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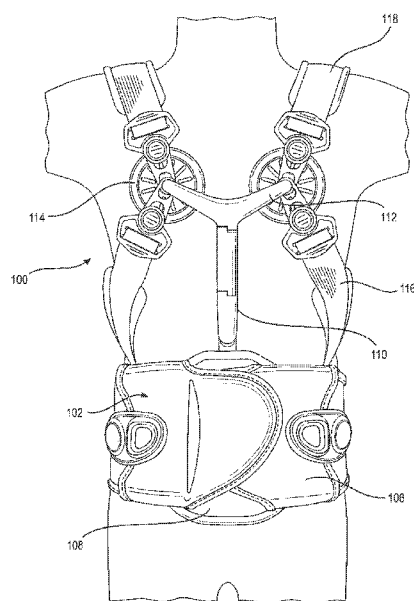


FIG. 1A

(57) **Abstract:** A thoracic lumbar sacral orthosis attachment (100) for configuring an orthopedic device (106) as a thoracic lumbar sacral orthosis by connecting the attachment to the orthopedic device (106). The attachment (100) has an anterior aspect (102) including an anterior panel (108) arranged to connect to an orthopedic device (106). An anterior thoracic extension (ATE) (110) is securable to the anterior panel (108), and a support bar (112) extends from the ATE (110). A strap system includes an axillary strap system (116) and/or a shoulder strap system (118) removably securing onto a surface of the orthopedic device (106), and/or the ATE (110).



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THORACIC LUMBAR SACRAL ORTHOSIS ATTACHMENT

[1] FIELD OF THE DISCLOSURE

[2] The application relates to an orthopedic device, and more particularly to a thoracic
5 lumbar sacral orthosis attachment for a lumbar sacral orthosis, and to a method for configuring
the thoracic lumbar sacral orthosis attachment.

[3] BACKGROUND

[4] Spinal orthoses are used to treat many conditions associated with the skeletal structure,
including such conditions as osteoporosis, back injuries, chest injuries and spinal deformities,
10 by applying pressure to selected positions along the user's spine, abdomen and torso. There are
different spinal orthoses typically categorized by the vertebral level intended for treatment.
Spinal orthoses include the sacral orthosis (SO), lumbosacral orthosis (LSO), and the
thoracolumbosacral or thoracic lumbar sacral orthosis (TLSO).

[5] The TLSO provides support and immobilization of the thoracic and lumbar regions
15 following various traumatic injuries or surgical procedures. Indications for a TLSO include
post-surgical immobilization, herniated disc, spinal stenosis, which occurs when the spinal
canal narrows and compresses the spinal cord and nerves, spondylolisthesis which occurs due
to anterior displacement of a vertebra or the vertebral column in relation to the vertebrae below,
spondylolysis or defects of the vertebra, compression fractures, and degenerative spinal
20 pathologies such as osteoporosis.

[6] Types of TLSO are known in the art. Many TLSOs include flexion control, sagittal
control, sagittal-coronal control, and triplanar control such that as a person attempts right or
left rotation of the thoracic spine, counterforces from the thoracic band and the subclavicular
extension limit motion. There are both commercially available TLSO products, and custom-
25 fabricated TLSO types constructed typically from a rigid thermoplastic to form a body jacket.

[7] While either commercially available or custom orthoses exist, many of these orthoses
are uncomfortable to the wearer and difficult to apply. With commercially available TLSO
products, some have the tendency to poorly fit the contours of the wearer, including the spine,
which results in an ill-fitting TLSO that ineffectively supports the spine. Many TLSO types,
30 particularly custom-fabricated body jackets, are poorly ventilated and lack sufficient padding.
They also lack versatility to enable step-up or step-down treatment of the wearer during
treatment. Such known TLSO products and custom orthoses are not adaptable to provide
different control configurations, and are limited to a single control configuration. Known
TLSOs may be configurable to either an over-the-shoulder, or under-the-arm configuration.

[8] Accordingly, there is a need for an improved TLSO with versatile configurations that better fit a user's dynamic needs throughout treatment and without incurring the costs of custom orthoses.

[9] SUMMARY

5 [10] Under an embodiment of the disclosure, the orthopedic device is configured as a thoracic lumbar sacral orthosis (TLSO) attachment arranged for removably attaching to an orthopedic device, such as a lumbar sacral orthosis (LSO) or torso orthosis, securable about the waist and lumbar region of a user. The TLSO attachment may have an anterior assembly including an anterior panel secured to the LSO, an anterior thoracic extension (ATE) connected
10 to the anterior panel, and a pectoral assembly connected to the ATE. The TLSO attachment may have a posterior assembly connected to the LSO by a posterior panel and includes a posterior thoracic extension (PTE). Either an axillary strap system or a shoulder strap system, or both, may connect to the ATE and the PTE.

[11] The embodiments of the TLSO may be configured to provide gross immobilization of
15 the thoracolumbar spine in all three planes: coronal, sagittal, and transverse. The embodiments offer the ability for a clinician to adapt the TLSO to different strapping configurations including over-the-shoulder or under-the-arm configurations. The embodiments offer improved donning and doffing over known TLSOs, with improved fitting features such as quick-release buckles, slidable straps, and multi-positional attachments.

20 [12] Because the TLSO attachment connects to an existing LSO or torso orthosis and cervical collar, the attachment can be removed after the wearer no longer has need for a TLSO. This results in a modular system that enables the TLSO attachment to be applied to the LSO when needed, or likewise removed when needed. This results in a step-up and step-down treatment option that better accommodates a user's dynamic needs throughout treatments.

25 [13] BRIEF DESCRIPTION OF THE DRAWINGS

[14] The orthopedic device is described referring to the accompanying drawings, which show preferred embodiments according to the thoracic lumbar sacral orthosis attachment described herein.

[15] Fig. 1A is a front schematic view of an orthopedic device configured as a thoracic
30 lumbar sacral orthosis (TLSO) with a TLSO attachment connected to a lumbar sacral orthosis (LSO) on a user.

[16] Fig. 1B is a rear schematic view of the TLSO of Fig. 1A on a user.

[17] Fig. 2 is a detail view of an embodiment of a pectoral assembly for the TLSO of Fig. 1A.

- [18] Fig. 3A is a side perspective view of an anterior thoracic extension for the TLSO of Fig. 1A.
- [19] Fig. 3B is an exploded view of the ATE of Fig. 3A.
- [20] Fig. 3C is a perspective view of an ATE adapted to connect to a cervical collar.
- 5 [21] Fig. 3D is a schematic view of an ATE adapted to be adjustable in height by means of an adjustment portion.
- [22] Fig. 3E is a schematic view of the ATE of Fig. 3D arranged with a TLSO attachment.
- [23] Fig. 3F is a schematic view of the ATE of Fig. 3D connected to strap systems via a single boss.
- 10 [24] Fig. 3G is a schematic view of the ATE of Fig. 3D arranged with a TLSO attachment and an orthopedic device and configured for a shorter user.
- [25] Fig. 4A is a schematic view of a first step of connecting an anterior panel attachment system for connecting an anterior panel to an orthopedic device in the TLSO of Fig. 1A.
- [26] Fig. 4B is a schematic view of a second step of connecting the anterior panel to the
15 orthopedic device in the TLSO of Fig. 4A.
- [27] Fig. 4C is a schematic view of an alternative embodiment of an anterior panel attachment system for connecting an anterior panel to an orthopedic device in the TLSO of Fig. 1A.
- [28] Fig. 4D is a schematic view of the anterior panel attachment system of Fig. 4C.
- 20 [29] Fig. 5A is a schematic view of a first step of using a posterior panel attachment system for connecting an anterior panel to the orthopedic device in the TLSO of Fig. 1B.
- [30] Fig. 5B is a schematic view of a second step of connecting a posterior panel attachment system to the orthopedic device in Fig. 5A.
- [31] Fig. 5C is a schematic view of a third step of connecting a posterior panel attachment
25 system to the orthopedic device in Fig. 5A.
- [32] Fig. 5D is a schematic view of a fourth step of connecting a posterior panel attachment system to the orthopedic device in Fig. 5A.
- [33] Fig. 6A is a schematic view of a posterior thoracic extension (PTE) connected to a posterior panel.
- 30 [34] Fig. 6B is a schematic view of the PTE removed from the posterior panel.
- [35] Fig. 7A is an elevational view showing another embodiment of a PTE connected to a posterior panel.
- [36] Fig. 7B is a schematic view showing yet another embodiment of a PTE connected to a posterior panel.

[37] Fig. 8A is a schematic view showing a versatile strap mount system for connecting an axillary strap system to a posterior panel.

[38] Fig. 8B is a schematic view showing an alternative embodiment of a versatile strap mount for connecting an axillary strap system to a posterior panel.

5 [39] Fig. 9A is a schematic view showing a variably positioned sternum strap.

[40] Fig. 9B is a detail view IX B derived from Fig. 9A.

[41] Fig. 9C is a schematic view derived from Fig. 9B.

[42] Fig. 10A is a perspective view of a variation of the TLSO in Fig. 1A having a shoulder strap assembly and without an ATE.

10 [43] Fig. 10B is a perspective view of the TLSO in Fig. 1A showing only a shoulder strap assembly connected to the ATE.

[44] Fig. 10C is a perspective view of the TLSO in Fig. 1A showing only an axillary strap assembly connected to the ATE.

[45] DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS

15 [46] The embodiments of the disclosure are particularly adapted for a human body, and may be dimensioned to accommodate different types, shapes and sizes of human body sizes and contours. For explanatory purposes, the orthopedic device embodiments described herein correspond to different sections of a body and are denoted by general anatomical terms for the human body.

20 [47] The embodiments of the orthopedic device are particularly referred to as corresponding to anterior and posterior body sections by an anterior-posterior plane. The anatomical terms described herein are not intended to detract from the normal understanding of such terms as readily understood by one of ordinary skill in the art of orthopedics.

[48] Embodiments of the orthopedic device described herein may be adapted to the disclosures found in U.S. patent no. 8,172,779, and U.S. patent application publication no. 25 2016/0250061.

[49] Fig. 1A shows an anterior aspect 102 of an embodiment of an orthopedic device wherein a thoracic lumbar sacral orthosis (TLSO) attachment 100 for configuring a lumbar sacral orthosis (LSO) 106 into a TLSO by connecting the attachment 100 to the lumbar sacral orthosis (LSO) 106. The attachment 100 includes an anterior panel 108 connecting to the LSO 30 106, an anterior thoracic extension (ATE) 110 secured to the anterior panel 108, a support bar 112 extending from the ATE, at least one pectoral pad 114 secured to the support bar 112, and at least one strap system including an axillary strap system 116 and/or a shoulder strap system 118 connecting to the orthopedic device 106.

[50] The support bar and the at least one pectoral pad, and other features that may become evident from the following disclosure may be adapted from U.S. patent no. 8,657,769.

[51] Fig. 1B shows a posterior aspect 104 of a TLSO attachment 100, and includes a posterior panel 122 having a cover 124 connecting to the LSO/orthopedic device 106, a
5 posterior thoracic extension (PTE) 120 secured to the posterior panel 122, and at least one strap system including an axillary strap system 116 and/or a shoulder strap system 118 connecting to the orthopedic device 106.

[52] Referring to Fig. 2, the support bar 112 includes at least one boss 132, 134 protruding from the support bar 112. At least one of the strap systems 116, 118 includes a fastener 128,
10 130 for removably securing to the at least one boss 132, 134. The at least one boss 132, 134 may include first and second sets of bosses 132, 134, such that the first set of bosses 132 is located closer to the ATE than the second set of bosses 134.

[53] At least one boss 133, as shown in Fig. 3A, may be located opposite the pectoral pads, as described in U.S. patent no. 8,657,769, to provide alternative relief from a strap system for
15 a user. In any of these variations, there is flexibility on the user for selecting attachment of the strap systems 116, 118 to different locations for comfort and improved immobilization. The axillary strap system 116 may be adapted to secure to the first set of bosses 132 to accommodate a larger arm size.

[54] In the embodiments, fasteners 128, 130 extend from the strap systems 116, 118, and are
20 arranged with an engagement element 138 for receiving a segment 139 of the at least one strap system 116, 118. Each of the fasteners 128, 130 may define a fitting 136, such as a keyhole fitting, arranged for securing about the at least one boss 132, 134 and/or pectoral pads 114.

[55] Figs. 3A and 3B show how the ATE 110 may comprise first and second parts 140, 142 connected to one another by a first hinge 144, and the second part 142 is hingedly coupled to
25 the support bar 112 at a second hinge 146. The second part 142 is removable so the overall height of the ATE can be shorter based on the dimensions of individual users. A kit may be provided with the second part 142 for added height or additional contourability of the ATE by providing two hinges.

[56] To accommodate the addition or removal of the second part 142, while still offering a
30 hinged ATE 110, the first part 140 preferably has a first interlocking section 148 coupled to a fourth interlocking section 154 extending from the support bar 112 to hingedly connect. The second part 142 has second and third interlocking sections 150, 152 adapted to hingedly couple to the first and fourth interlocking sections 148, 154 of the first part 140 and the support bar 112, respectively.

