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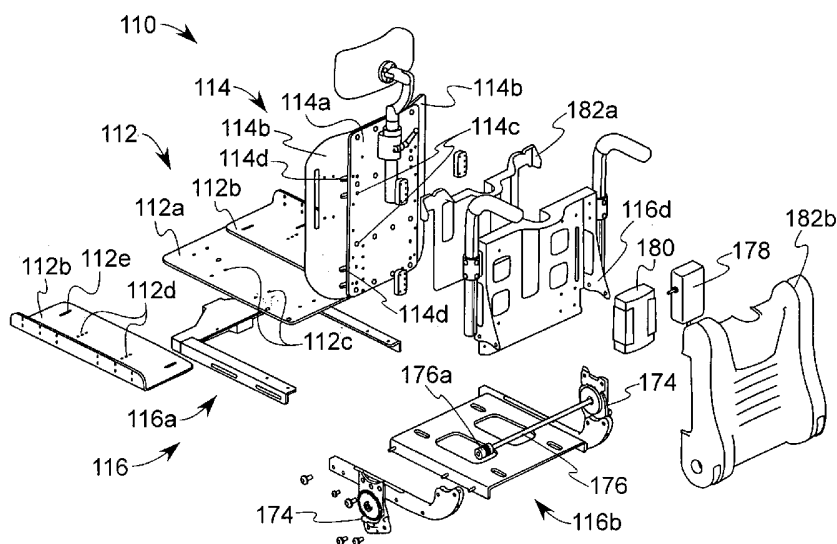
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(54) Title: SEAT ASSEMBLY FOR WHEELCHAIR



(57) Abstract: A seat assembly can be mounted on various wheelchair bases. The seat assembly enables the seat width and backrest width to be adjusted independently of each other. A backrest has a plurality of open slots, the number and orientation of which contributes to depth, width, and height adjustment of the backrest as well as angular adjustment of lateral supports to permit the backrest to conform to the anatomical curves of a user. A backrest foam assembly comprises multiple foam sections that are adapted to be positioned relative to each other and thereby vary the overall width of the assembly. A cover comprises multiple sections, each covering a foam section. A multi-position adjustable armrest assembly combines large-scale and small-scale adjustments, which provides a broad range of adjustment for the armrest and its position. A power recline mechanism with programmable shear reduction includes a dual rotary recline mechanism.



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SEAT ASSEMBLY FOR WHEELCHAIR

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 60/621,409, filed on October 22, 2004.

BACKGROUND OF INVENTION

[0002] This invention relates in general to personal mobility vehicles and more particularly, to accessories for personal mobility vehicles. Most particularly, this invention relates to seating systems for wheelchairs and like vehicles.

[0003] Conventional seat assemblies for wheelchairs have a seat and a backrest that are not independently adjustable. Such seat assemblies are not well suited for users having apple or pear shaped anatomies (i.e., a normal trunk and wide hips, usually due to redundant tissue). Such users would be better accommodated with a wide seat and narrow backrest. Conventional seat assemblies with a seat and a backrest that are not independently adjustable cannot accommodate such users.

[0004] Conventional seat assemblies also have lateral thoracic supports. However, most of these supports are limited to adjustment in a vertical plane or direction. That is to say, these supports do not accommodate changes in width over the vertical extent of the seat assembly due to asymmetry in the anatomy of the user. However, some conventional lateral supports have been designed as after market components, which are typically mounted externally. What is needed is a seat assembly with integral or integrated components that accommodate irregular shaped users.

[0005] Conventional backrests are covered with a foam and cover that are constructed specifically for the size of the backrest to which the foam and covers are supported. If a user needs a backrest that is a different size, the user would have to acquire another foam and cover to fit that backrest. A backrest is needed that allows a user to make width adjustments to in the foam and cover, especially in modular seating systems.

[0006] Convention seat assemblies employ armrest assemblies that have adjustment features, including height adjustment, width adjustment, depth adjustment and armrest pad angle adjustment. However, conventional armrest assemblies do not incorporate all these adjustment features. An armrest assembly is needed that integrates all these adjustment features so that the armrest can be position to provide maximum benefit to the user.

[0007] Conventional armrest assemblies also utilize incremental height adjustment mechanisms and incremental armrest pad adjustment mechanisms. Some armrest assemblies utilize a threaded fastener for infinite armrest pad angle adjustment but such an adjustment is very limited. An armrest is further needed that is not limited to make incremental adjustments.

