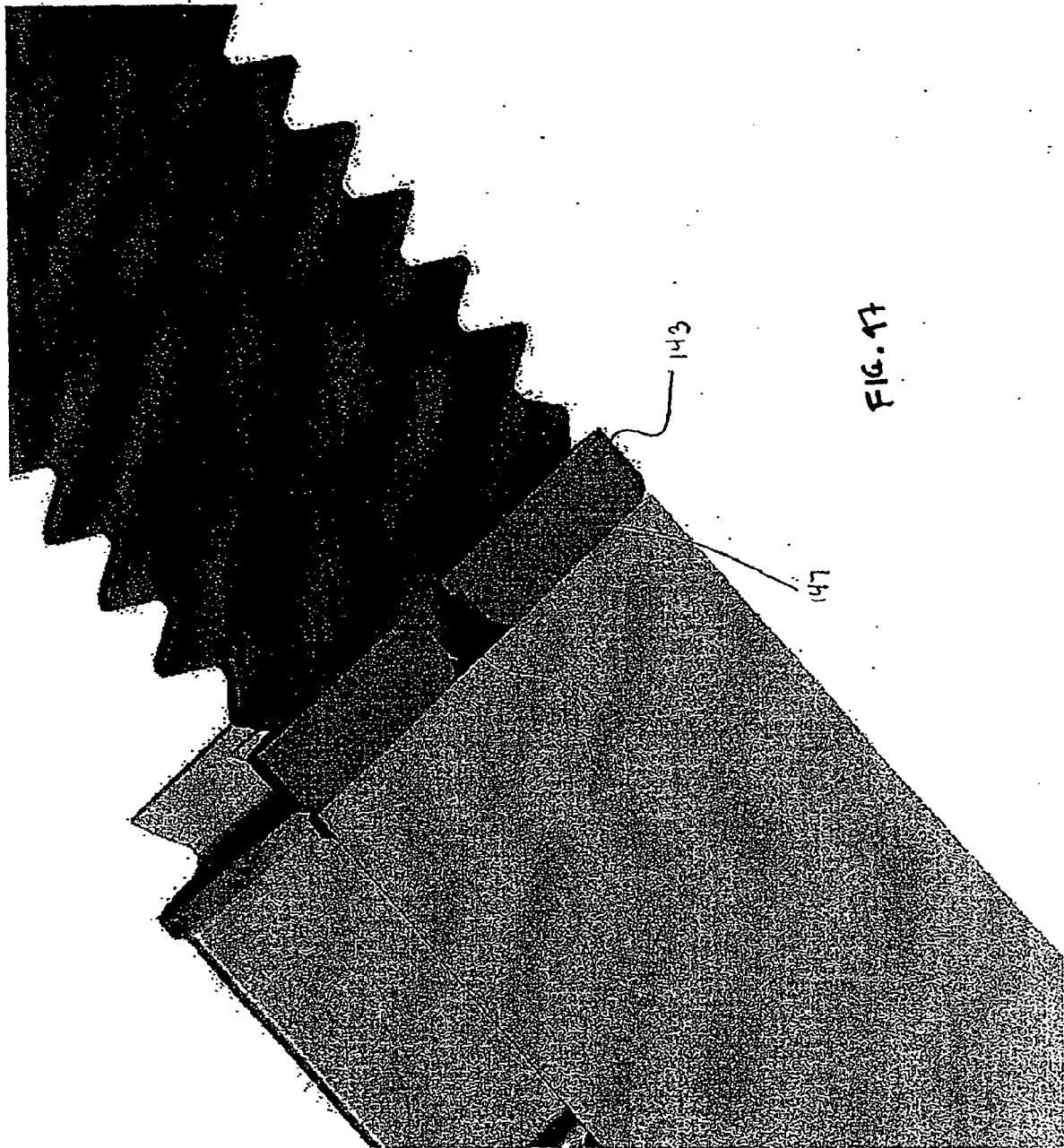


FIG. 16





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 00 3073

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Place of search The Hague		Date of completion of the search 17 May 2006	Examiner Knoflachner, N
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 06 00 3073

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