[57] The hinges 144, 146 may be coupled together by a fastener 151, 157 with a spring bias 153, 159. The hinges 144, 146 or parts thereof, may define a set of teeth engageable with one another, and the coarseness of the teeth may be arranged according to predetermined rotational settings of the hinges 144, 146 of the parts 140, 142, 112 relative to one another.

5 [58] The first hinge 144 may be formed at a connection between the first part 140 and the second part 142, or at a connection between the first part 140 and the support bar 112. As the second part 142 is removable from the ATE 110 to create a shorter configuration of the ATE110 for shorter users, the first and second hinges 144, 146 are lockable to create custom angles between the first and second parts 140, 142, and the first part 140 or second part 142 between
10 the support bar 112 based on the dimensions of the user.

[59] This arrangement advantageously allows for a user to easily adjust the TLSO attachment to a customized configuration based on the user's dimensions. For example, male and female users, tall and short users, and large and small users easily can adapt the configuration of the hinges 144, 146 and the first and second parts 140, 142 to find the best fit.

15 [60] Fig. 3C shows anterior thoracic extension 110 adapted to connect to a cervical collar 113. The support bar 112 connects to a yoke 115 by the pectoral pad 114 by a suitable fastener, such a hook and loop. The cervical collar 113 has a connection 117, such as a thoracic extension, securable to a fastener 119 located on the yoke 115. Fastener 119 may be arranged as a hook island, and a surface of the connection 117 is correspondingly arranged with loop
20 material for removably and conveniently attaching to the hook island, thereby securing the cervical collar 113 to the ATE 110. In this manner, the TLSO can be converted to a cervical-thoracic-lumbar-sacral orthosis that stabilizes the pelvis, back and neck. This arrangement further allows the connection procedure to be simple, intuitive, and repetitive as necessary for individual users.

25 [61] By providing an attachment as in the embodiment of Fig. 3C that allows for the modular attachment and use of cervical, thoracic, lumbar, and sacral orthopedic devices, individual users are able to dynamically treat a wide variety of pathologies that may change throughout the course of treatment and without the added costs and inconvenience of obtaining custom-fit orthopedic devices.

30 [62] Fig. 3D shows an alternative embodiment of anterior thoracic extension 110 configured to be adaptable to a user's height and dimensions by use of an adjustment member 141 extending from the first part 140 at a juncture 145. In the embodiment of Fig. 3D, the juncture 145 is not a hinged attachment, but in other embodiments may be arranged as a hinge like first

and second hinges 144, 146 in order to better fit a user's dimensions via a third degree of rotation.

[63] Adjustment member 141 is configured as a strut and contains an adjustment slot 143 which may define discrete settings or heights from which a user may select. The discrete settings may be defined by a toothed surface 149 as seen in Fig. 3D, with individual teeth of the toothed surface 149 corresponding to a desired height. In certain embodiments, indicia may be provided on a surface of the adjustment member 141 for indicating the height setting currently being used. The adjustment slot 143 may be alternatively configured in other manners that achieve the function of allowing for optimal height adjustment of the ATE 110.

[64] The adjustment member 141 may translate up and down through a channel (not shown) defined by a portion of the anterior panel 108 with removable fastening means for securing the ATE 110 at a desired height setting. By providing adjustment member 141, the ATE 110 may be positioned at the optimal location along a user's torso, allowing the user or a clinician assisting the user to finely position one of the hinges 144, 146, the pectoral bar 112, the pectoral pads 114, or the strap systems 116, 118 at the ideal location based on the user's movements and dimensions.

[65] Fig. 3E shows the ATE 110 of Fig. 3D arranged on a user, with adjustment member 141 and adjustment slot 143 configured to be adjusted through the use of a button 147. In the depicted embodiment, button 147 may be arranged with a removable fastener (not shown) that releases the adjustment member 141 when the button is depressed, allowing a user or a clinician to freely slide the adjustment member 141 up or down as needed to obtain an optimal height of the ATE 110. When the optimal height has been attained, the button 147 may be released, allowing an automatic biasing mechanism to apply the removable fastener to secure the adjustment member 141 at the selected height setting.

[66] The arrangement of the button 147 allows for intuitive adjustment of the height of the ATE 110 that allows for the ATE 110 to be positioned where needed based on the user's dimensions and stage of treatment. The arrangement further allows for the ATE 110 to be assembled simply and modularly with the TLSO attachment and the orthopedic device 106.

[67] The embodiment of Fig. 3E is shown further in Fig. 3F, which illustrates an arrangement of strap systems 116, 118 about the ATE 110. The strap systems 116, 118 may attach about a same boss 111, at which the pectoral pads 114 may also be attached to the pectoral bar 112, allowing for a simple, robust, and intuitive assembly of the device, especially as the strap systems 116, 118 are engaged over the user's shoulders and under the user's arms.

[68] Figs. 4A and 4B show an embodiment of an anterior attachment system 155 including at least one side fastener 156, such as a patch having hook material that may be in a cut-away 158 of the anterior panel 108, secured to a side of the anterior panel 108, and a central fastener 168 generally centrally secured to the anterior panel 108 for providing lateral attachment to an anterior section of the orthopedic device 106.

[69] The anterior attachment system 155 further comprises a longitudinal attachment to the orthopedic device 106 with a first strap 160 extending from a top portion of the anterior panel 108. The first strap may be tethered by at least one tether 162 extending toward a second strap 164 and coupling therewith with a coupler 166 extending from the second strap 164 to form a loop for securing to an anterior section, such as a belt member 170, of the orthopedic device 106. A surface 172 of the belt arm is preferably engageable with the at least one side fastener 156 and the central fastener 168. In this manner, the TLSO attachment is easily combined with a variety of existing lumbar support orthoses. The side and central fasteners 156, 168 and the longitudinal attachment system are broadly compatible with and adaptable for existing devices and offer a secure attachment system on both inward- and outward-facing surfaces of the lumbar support orthoses without the need for custom configurations.

[70] Figs. 4C - D show an alternative embodiment of the anterior attachment system 155, wherein the anterior panel 108 receives and secures to an orthopedic device via top and bottom fasteners 163, 165 which attach over the orthopedic device 106 (for example a lumbar sacral orthosis belt) and secure at an outer-facing surface thereof via fasteners, which in this embodiment may be hook and loop fasteners. Additionally, a central fastener 167 attaches to an inner-facing surface of the orthopedic device 106, in this embodiment also hook and loop fastener. The top and bottom fasteners 163, 165 attach independently of each other, allowing for flexibility, intuitiveness, and simplicity in how the straps are arranged over the orthopedic device 106. The top and bottom fasteners 163, 165 may be arranged in length to abut one another at a junction or point 173.

[71] This arrangement allows the top and bottom fasteners 163, 165 to effectively provide a complete longitudinal engagement with the orthopedic device 106 without having to physically couple the top and bottom fasteners 163, 165 with each other via another fastening device. As with the embodiment in Figs. 4A - B, a side fastener 156 may be arranged at a cutout 158 for additional stabilization, especially in the axial direction. Cutout 158 may be arranged with a sufficient size to allow the side fastener 156 or additional side fasteners to be arranged in a variety of configurations deemed advantageous for a particular use.

[72] Figs. 5A-5D show an embodiment of a posterior attachment system 175 for securing to a posterior section of the orthopedic device 106, and includes a cover 176 extending over the posterior panel 122. The cover 176 has a central fastener 177 for engaging a surface 172 of a posterior section 174 of the orthopedic device 106 to laterally secure the orthopedic device 106 to the posterior panel 122. The cover 176 has a first flap 178 defining a portion of cover 124 extending over the posterior section 174 of the orthopedic device 106, and a second flap 180 having a fastener 182 engaging the first flap 178 to longitudinally secure the orthopedic device 106 to the posterior panel 122.

[73] Like the anterior attachment system 155 depicted in Figs. 4A and 4B, the posterior attachment system 75 is configured to be broadly compatible with and adaptable to existing lumbar sacral orthoses of different sizes and configurations. The central fastener 177 and the first and second flaps 178, 180 serve to effectively secure the TLSO attachment to the existing lumbar sacral orthosis on both inward- and outward-facing surfaces thereof.

[74] Figs. 6A and 6B depict an embodiment of a PTE, wherein the PTE 120 secures to a crest 184 of the posterior panel 122. The PTE 120 defines a shell having an opening 188 generally extending about a portion of the crest 184 and a bar 186 adapted for receiving fasteners 126 engageable with the posterior panel 122. Bar 186 defines at least one aperture 190 for receiving fasteners 126. If extra height of the PTE is desired relative to the posterior panel 122, the PTE 120 may be inserted over the crest 184 of the posterior panel 122 via the opening 188 such that the bar 186 will reside at a higher location relative to the crest 184 than the fasteners 126 with the PTE 120 being wedged onto the crest 184 of the posterior panel 122. This arrangement of the PTE 120 allows for a user-specific adjustment of the height of the PTE relative to the user and the posterior panel 122 with a simplified procedure for securing the device together, as the fasteners 126 are easily adaptable to secure through the posterior panel 122 at any convenient location to engage the at least one aperture 190.

[75] Fig. 7A exemplifies how the PTE 194 secures to a crest 198 of a posterior panel 192 by a slot 196 formed by the PTE 194. The PTE 194 overlaps with the crest 198, and the PTE 194 may be secured to the posterior panel 192 by fasteners or by being wedged. In this embodiment, the PTE 194 defines at least one side slot 200 and at least one end slot 202 for receiving strap segments. Returning to Fig. 1B, the axillary strap system 116 may secure to the PTE 194 by the at least one side slot 200, and the shoulder strap system 118 may secure to the at least one end slot 202.

[76] Fig. 7B shows how the PTE 206 may overlap a posterior panel 204, and is secured thereto by fasteners 208. At least one side ring, bracket or buckle 212 may be pivotally secured

to the PTE 206 for receiving a strap segment 210, and at least one end ring, bracket or buckle 216 may be pivotally secured to the PTE 206 for receiving a strap segment 214. For example, returning to the embodiment of Fig. 1B, bracket 212 may receive axillary strap system 116 at the at least one side ring, bracket or buckle 212. Shoulder strap system may be received at the at least one side ring, bracket or buckle 216. Alternatively, PTE 206 may be arranged in a system without an ATE, wherein strap segments 210 and 214 connected by wrapping around the user's shoulders.

[77] PTE 206 may adapt to a user's movements and specific dimensions by providing that the at least one side ring, bracket, or buckle 212, 216 are pivotally attached to the PTE 206. As a user moves, the strap attachments may accordingly pivot to a desired degree on the PTE 206 in order to accommodate the motion and the user's dimensions.

[78] Referring to Fig. 8A, at least one strap mount 218, 220 may be removably attachable to a surface 232 of the posterior panel 122, such that a posterior section 174 of the orthopedic device 106 overlaps the at least one strap mount 218, 220. The at least one strap mount 218, 220 may be removably attachable over the entire surface 232. For example, the at least one strap mount 218, 220 may include a hook material engageable with a loop material extending from the surface 232. The at least one strap mount 218, 220 may define a strap attachment 222 extending from the at least one strap mount 218, 220 for receiving a strap segment 224 to a strap system.

[79] The at least one strap mount is provided to attach a strap to the PTE according to the anatomy of the user, since the strap, particularly an axillary strap system, may be uncomfortable to some users under the armpit, such that the axillary strap system is arranged to be more comfortable to the user while still possessing the function of immobilization and accommodating a user's morphology.

[80] Fig. 8B depicts an alternative embodiment of a strap mount 221 arranged to be removably attached to an exterior surface material 121 of the orthopedic device 106 as opposed to the posterior panel 122. This arrangement allows for added convenience as a user is able to easily adjust the position of the strap mount for optimal comfort and fit without having to remove or decouple the posterior attachment system 175 from the orthopedic device 106.

[81] Strap mount 221 is coupled to a strap segment 225 by a reinforcement portion 223, wherein additional stitching and strong stitching patterns enable a more robust connection between the material of the strap mount 221 and the strap segment 225. Strap mount 221 is arranged with a fastener such as a hook and loop fastener allowing for attachment of the strap mount 221 to an outer surface material 121 of the orthopedic device 106.

[82] Fig. 9A depicts a chest strap 250 adjustable along a user's chest and relative to first and second straps 252, 254. The anterior side of the first and second straps 252, 254 includes reinforced edges 256, 258, respectively, upon which the first and second sliders 260, 262 slide along, respectively. First and second strap segments 264, 266 are coupled by a buckle 268, and each of the first and second strap segments 264, 266 are tethered to the first and second sliders 260, 262. The arrangement of the embodiment in Fig. 9A allows the chest strap 250 to not only assure that the shoulder straps 252, 254 are retained in proper position over the user's shoulders but also the device to adjust for ideal comfort based on the user's characteristics, *e.g.* between male and female users.