[0008] Conventional seat assemblies further require at least two different mechanisms to address recline and shear compensation of the backrest. Also, when the seat assembly is fully reclined, there is an undesirable height differential between the seat and backrest for which there must be compensation. A seat assembly is needed that combines a recline operation and shear compensation in one mechanism. Such a mechanism should also eliminate seat to backrest height differential in full recline through the unique kinematics of the mechanism.

SUMMARY OF INVENTION

[0009] The present invention is directed towards a seat assembly for a wheelchair, wherein the seat assembly can be mounted on various wheelchair bases, and more particularly on power wheelchair bases. The seat assembly enables the seat width and backrest width to be adjusted independently of each other.

[0010] The present invention is also directed towards a backrest that has a plurality of open slots, the orientation of which contributes to depth, width, and height adjustment of the backrest as well as angular adjustment of lateral supports to permit the backrest to conform to the anatomical shape of a user.

[0011] The present invention is further directed towards a backrest foam assembly comprising foam having multiple sections that are adapted to be positioned or repositioned relative to each other and thereby vary the overall width of the foam. A cover also comprises multiple sections, each covering a foam section. The covered foam sections are adapted to be positioned or repositioned relative to each other to vary the overall width of the backrest foam assembly. The individual covers are adapted to interconnect to provide an aesthetic appearance for a complete backrest foam assembly.

[0012] Moreover, the present invention is directed towards a multi-position adjustable armrest assembly. The armrest combines large-scale and small-scale adjustments, which provides a broad range of adjustment for the armrest and its position. The armrest has the capability of infinitesimal angle adjustment of the armrest pad and infinitesimal height adjustment of the armrest pad within a given height range.

[0013] Additionally, the present invention is directed towards a power recline mechanism with programmable shear reduction. The mechanism includes a dual rotary mechanism.

[0014] Lastly, the present invention is further directed towards a roller clutch bearing (i.e., a one-way bearing) that is sleek and attractive. The roller clutch bearing is a tight aesthetically pleasing functional device. The roller clutch bearing is particularly well suited for use with a leg rest mechanism.

[0015] Various objects and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiment, when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0016] Fig. 1 is a rear perspective view of a seat assembly having a backrest according to one embodiment of the present invention.

[0017] Fig. 2 is a rear perspective view of a seat assembly having a single-pivot reclining backrest according to another embodiment of the present invention.

[0018] Fig. 3 is a rear perspective view of a seat assembly having a reclining backrest with shear reduction according to yet another embodiment of the present invention.

[0019] Fig. 4 is a rear perspective view of a seat assembly having a reclining backrest with programmable shear according to still another embodiment of the present invention.

[0020] Fig. 5 is a top plan view of a backrest according to the present invention with swing-away and non-swing-away lateral thoracic supports attached to the backrest.

[0021] Fig. 6 is a top plan view of the backrest shown in Fig. 5 with the swing lateral thoracic support swung away to the rear of the backrest.

[0022] Fig. 7 is a top plan view of the backrest shown in Fig. 5 with the lateral thoracic supports adjusted, for example, to conform to the natural anatomic shape (i.e., geometry) of a user.

[0023] Fig. 8 is a front elevation view of the backrest shown in Fig. 5.

[0024] Fig. 9 is a front elevation view of the backrest shown in Fig. 7.

[0025] Fig. 10 is an enlarged scale rear perspective view of the swing-away lateral thoracic support shown in Figs. 5-8.

[0026] Fig. 11 is an exploded reduced scale rear perspective view of the swing-away lateral thoracic support shown in Fig. 10.

[0027] Fig. 12 is an enlarged scale front perspective view of the non-swing-away lateral thoracic support shown in Figs. 5-8.

[0028] Fig. 13 is an exploded front perspective view of a backrest according to the present invention and a backrest foam assembly that is adjustable in width.

[0029] Fig. 14 is a top plan view of the backrest foam assembly shown in Fig. 13 in an initial position.

[0030] Fig. 15 is a top plan view of the backrest foam assembly shown in Fig. 13 wherein foam sections are outwardly displaced to increase the width of the backrest foam assembly.

[0031] Fig. 16 is a rear perspective view of an adjustable armrest assembly according to the present invention.

[0032] Fig. 17 is an exploded rear perspective view of the adjustable armrest assembly shown in Fig 16.

[0033] Fig. 18 is a partially exploded rear perspective view of the adjustable armrest assembly, depicting height adjustment capability using a rear mount.

[0034] Fig. 19 is a side elevational view of the adjustable armrest assembly in a lowered position.

[0035] Fig. 20 is a partial rear perspective view of the adjustable armrest assembly partially exploded to depict height adjustment steps and width adjustment capability using a mount rod.

[0036] Fig. 21 is a side elevational view of the adjustable armrest assembly in a raised position.

[0037] Fig. 22 is a side elevational view of the adjustable armrest assembly partially exploded to show an angle adjustment mechanism, and further depicting armrest pad depth adjustment capability.

[0038] Fig. 23 is a side elevational view of the adjustable armrest assembly in an upwardly angled position.

[0039] Fig. 24 is a side elevational view of the adjustable armrest assembly in a downwardly angled position.

[0040] Fig. 25 is an exploded front perspective view of a dual rotary power recline mechanism according to the present invention.

[0041] Fig. 26 is a side elevational view of the seat assembly shown in Fig. 26, wherein the backrest is non-reclined or at an angle 90 degrees relative to the seat.

[0042] Fig. 27 is a side elevational view of the seat assembly shown in Fig. 26, wherein the backrest is in a reclined position at an angle 110 degrees relative to the seat.

[0043] Fig. 28 is a side elevational view of the seat assembly shown in Fig. 26, wherein the backrest is in a reclined position at an angle 130 degrees relative to the seat.

[0044] Fig. 29 is a side elevational view of the seat assembly shown in Fig. 26, wherein the backrest is in a reclined position at an angle 150 degrees relative to the seat.

[0045] Fig. 30 is a side elevational view of the seat assembly shown in Fig. 26, wherein the backrest is in a reclined position at an angle 170 degrees relative to the seat.

[0046] Fig. 31 is a front perspective view of leg rest assemblies according to the present invention.

[0047] Fig. 32 is an enlarged exploded front perspective view of a roller clutch of a leg rest assembly shown in Fig. 32.

DETAILED DESCRIPTION

[0048] Referring now to the drawings, there are illustrated in Figs. 1-4 seat assemblies for wheelchairs. The seat assemblies 110 are in the form of modular seating platforms that can be mounted on various power wheelchair bases (not shown). The seat assemblies 110 may comprise a seat 112 that may be adjustable in width and a backrest 114 that may be adjustable in width independently of the width adjustment of the seat 112. In addition, the seat 112 may be adjustable in depth and the backrest 114 may be adjustable in height. As a consequence of these adjustments, the seat assemblies 110 can preferably accommodate a very wide range of users, including a fifth percentile female user (i.e., small user) and up to a ninety-fifth percentile male user (i.e., about 400 pound user). The seat assemblies 110 may further comprise a center frame 116 that is preferably continuous and that preferably has an architecture that supports both the seat 112 and the backrest 114. Consequently, the seat assemblies 110 may have an integrated aesthetic appearance.

[0049] In accordance with the present invention, the seat assemblies 110 may accommodate one or more electrical control devices, as well as peripheral devices (e.g., positioning devices, power and manual center-mount leg rests, power and manual lateral leg rests, reclining and non-reclining arm rests, etc.). Consequently, the seat assemblies 110 may have an architecture that accommodates one or more auxiliary devices, such as but not limited to a non-recline rotary actuator, a seat and backrest with an infinitely adjustable angle (shown in Fig. 1), a low-cost single-pivot power recliner (shown in Fig. 2), a dual-rotary recliner with shear reduction (shown in Fig. 3), and/or a dual-rotary recliner with programmable shear reduction (shown in Fig. 4).

[0050] Continuing with reference to the drawings, the seat assemblies 110 will be described in greater detail. For example, the seat 112 may comprise a central main

member 112a, such as the pan shown, and one or more lateral members, such as the opposing lateral members or wings 112b shown, that may be joined to the main member 112a in any suitable manner or fashion. As shown in the drawings, the main member 112a may be provided with one or more holes 112c. Similarly, the lateral members 112b may be provided with one or more holes and/or slots, such as a plurality of patterns of holes 112d and/or slots 112e. The holes 112d and/or slots 112e in the lateral members 112b may be adapted to selectively align with one or more desired holes 112c, or slots, in the main member 112a to permit one or more fasteners (not shown) to pass therethrough. The selective alignment may permit the width of the seat 112 to be adjusted as desired.