[83] Fig. 9B depicts a detail view of the chest strap 250 usable with an orthosis such as a TLSO attachment having only a posterior component as seen in Fig. 10A below, wherein a chord 268 is located along a softgood of the reinforced edge 258 to retain a shape for the slider 262 to slide along. The slider 262 may include a first end portion contoured to the chord 268, an engager part 270 proximate the first end portion and contoured for convenient gripping by a user, and a second end portion 272 arranged to receive the second strap segment 266. The chest strap 250 can be held in place by the first and second sliders 260, 262, but easily adjusted in height by the user relative to the user's chest.

[84] Fig. 9C depicts in detail view certain elements of the chest strap 250 depicted in Figs. 9A-B, illustrating in particular the presence and use of a buttress 251 disposed within a pocket defined by each of the first and second straps 252, 254. The buttress 251 may be formed of any suitable material providing added strength and definition to the first and second straps 252, 254, especially as forces are applied to the straps 252, 254 and as the slider 262 translates up and down portions of the first and second straps 252, 254 based on a user's dimensions and needs.

[85] In certain embodiments, the buttress 251 may be an elongate member that provides strength along a substantial length of the first and second straps 252, 254. A material suitable for use as buttress 251 may be polytetrafluoroethylene. A skilled artisan will understand that a variety of other materials, including other polymeric materials, metallic materials, and fabric or synthetic materials, among others, may also be suited for use as buttress 251. The buttress 251 is advantageously retained in place in the embodiment of Fig. 9C by a reinforcement area 253, in which added stitching and stronger stitching patterns are used to retain the buttress 251 in place within the pocket defined by the straps 252, 254, especially as forces are applied to the straps 252, 254.

[86] Fig. 10A illustrates a variation of the TLSO attachment wherein the at least one strap assembly 226 is arranged without the ATE, and is arranged to loop about the shoulders of the user, a sternum strap 228 connects first and second strap segments 234, 236 arranged to extend about a user's shoulders.

5 [87] Fig. 10B illustrates a variation of the TLSO attachment, wherein the at least one strap assembly 118 is a shoulder strap assembly 118 arranged to connect to the pectoral pads 114 via the fastener 130. In this arrangement, the shoulder strap assembly 118 connects to the ATE 110 and orthopedic device 106 without an axillary strap system.

10 [88] Fig. 10C illustrates a variation of the TLSO attachment, wherein only an axillary strap system 116 couples to the pectoral pads 114 and the orthopedic device 106, the axillary strap system 116 includes an axillary pad 230 located between the orthopedic device 106 and the pectoral pad 114.

[89] Advantageously, the TLSO attachment of the present disclosure allows for a user to easily select and switch between whichever of the embodiments depicted in Figs. 10A-C is most appropriate for the user's treatment plan, as each of the TLSO attachment embodiments in Figs. 10A-C may be broadly compatible and modularly configurable with existing lumbar sacral orthoses, cervical orthoses, and other devices. The TLSO attachment thus provides improved cost, convenience, and effectiveness of treatment for users.

20 [90] As is readily apparent from the foregoing discussion, it is understood that the size of the orthopedic device and the components thereof can be adjusted so that many different users having different sized joints and body parts may benefit from the present design without the need for custom manufacturing and design. It is also understood that the locations of the various connection points can be alternated from those shown, such that the connection points may be altered from the positions as illustrated herein, as advantageous for users of different
25 dimensions and pathologies.

Claims

1. A thoracic lumbar sacral orthosis attachment (100) for configuring an orthopedic device (106) as a thoracic lumbar sacral orthosis by connecting the TLSO attachment (100) to the orthopedic device (106), the TLSO attachment (100) comprising:
- 5 an anterior panel (108) arranged to connect to the orthopedic device (106);
- an anterior thoracic extension (ATE) (110) secured to the anterior panel (108);
- 10 a support bar (112) extending from the ATE (110);
- at least one strap system including an axillary strap system (116) and/or a shoulder strap system (118) removably securing onto a surface of the orthopedic device (106).
- 15
2. The TLSO attachment of claim 1, wherein the support bar (112) includes at least one boss (132, 134) protruding from the support bar (112), the at least one strap system (116, 118) including a fastener (128, 130) for removably securing to the at least one boss (132, 134).
- 20
3. The TLSO attachment of claim 2, wherein the at least one boss (132, 134) includes first and second sets of bosses (132, 134), the first set of bosses (132) being located closer to the ATE (110) than the second set of bosses (134).
4. The TLSO attachment of claim 2, wherein the fastener (128, 130) is arranged with an engagement element (138) for receiving a segment (139) of the at least one strap system (116, 118).
- 25
5. The TLSO attachment of claim 2, wherein the fastener (128, 130) defines a fitting (136) arranged for securing about the at least one boss (132, 134).
- 30
6. The TLSO attachment of claim 1, wherein the ATE (110) comprises first and second parts (140, 142) connected to one another by a first hinge (144), the second part (142) hingedly coupling to the support bar (112) at a second hinge (146).

7. The TLSO attachment of claim 6, wherein the first part (140) has a first interlocking section (148) arranged to couple to a fourth interlocking section (154) extending from the support bar (112), the second part (142) having second and third interlocking sections (150, 152) adapted to hingedly couple to the first and fourth interlocking sections (148, 154) of the first part (140) and the support bar (112), respectively.

10

8. The TLSO attachment of claim 6, wherein the first hinge (144) is formed at a connection between the first part (140) and the second part (142), or at a connection between the first part (140) and the support bar (112).

15

9. The TLSO attachment of claim 6, wherein the second part (142) is removable from the ATE (110) to create a shorter configuration of the ATE (110), the first and second hinges (144, 146) being lockable to form fixed angles between the first and second parts (140, 142), and the first part (140) and/or second part (142) between the support bar (112).

20

10. The TLSO attachment of claim 1, further comprising an anterior attachment system (155) including at least one side fastener (156) securable to a side of the anterior panel (108), and a central fastener (168) generally centrally secured to the anterior panel (108) for providing lateral attachment to an anterior section of the orthopedic device (106).

25

11. The TLSO attachment of claim 10, wherein the anterior attachment system (155) further comprises a longitudinal attachment to the orthopedic device (106) with a first strap (160) extending from a top portion of the anterior panel (108) and tethered by at least one tether (162) extending toward a second strap (164) and coupling therewith with a coupler (166) extending from the second strap (164) to form a loop for securing to the anterior section of the orthopedic device (106).

30

12. The TLSO attachment of claim 11, wherein a surface (172) of a belt arm is engageable with the at least one side fastener (156) and the central fastener (168).

13. The TLSO attachment of claim 1, further comprising a posterior panel (122) including a posterior attachment system (175) for securing to a posterior section (174) of the orthopedic device (106), and a cover (176) extending over the posterior panel (122), the cover (176) having a central fastener (177) for engaging a surface (172) of the posterior section (174) of

the orthopedic device (106) to laterally secure the orthopedic device (106) to the posterior panel (122), the cover (176) having a first flap (178) extending over the posterior section (174) of the orthopedic device (106), and a second flap (180) having a fastener (182) engaging the first flap (178) to longitudinally secure the orthopedic device (106) to the posterior panel (122).

14. The TLSO attachment of claim 13, further comprising a posterior-thoracic-extension (PTE) (120) securing to a crest (184) of the posterior panel (122), the PTE (120) defining a shell having an opening (188) generally extending about a portion of the crest (184) and a bar (186) adapted for receiving fasteners (126) engageable with the posterior panel (122), the PTE is insertable over the crest (184) of the posterior panel (122) via the opening (188) such that the bar (186) resides at a higher location relative to the crest (184) than the fasteners (126).

15. The TLSO attachment of claim 14, wherein the PTE (194) secures to a crest (198) of a posterior panel (192) by a slot (196) formed by the PTE (194), such that the PTE (194) overlaps with the crest (198).

16. The TLSO attachment of claim 1, wherein at least one strap mount (218, 220) is removably attachable to a surface (232) of the posterior panel (122), such that a posterior section (174) of the orthopedic device (106) overlaps the at least one strap mount (218, 220).

17. The TLSO attachment of claim 16, wherein the at least one strap mount (218, 220) defines a strap attachment (222) extending from the at least one strap mount (218, 220) for receiving a strap segment (224) to a strap system.

18. The TLSO attachment of claim 1, further comprising an adjustable chest strap, slidably mounted onto the shoulder strap system (118).

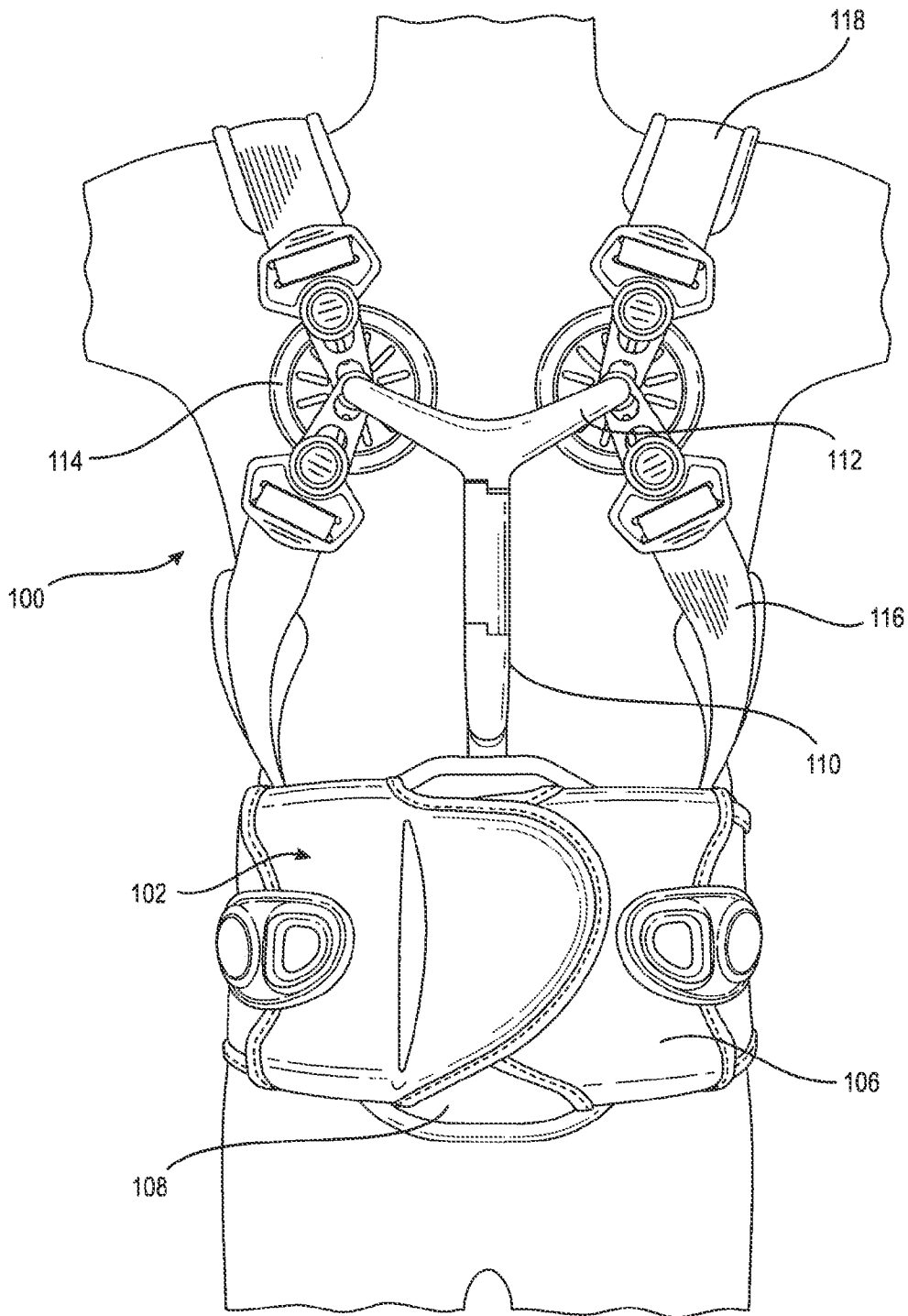


FIG. 1A

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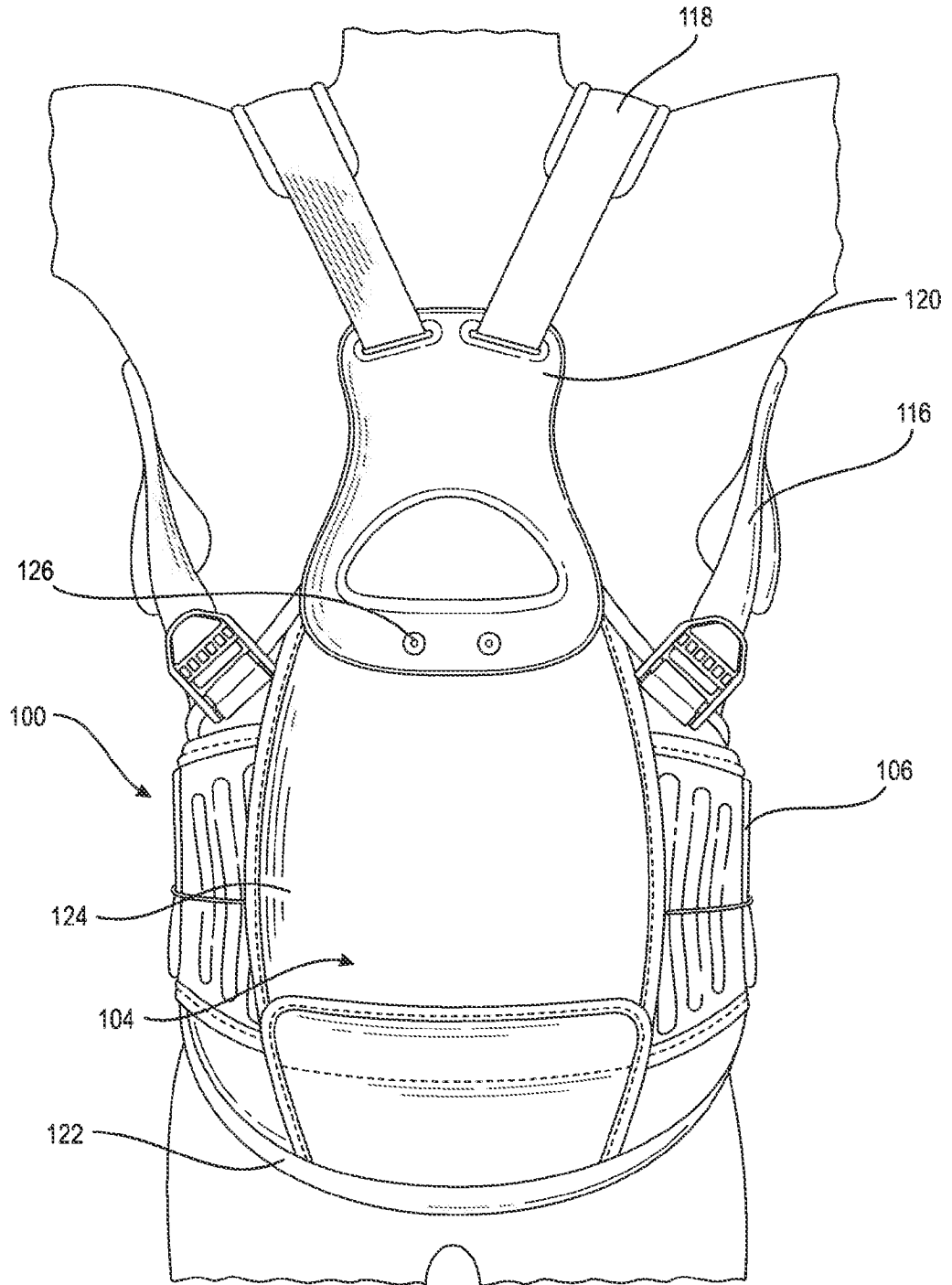