[0051] The main member 112a may be supported from below by a first seat portion 116a of the center frame 116. The first seat portion 116a may be slidably adjustable relative to a second seat portion 116b, 116c of the center frame 116. This may permit the seat 112 to be adjusted relative to the back 114 and thus may permit the depth of the seat 112 to be adjusted. The first seat portion 116a of the center frame 116 may be secured in a fixed position relative to the second seat portion 116b, 116c of the center frame 116 in any suitable manner, such as by one or more fasteners (not shown), including but not limited to threaded fasteners.

[0052] The backrest 114, like the seat 112, may comprise a central main member 114a and one or more lateral members, such as the opposing lateral members or wings 114b shown, that may be joined to the main member 114a in any suitable manner or fashion. As shown in the drawings, the main member 114a may be provided with a plurality of holes 114c, or slots. The lateral members 114b may be provided with a plurality of holes or slots 114d. The holes or slots 114d in the lateral members 114b may be adapted to selectively align with one or more desired holes or slots 114c in the main member 114a to permit one or more fasteners (not shown) to pass therethrough. The selective alignment may permit the width of the backrest 114 to be adjusted as desired.

[0053] The main member 114a may be supported from behind by a backrest portion 116d, 116e of the center frame 116. The main member 114a may be adjustable, for example, in a substantially vertical direction, relative to the backrest portion 116d, 116e. This may permit the backrest 114 to be adjusted in height. The main member 114a of the backrest 114 may be secured in a fixed position relative to the backrest portion 116d, 116e of the center frame 116 in any suitable manner, such as by one or more fasteners (not shown), including but not limited to threaded fasteners.

[0054] As shown in the drawings, the second seat portion 116b, 116c and the backrest portion 116d, 116e of the center frame 116 may be connected together by a rotary mechanism 174, such as, for example, a Taumel 2000 Power rotary mechanism, manufactured by KEIPER Seat Components L.L.C., in Clawson, MI, USA, which includes interacting stamped components that may connect the second seat portion 116b, 116c and the backrest portion 116d, 116e.

[0055] It is noted that the lateral members 112b, 114b may have a curved outer portion that may provide lateral support for the user of the seat assemblies. It should be appreciated that the invention is not intended to be limited to the particular features of the seat assemblies shown. For example, the main members 112a, 114a may be shaped differently than shown, or have different arrangements of holes or slots, or may be provided with grooves, tracks or other suitable positive or negative structure that permits adjustment of the lateral members 112b, 114b. Similarly, the lateral members 112b, 114b may be shaped differently than shown, or have different arrangements of holes or slots, or may be provided with grooves, tracks or other suitable positive or negative structure that selectively mates with corresponding structure of the main members 112a, 114a to permit adjustment of the lateral members 112b, 114b.

[0056] Now, with reference to Figs. 5-12, there are illustrated swing-away and non-swing-away lateral thoracic supports 118, 120 that may be adapted to be attached to the backrest 114. The thoracic supports 118, 120 may be removably or releasably

secured to one or more lateral members 114b, which may be adjustable relative to a central main member 114a of the backrest 114, as will be described below. The thoracic supports 118, 120 may be secured to the lateral members 114b in any suitable manner or fashion, including but not limited to the use of one or more threaded or other suitable fasteners 124.

[0057] One or more holes or slots 114e, as shown in Figs. 8 and 9, may be provided along outer portions of one or more of the lateral members 114a and may be adapted to receive one or more fasteners 124. The holes or slots 114e may permit adjustment (e.g., up and down along the lines 126 in Fig. 8) of the thoracic supports 118, 120, for example, in a substantially vertical direction, relative to the lateral members 114b. One or more backing plates 128, or washers or the like, may be provided and the fasteners 124 may pass through the backing plates 128 and further through the holes or slots 114e for securing the thoracic supports 118, 120 to the lateral members 114b. The backing plates 128 may improve the securement of the thoracic supports 118, 120 to the lateral members 114b. Although slots 114e are shown, the invention is not intended to be limited to slots but may be practiced with other positive or negative structure, such as but not limited to holes, grooves or other suitable structure.