FIG. 1B

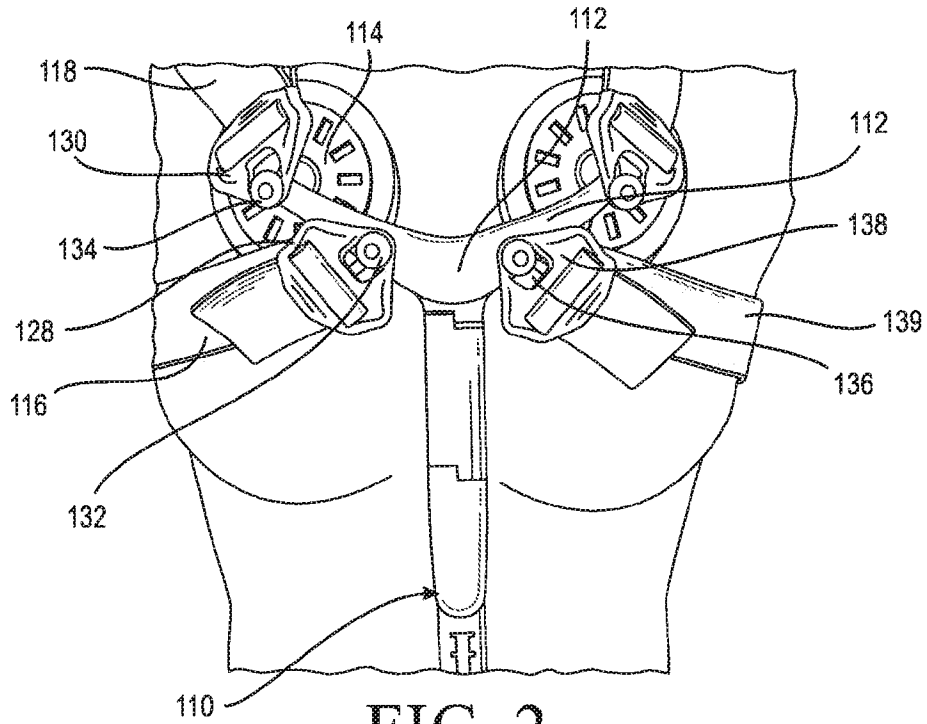


FIG. 2

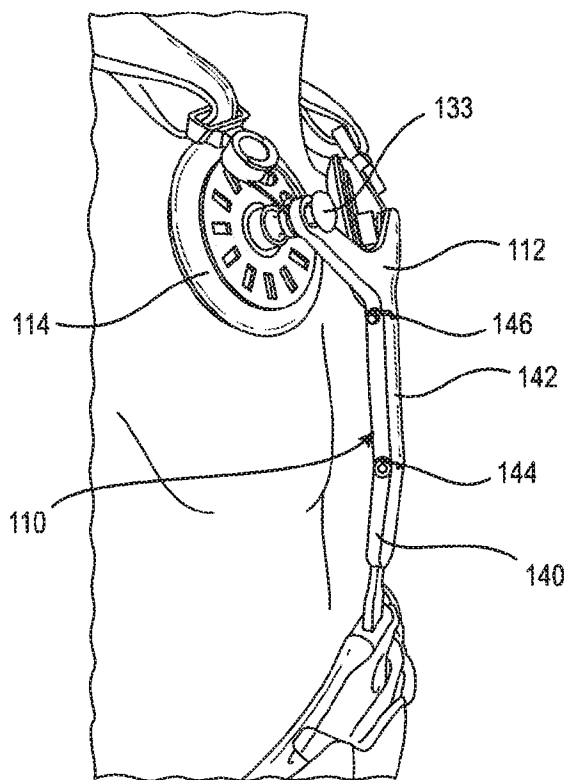


FIG. 3A

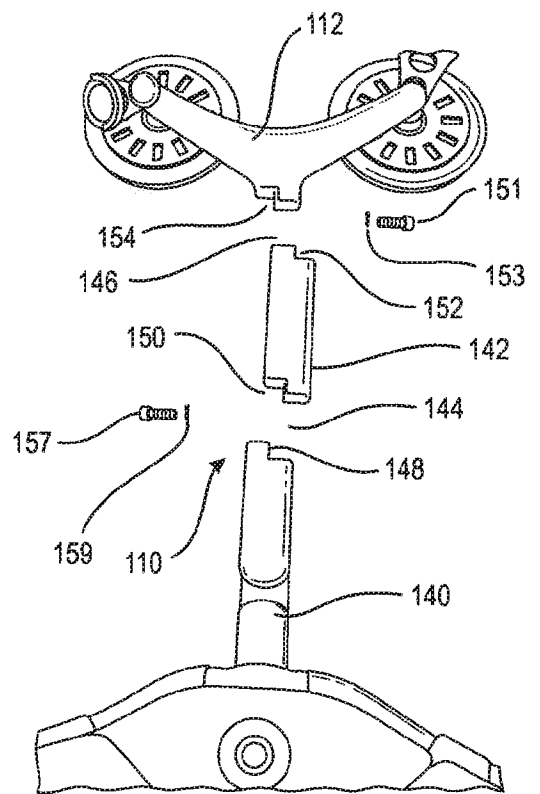


FIG. 3B

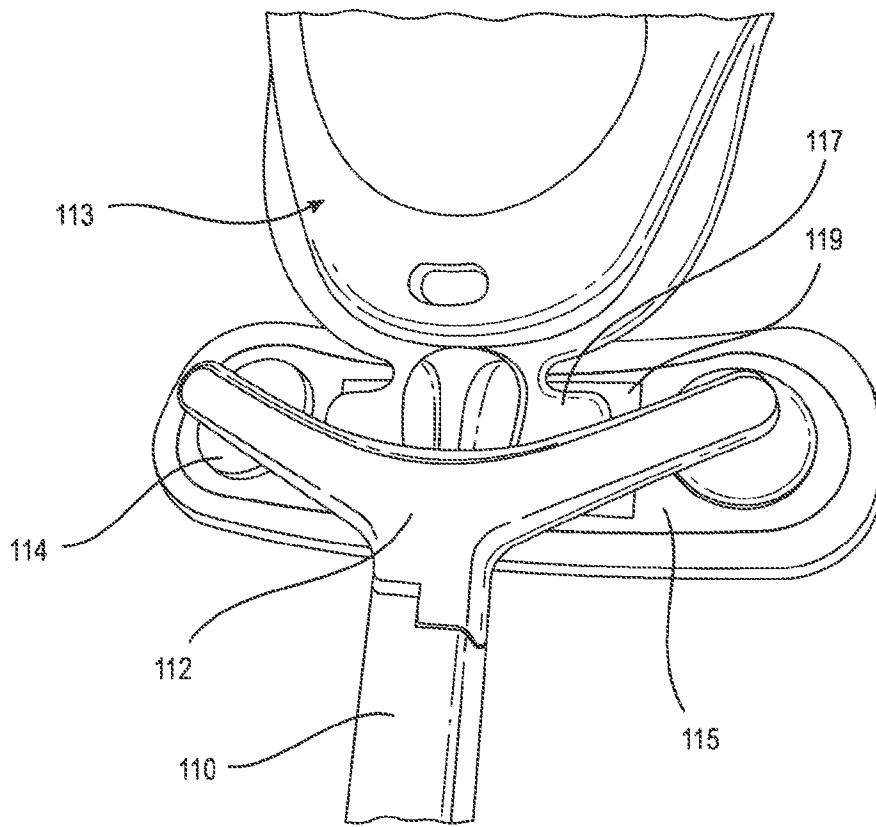


FIG. 3C

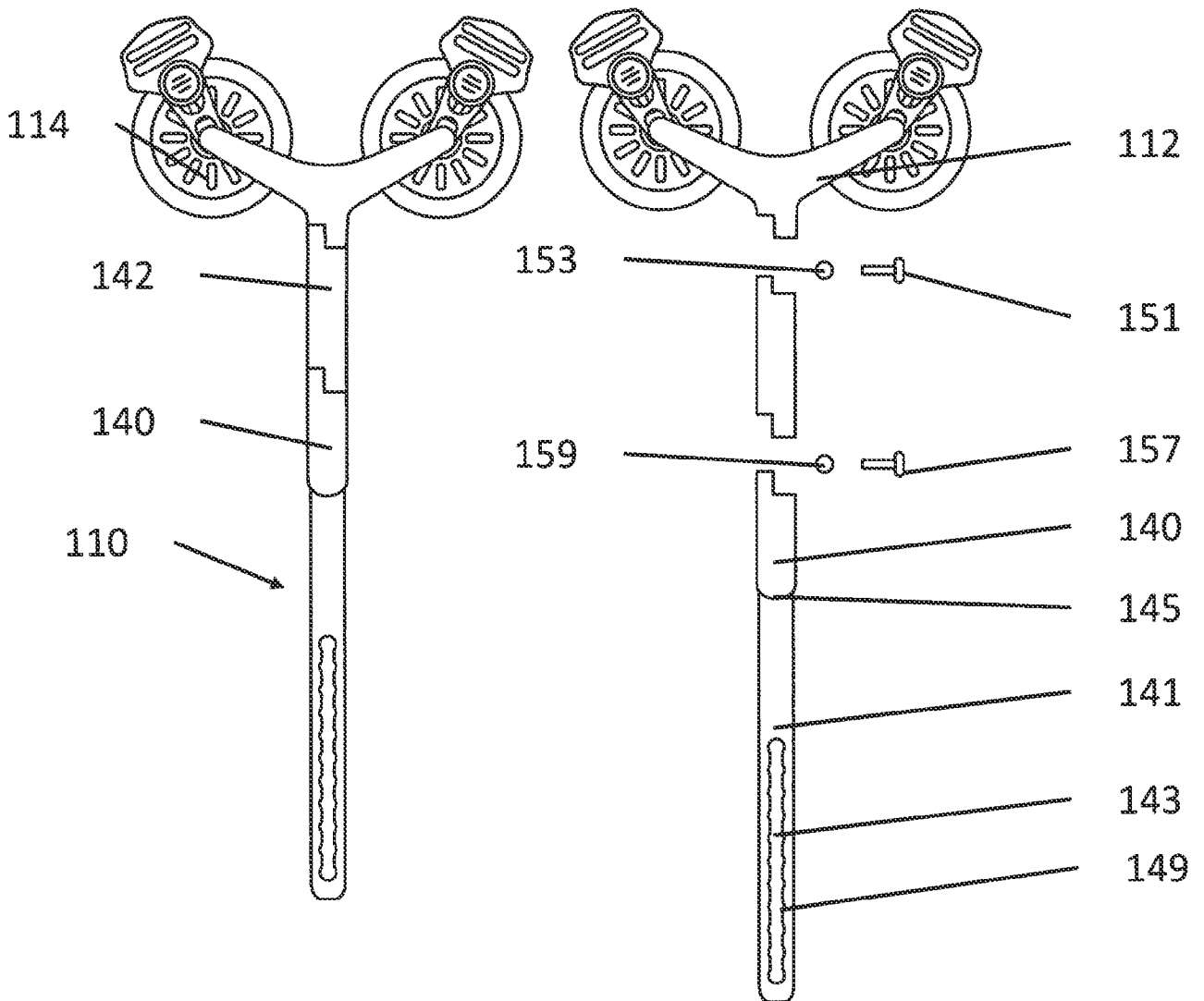


FIG. 3D

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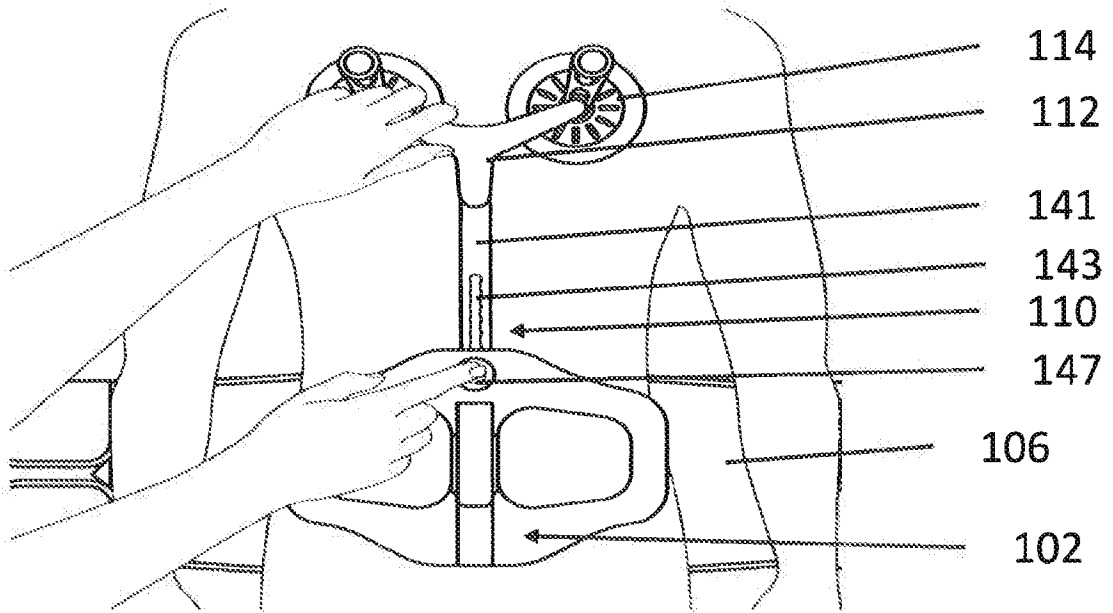


FIG. 3E

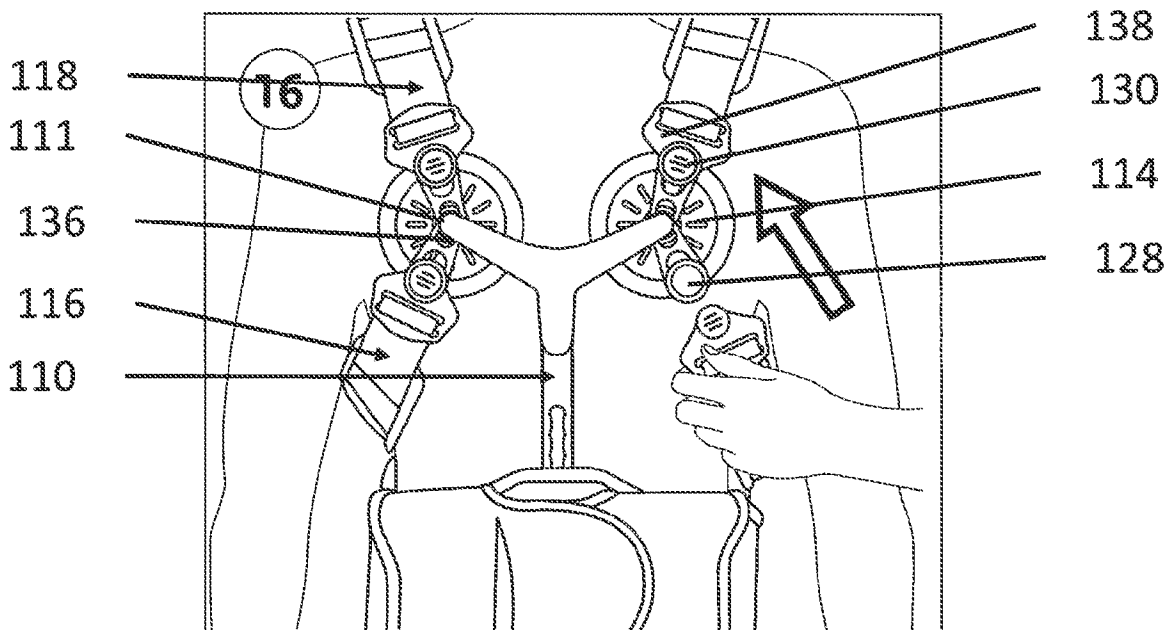


FIG. 3F

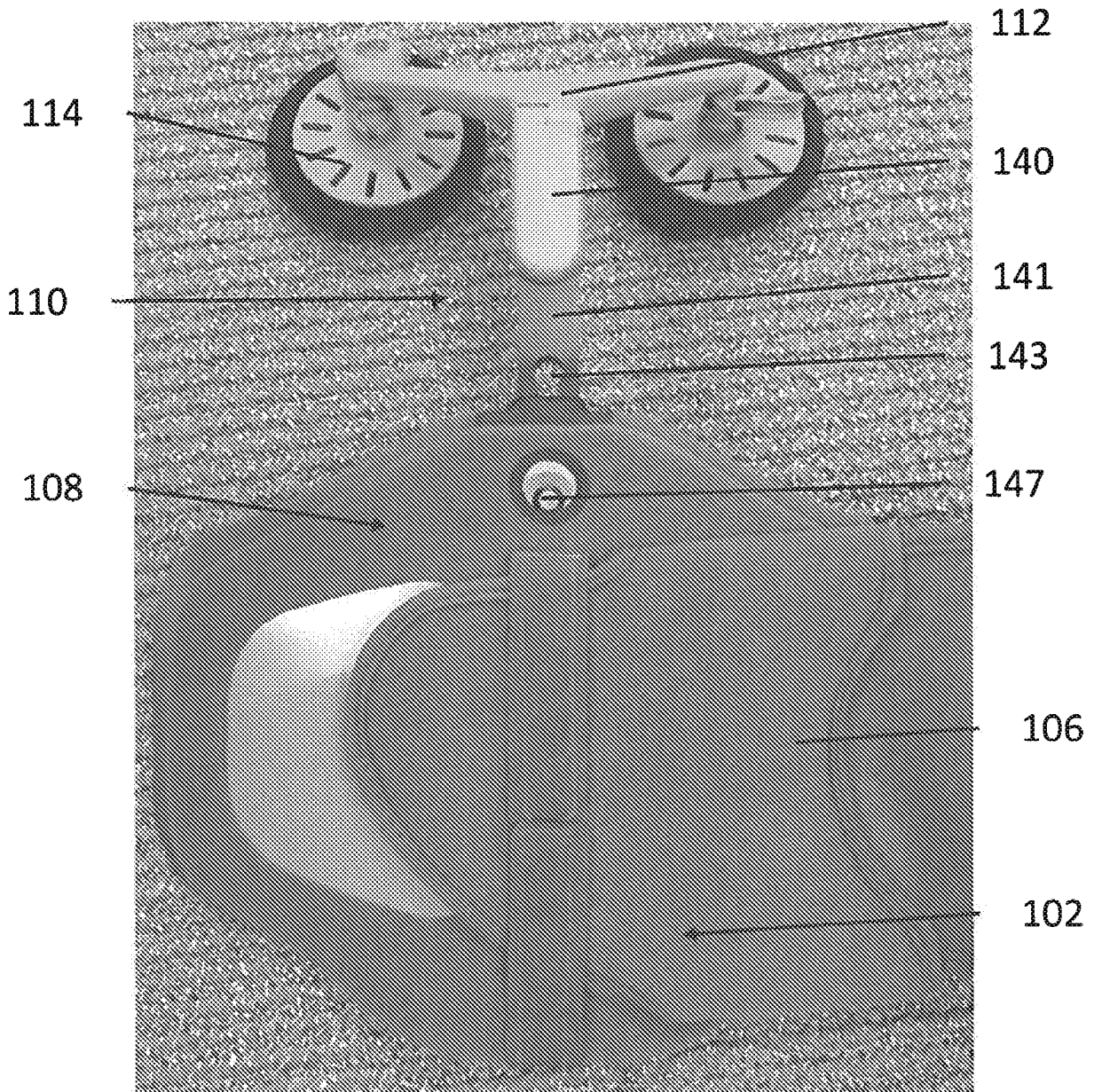


FIG. 3G

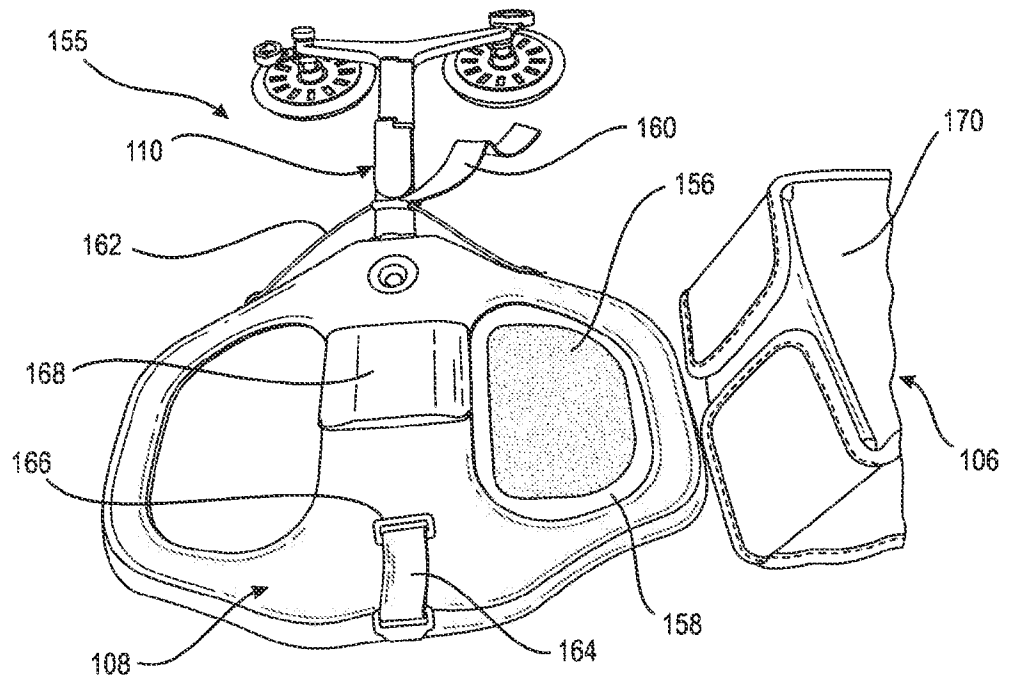


FIG. 4A

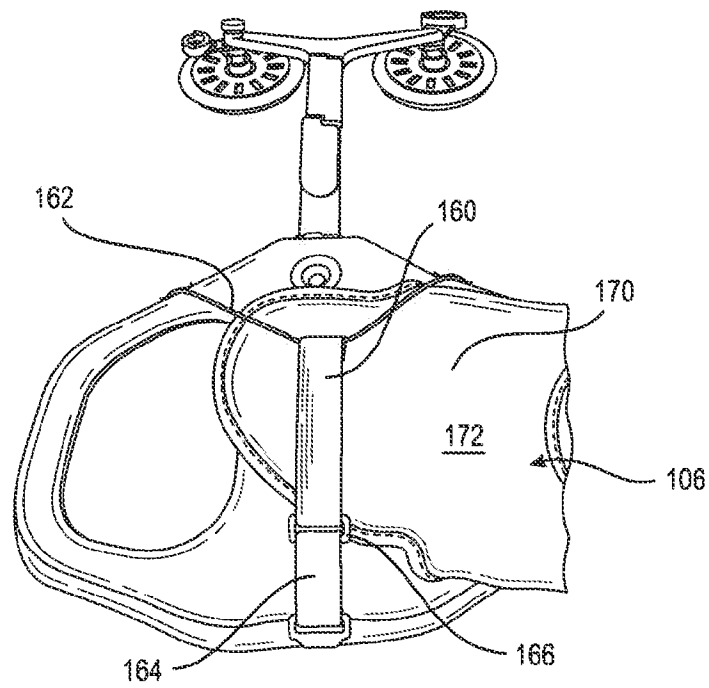


FIG. 4B

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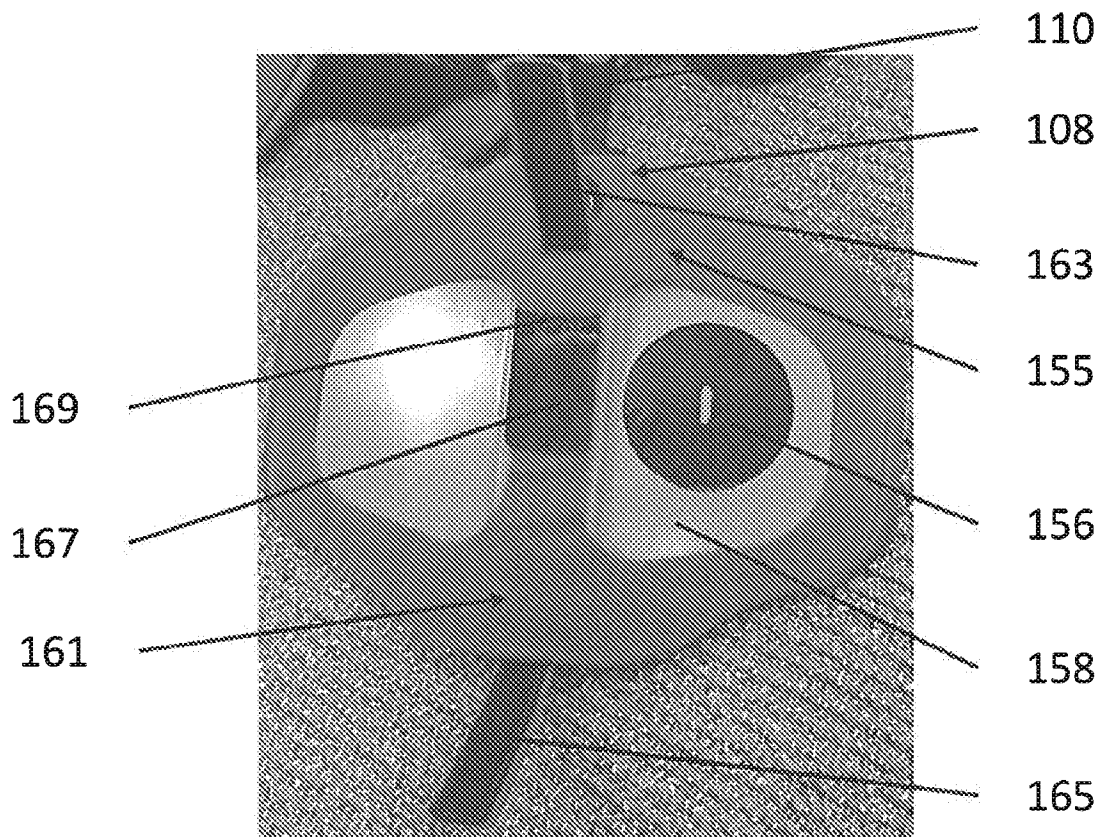