[0058] The thoracic supports 118, 120 also may be adapted to be adjusted laterally (i.e., along the lines 130 in Fig. 5) relative to the lateral members 114b. This can be achieved in any suitable manner. For example, the thoracic supports 118, 120 can be provided with one or more lateral slots, such as the holes or slots 118a, 120a shown in Figs. 10-12. These slots 118a, 120a may permit the thoracic supports 118, 120 to be laterally adjusted simply by, for example, loosening the fasteners 124. In addition to being laterally adjustable, the slots 118a, 120a may permit angular adjustment (i.e., along the lines 132 in Fig. 9) of the thoracic supports 118, 120, as shown in Figs. 7 and 9.

[0059] The swing-away thoracic support 118, unlike the non-swing-away thoracic support 120, may have a hinge, generally indicated at 118b in Figs. 10 and 11. The

hinge 118b may permit the swing-away thoracic support 118 to be swung (i.e., along the line 134 in Fig. 6) rearward of the backrest 114 and out of the way of the user. This can be accomplished in any suitable manner or fashion. For example, a latch lever 118c may be displaced (i.e., along the line 136 in Fig. 10) from a locked position to unlock the hinge 118b and permit the swing-away thoracic support 118 to be swung, for example, rearward of the backrest 114. The latch lever 118c may be biased back into the locked position to lock the hinge 118b and prevent the swing-away thoracic support 118 from being swung. It should be appreciated that the latch lever 118c may be biased automatically, for example, by a spring 118d or other suitable element, into the locked position.

[0060] Now, further with reference to Figs. 13-15, there is illustrated a width-adjustable backrest foam assembly 138 according to the present invention. The backrest foam assembly 138 may comprise a central main foam member 138a and one or more lateral foam members, such as the opposing lateral foam members 138b shown, that may be displaceable relative to the main foam member 138a.

[0061] The foam members 138a, 138b are preferably made of polyurethane, although the invention may be practiced with any suitable material. The main foam member 138a may be provided with one or more tapered regions and/or flange portions, such as the opposing tapered regions 138c and the opposing flange portions 138d shown. The lateral members 138b may be provided with one or more tapered regions 138e that may mate with corresponding tapered regions 138c of the main foam lateral member 138a. The lateral members 138b may be displaceable to adjust the width of the backrest foam assembly 138. For example, from an initial position shown in Fig. 14, the lateral members 138b may be outwardly displaceable (i.e., along the lines 140 in Fig. 15) to increase the width of the backrest foam assembly 138.

[0062] The backrest foam assembly 138 may further comprise one or more covers, such as the covers 138f, 138g shown about the foam members 138a, 138b. The covers 138f, 138g are preferably made of a breathable material. The covers 138f, 138g may

be secured about the foam members 138a, 138b in any suitable manner. For example, the covers 138f, 138g may be made of material cut to fit the form of the foam members 138a, 138b and stitched to form enclosures. The enclosures may be closed via one or more fasteners (not shown), such as slideable fasteners (i.e., zippers) or other suitable fasteners.

[0063] The foam members 138a, 138b may be secured to the seat back and to each other in any suitable manner. For example, a first part 142 of a hook-and-loop type fastener may be attached to the flange portions 138d of the main foam member 138a and/or the front of the backrest 114. A second part 144 of the hook-and-loop type fastener may be attached to the back and/or tapered regions 138e of the lateral foam members 138b. The first part 142 may be matingly engageable with the second part to secure the foam members 138a, 138b to one another and to the backrest 114. The parts 142, 144 of the hook-and-loop type fastener may be disengaged to permit the lateral foam members 138b to be displaced relative to the main foam member 138a to adjust the width of the foam assembly 138.

[0064] It should be appreciated that, since the foam assembly 138 may comprise multiple foam sections that may be adapted to be positioned or repositioned relative to each other and thereby vary the overall width of the foam assembly 138, the foam assembly also may comprise multiple covers sections, each covering a foam section. The covered foam sections may be adapted to be positioned or repositioned relative to each other to vary the overall width of the foam assembly 138. The individual covers may be adapted to interconnect to provide an aesthetic appearance for a complete foam assembly 138. It should be appreciated that the foam assembly 138 is not limited to the assembly described and shown. For example, such an assembly may be similarly configured with foam sections that may be positioned or repositioned relative to each other to vary the overall height of the foam assembly. Similarly, multiple foam sections may be adapted to be positioned or repositioned relative to

each other to vary the overall width or depth of an assembly that is suitable for use as a seat cushion.