FIG. 4C

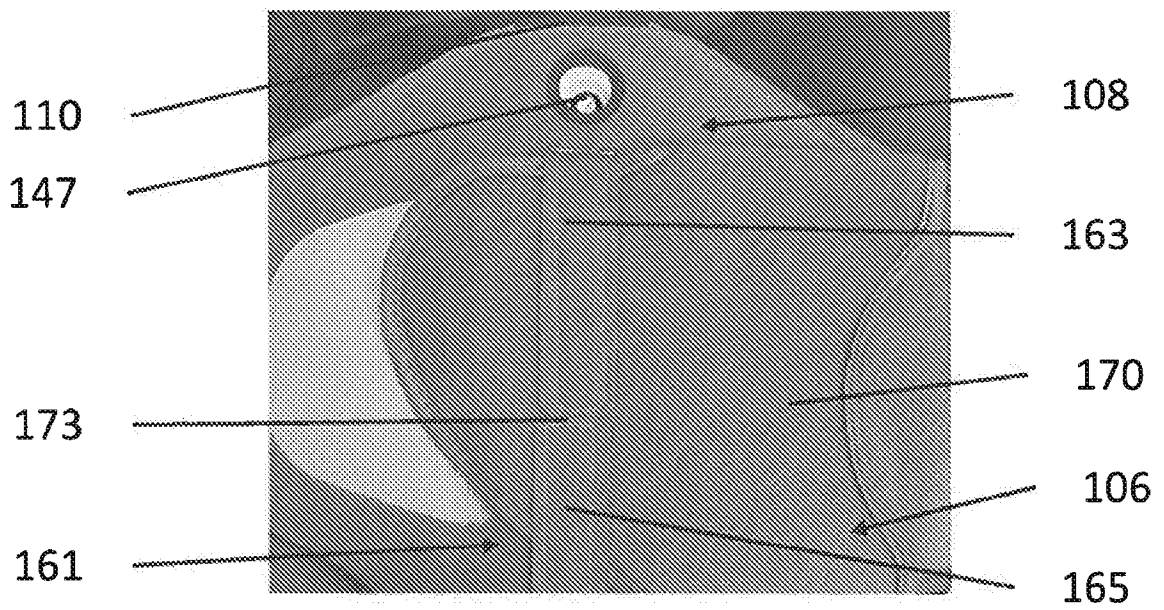


FIG. 4D

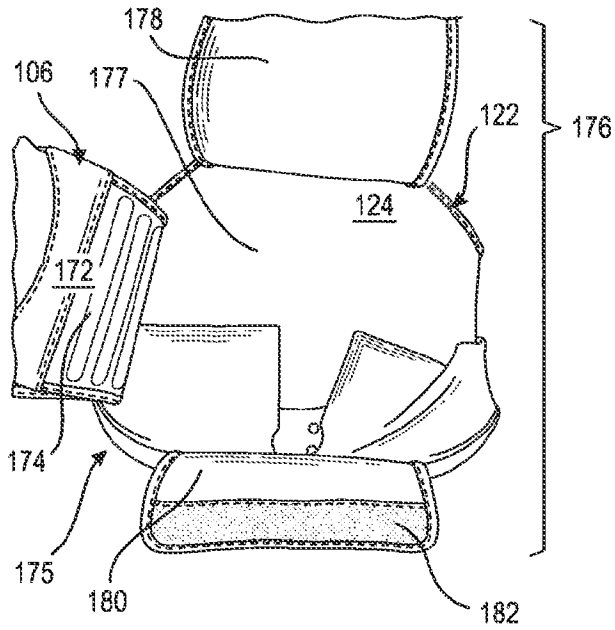


FIG. 5A

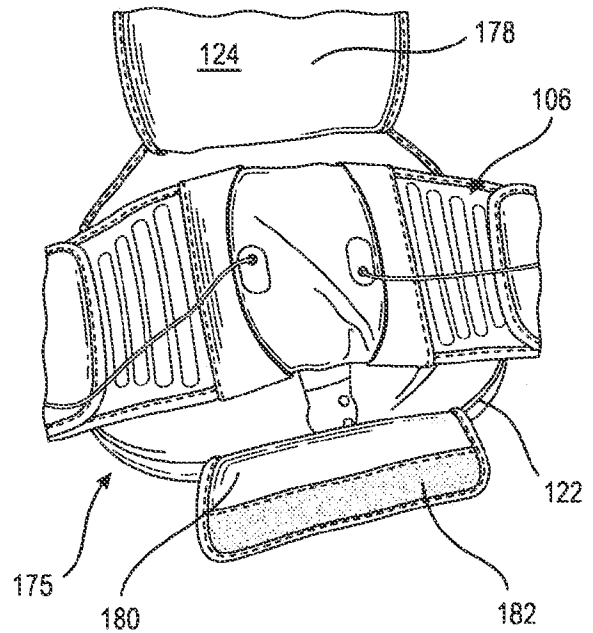


FIG. 5B

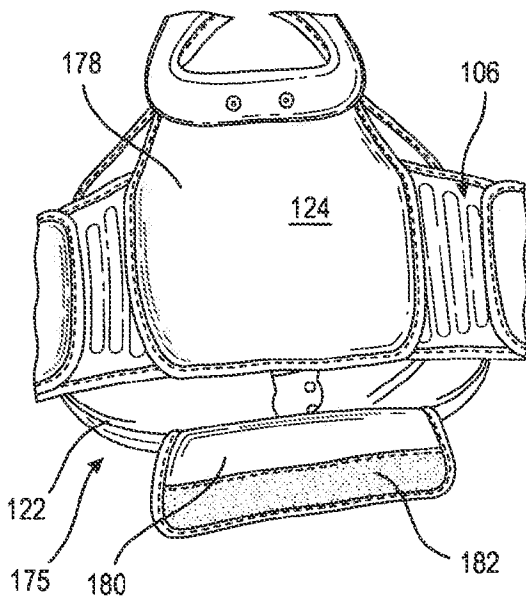


FIG. 5C

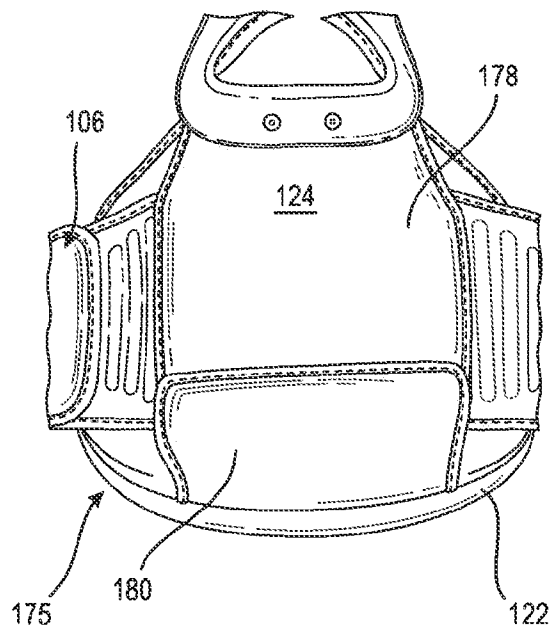


FIG. 5D

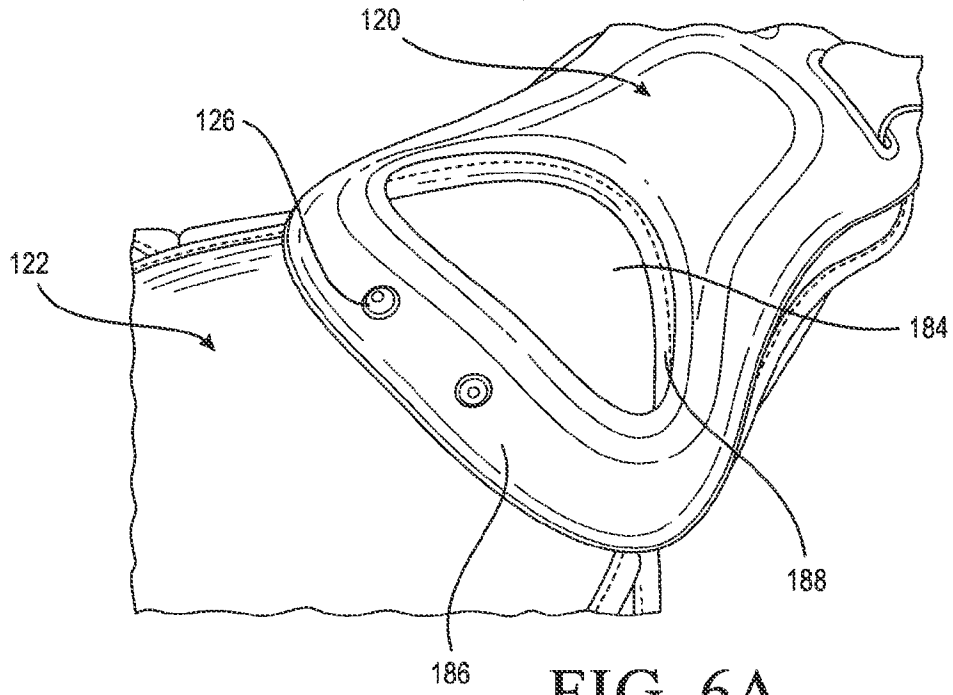


FIG. 6A

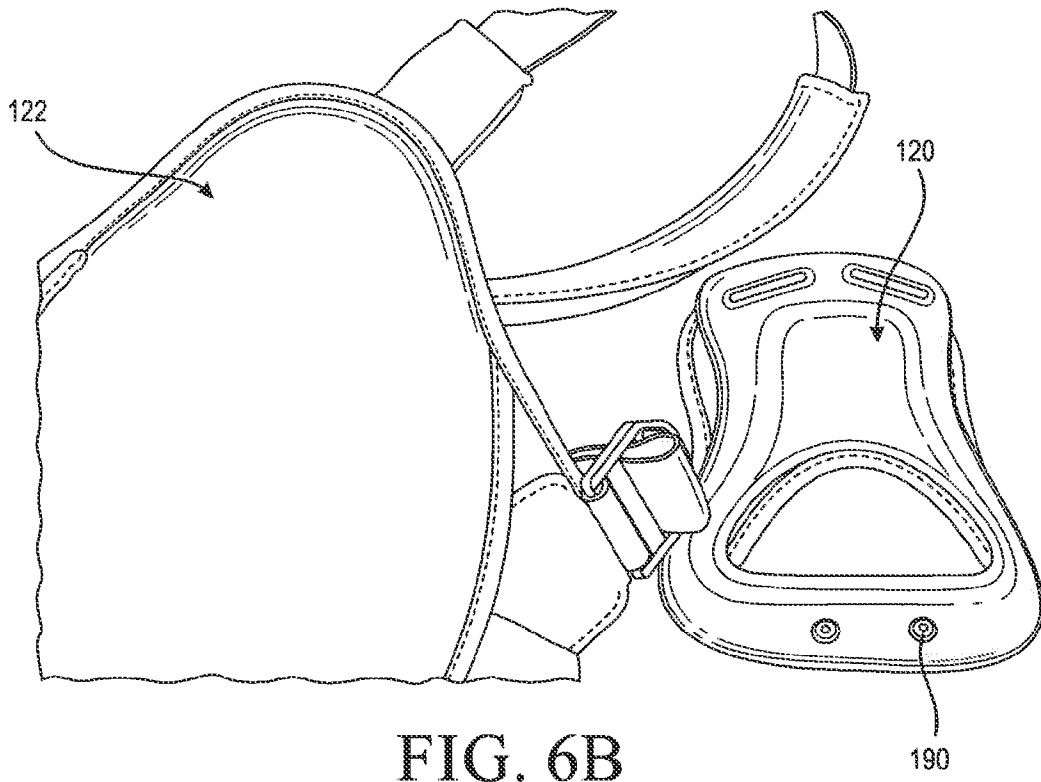


FIG. 6B

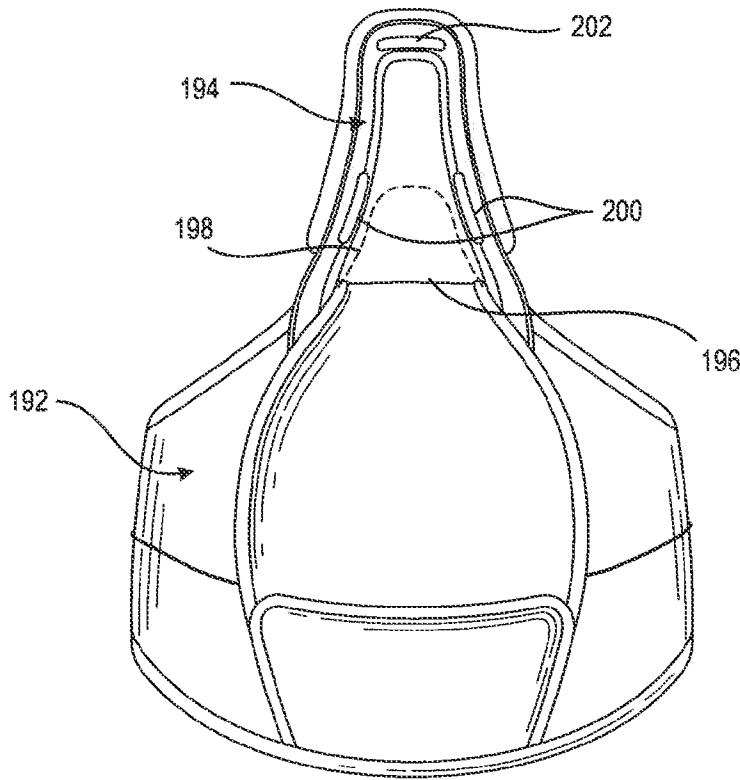


FIG. 7A

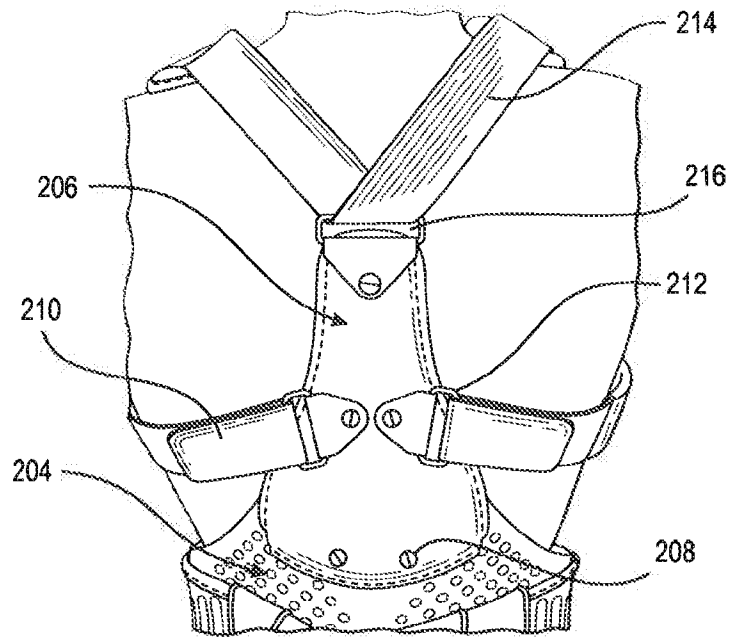


FIG. 7B

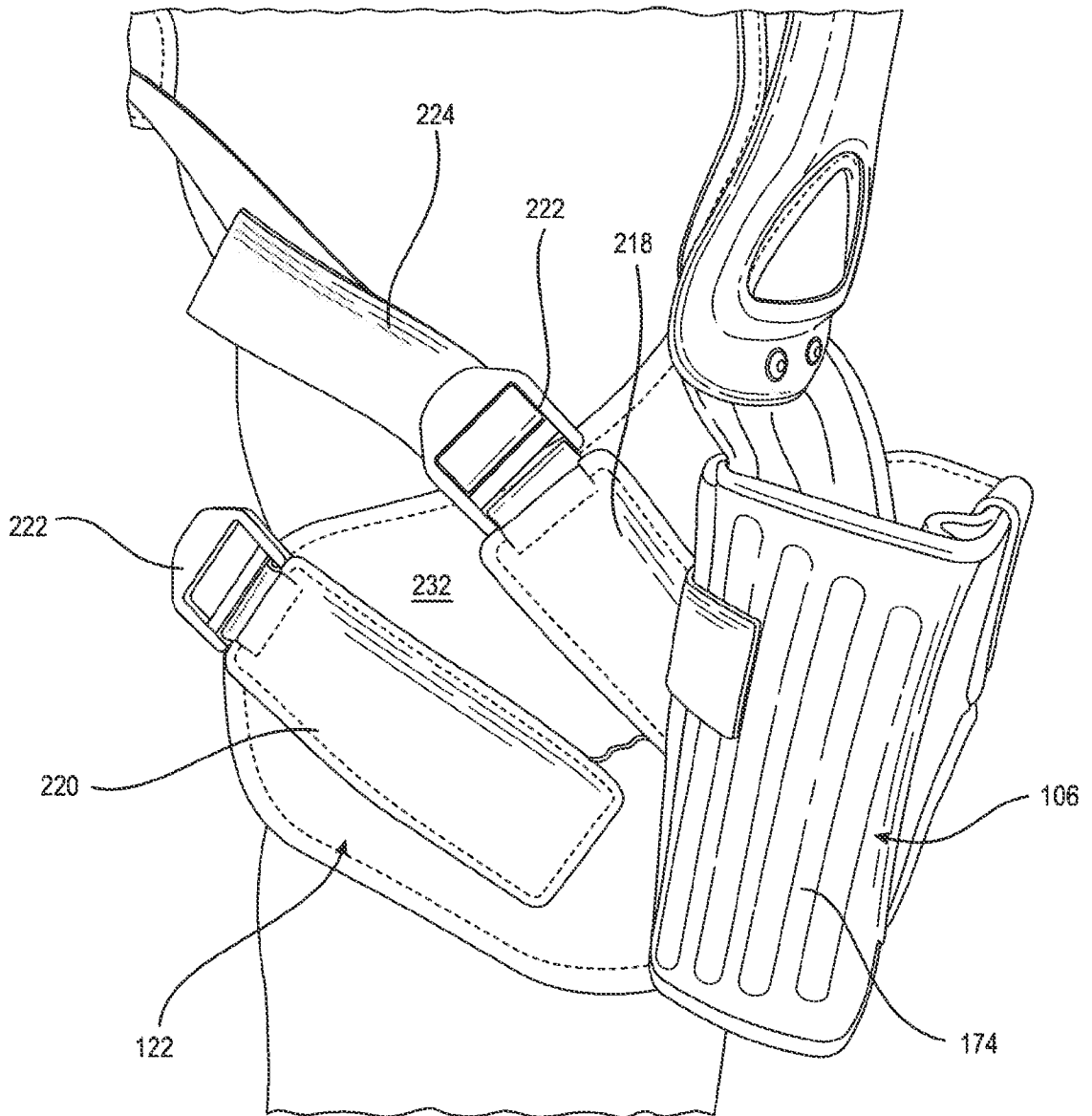


FIG. 8A

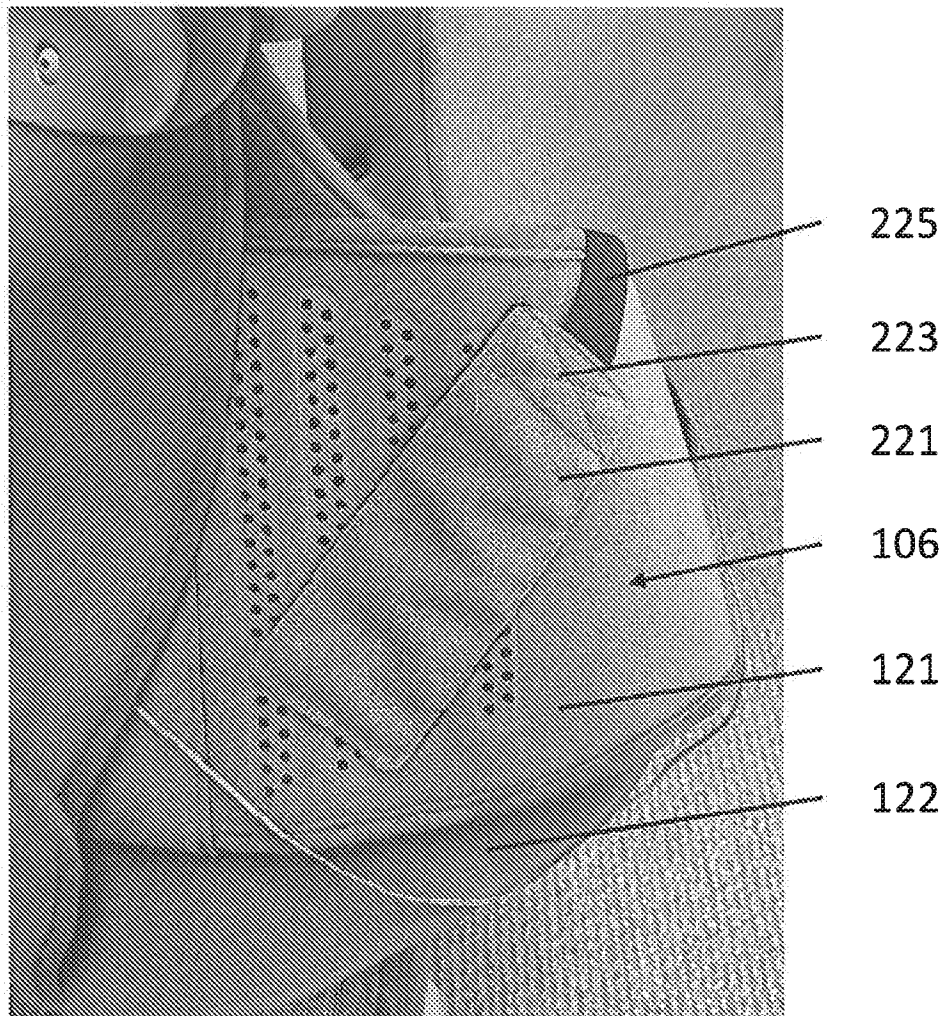


FIG. 8B

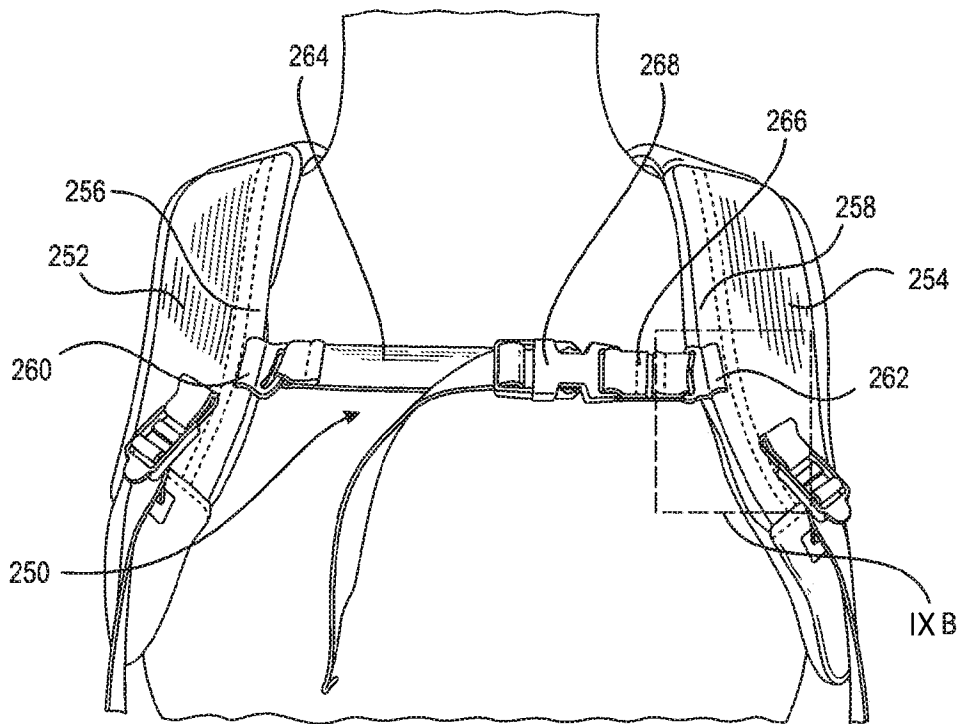


FIG. 9A

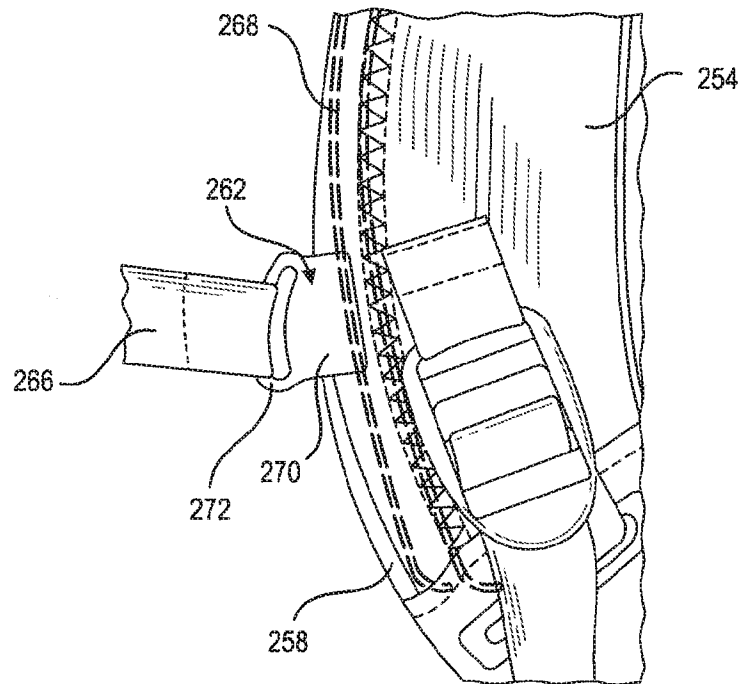


FIG. 9B

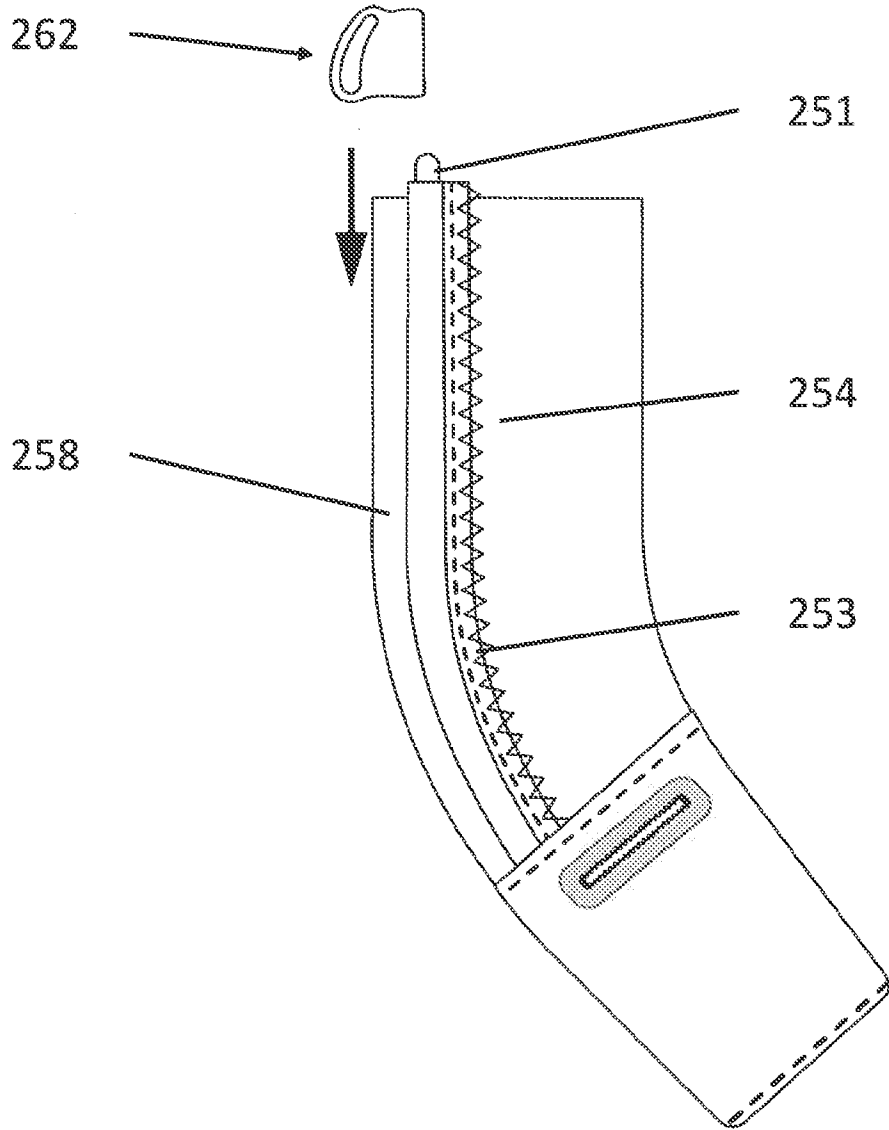


FIG. 9C

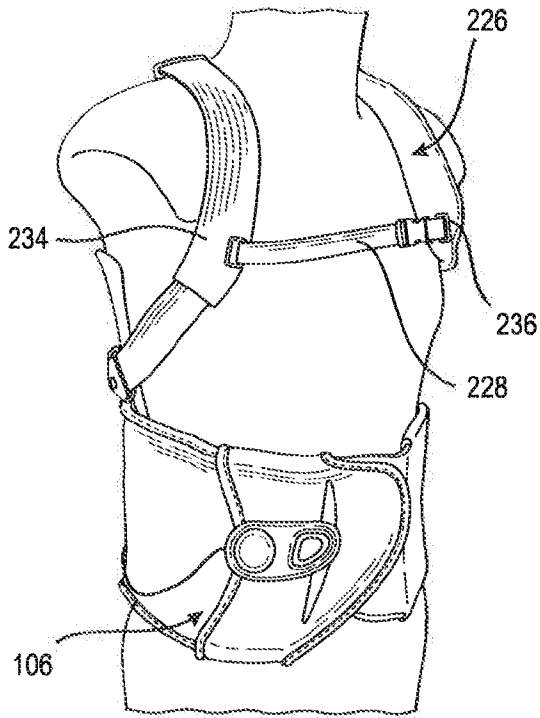


FIG. 10A

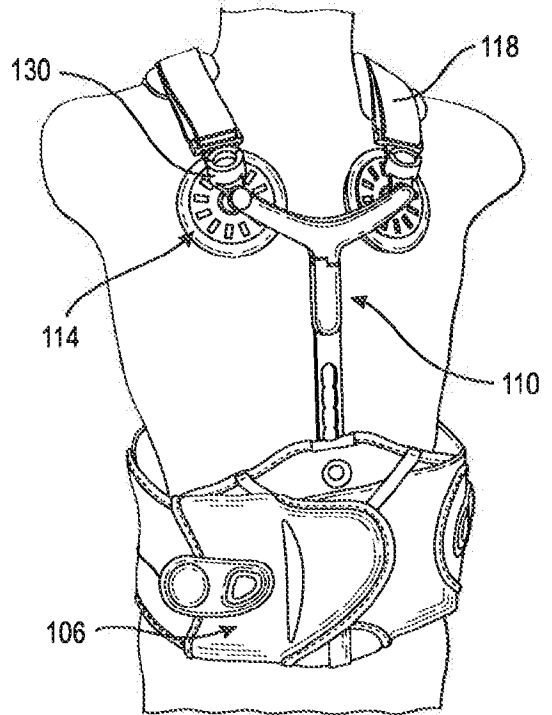


FIG. 10B

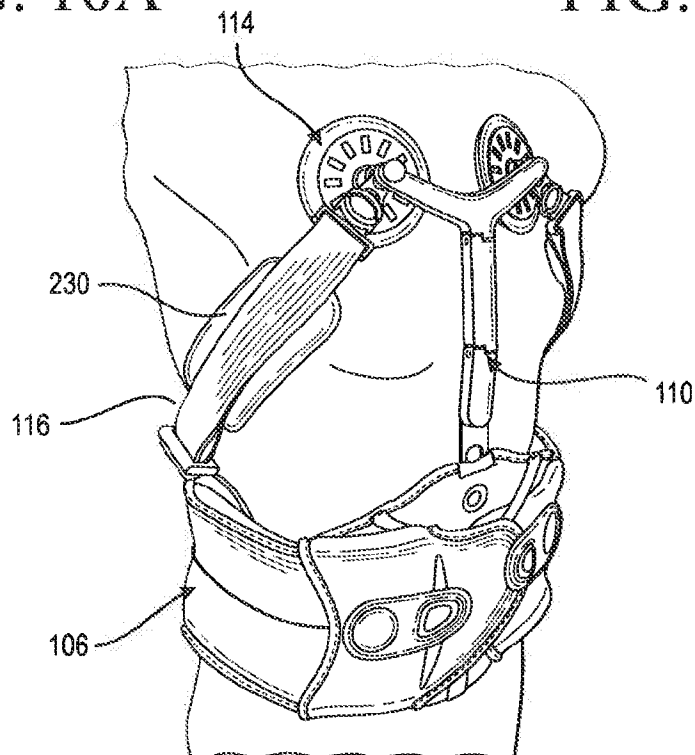


FIG. 10C

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/049969

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61F5/02 A61F5/03
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
A61F
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2011/105971 A1 (INGIMUNDARSON ARNI THOR [US] ET AL) 5 May 2011 (2011-05-05) figure 1, 2a, 8b,, 8d, 13, 9, paragraph [45,47,48,49,53,54,61,66, 70] -----	1,2,4-8, 10-12,18 3
A	US 2004/133138 A1 (MODGLIN MICHAEL D [US]) 8 July 2004 (2004-07-08) figure 9, 10, 11, paragraph [40, 42] -----	13-17
A	US 5 840 051 A (TOWSLEY HAROLD E [US]) 24 November 1998 (1998-11-24) figure 3, 5, column 4, line 1-40 ----- -/--	9

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 7 November 2018	Date of mailing of the international search report 16/11/2018
-------------------------------------------------------------------------------------	-------------------------------------------------------------------------

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

International application No
PCT/US2018/049969

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 103 29 454 A1 (DJ ORTHOPEDICS DEUTSCHLAND GMB [DE]) 27 January 2005 (2005-01-27) figure 3, 4, paragraph [23, 26]	13-17
A	----- US 2016/228279 A1 (MODGLIN MICHAEL D [US] ET AL) 11 August 2016 (2016-08-11) figure 5, 6, paragraph [23, 24] -----	13-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/049969

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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