[0065] In Figs. 16 and 17, there is illustrated an adjustable armrest assembly 146 according to the present invention. The armrest assembly 146 may comprise an armrest base 148 and armrest pad 150 that may be supported by the base 148. The base 148 may be adapted to be secured to a backrest (not shown), for example, by a rear mount 152 and a mount rod 154. The mount rod 154 may be engageable with a fine adjustment mechanism 156 (shown in Fig. 17) that may be supported by the base 148. The armrest assembly 146 may permit several adjustments, including, for example, height adjustment, width adjustment, armrest pad angle adjustment, and/or armrest pad depth adjustment. All of the adjustments that can be made are preferably infinitesimal in nature.

[0066] As depicted in Fig. 18, the armrest assembly 146 may be adjustable in height via the rear mount 152. This can be accomplished, for example, by loosening the rear mount 152 (e.g., via fasteners 152a) and sliding the rear mount 152 (i.e., along the line 158 in Fig. 18), for example, in a substantially vertical direction relative to the backrest (not shown). The armrest assembly 146 also can be adjustable in height, for example, by removing the rear mount 152, inverting the rear mount 152, and then replacing the rear mount 152 on the backrest.

[0067] The armrest assembly 146 also may be adjustable in height via the mount rod 154. For example, the armrest assembly 146 is shown in a lowered position in Fig. 19. To raise the armrest assembly 146, the rear mount 152 may be comprised of a clamp 152b that may be adapted to be loosened (e.g., via threaded fastener 152c). Upon loosening the clamp 152b, the mount rod 154 can be slid out of the clamp 152b (i.e., in the direction of arrow 162 in Fig. 20). The mount rod 154 can then be rotated (i.e., along the line 164 in Fig. 20) until the armrest assembly 146 is at a desired height. Once at a desired height, the mount rod 154 can be slid back into the clamp

(i.e., in the direction of arrow 166 in Fig. 20) and the clamp can be tightened accordingly. In Fig. 21, the armrest assembly 146 is secured in a raised position.

[0068] The armrest assembly 146 is preferably incrementally adjustable in height by providing, for example, indexing flats 154a (shown in Fig. 20) on the mount rod 154. Infinite height adjustment (i.e., fine tuning) in the armrest assembly 146, within a given height range, may be accomplished by, for example, loosening the threaded fasteners 152a and moving the rear mount 152. The indexing flats 154a on the mount rod 154 and the movement of the rear mount 152 may permit the armrest pad 150 to be placed at substantially any angle, or at a wide range of angles, in an X-Y plane.

[0069] As depicted in Fig. 18, the armrest assembly 146 may be adjustable in width inward and outward (i.e., along the line 168 in Fig. 18), for example, at the interface of the rear mount 152 and the mount rod 154. Also, the armrest pad 150 can be, for example, rotated (i.e., along the line 170) to provide additional width adjustment.

[0070] The angle adjustment of the armrest assembly 146 may be best understood with reference to Figs. 22-24. Fig. 22, in particular, shows the fine adjustment mechanism 156, which may include a clamp 156a, which can be loosened, for example, by loosening a fastener, such as the threaded fastener 156b shown. Upon loosening the clamp 156a, the armrest base 148 can be rotated relative to the mount rod 154 within the clamp 156a. The base 148 can be rotated up to angle the base 148 upward, as shown, for example, in Fig. 23, and down to angle the base 148 downward, as shown, for example, in Fig. 24. With the armrest base 148 at the desired angle, the threaded fastener 156b can be tightened to tighten the clamp 156a about the mount rod 154 and thus secure the armrest base 148 in place. It should be understood that the mount rod 154 can include, for example, indexing flats (not shown), as shown on the opposite end of the mount rod 154. Also, a secondary clamp 156c may be provided, which can be tightened, for example, via a fastener, such as the threaded fastener 156d shown, to remove slop in the armrest assembly 146. Further, the angle of the base 148

can be fine tuned by, for example, a fastener, such as the threaded fastener 156e shown.

[0071] The armrest pad 150 also may have a depth adjustment capability. The adjustment of the depth of the armrest pad 150 can be achieved, for example, by loosening one or more fasteners, such as threaded fasteners (not shown), sliding the armrest pad 150 (i.e., left or right along the line 172 when viewing Fig. 22) to a desired depth, and then tightening the fasteners.

[0072] The adjustable armrest assembly 146 according to the invention combines four adjustment features without limiting those adjustments to pre-set increments. The new armrest assembly 146 has a capacity for positioning the armrest pad 150 where it is needed for maximum benefit to the user.

[0073] Referring back to Fig. 1, there is illustrated a seat assembly according to one embodiment of the invention. This seat assembly may include one or more single rotary mechanisms, such as the single rotary mechanism 174 on the opposing seat portions 116b of the center frame 116. A shaft 176 may be splined to mate with the rotary mechanisms 174. A tool-engaging portion 176a may be provided on at least one end of the shaft 176. The tool or knob (not shown) may engage the tool engaging portion 176a, and may be rotated to operate the rotary mechanism 174 to recline the backrest 114. Though the rotary mechanisms 174 are manually controlled, the seat assembly may include one or more actuators 178 and more or more controllers 180 for operating peripheral devices (not shown). This seat assembly may include shroud members 182a, 182b that provide a pleasing aesthetic appearance for the seat assembly.

[0074] In Fig. 2, there is illustrated a single-pivot reclining seat assembly, wherein a motor 184 is supported at each end of the shaft 176. The motors 184, in turn, are mounted between the rotary mechanisms 174 and the backrest portion 116d of the center frame 116. The motors 184 may be controlled to operate the rotary

mechanisms 174 to recline the backrest 114. The seat assembly may include one or more actuators 178 and controllers 180 for operating the rotary mechanisms 174 and other the peripheral devices (not shown), and may include shroud members 182a, 182b that provide a pleasing aesthetic appearance for the seat assembly.

[0075] In Fig. 3, there is illustrated a reclining seat assembly with shear reduction. The shear reduction is achieved through the use of one or more dual rotary recline mechanisms 186. In accordance with the present invention, recline mechanisms 186 are supported by opposing sides of the second seat portion 116c of the center frame 116. A shaft 176 may extend between the recline mechanisms 186. A motor 184 may be supported at each end of a shaft 176. The motors 184, in turn, may be mounted between the recline mechanisms 186 and the backrest portion 116e of the center frame 116. The motors 184 may be controlled to operate the recline mechanisms 186 to recline the backrest 114. The seat assembly may include one or more actuators 178 and controllers 180 for operating the recline mechanisms 186 and optionally other the peripheral devices (not shown), and may include shroud members 182c, 182d that provide a pleasing aesthetic appearance for the seat assembly.

[0076] It should be noted that a gas spring 190 may be connected between the second seat portion 116c of the center frame 116 and the backrest portion 116e of the center frame 116. The gas spring 190 may be slidably connected to a bracket 192, which in turn may be attached to the backrest portion 116e of the center frame 116. As the backrest 114 reclines, the gas spring 190 may slide along the bracket 192 until an upper end of the gas spring 190 engages a lip at the top of the bracket 192. When the upper end of the gas spring 190 engages the lip at the top of the bracket 192, which preferably occurs when the backrest 114 has reclined at an angle of about 130 degrees relative to the seat 112, the gas spring 190 begins to compress. This reduces the load on the motors 184.

[0077] In Fig. 4, there is illustrated a reclining seat assembly with programmable shear reduction. This seat assembly is similar to that shown in Fig. 3 and described

above in that the seat assembly includes one or more dual rotary recline mechanisms 186, corresponding motors 184 for controlling the operation of the recline mechanisms 186, and a gas spring 190 for reducing the load on the motors 184. Further in accordance with the present invention, this seat assembly may comprise a linear actuator 194 connected between the second seat portion 116c of the center frame 116 and the backrest portion 116e of the center frame 116, or is otherwise connected to the backrest. In addition, the seat assembly may comprise a pair of tracks 196 or other suitable structure upon which the backrest 114 can travel. The linear actuator 194 may be controlled by a controller 188 to move the backrest along the tracks 196 to substantially eliminate any shear that is not addressed by the dual rotary recline mechanisms 186 as the backrest is moved between tilted and non-tilted positions, or vice versa.

[0078] Now, with reference to Fig. 25, a dual rotary recline mechanisms 186 according to one embodiment of the invention will be described. The dual rotary power recline mechanism 186 may comprise two rotary recline mechanisms 186a, 186b engaging one another. The recline mechanisms 186a, 186b may be joined together in any suitable manner. In the illustrated embodiment of the invention, fasteners 198 join the recline mechanisms 186a, 186b together. The same fasteners 198 may attach a pulley plate 200 to the recline mechanisms 186a, 186b. Bearings 210 may be supported relative to the pulley plate 200, such as by being pressed into the pulley plate 200. Female splined shafts 212 may be passed through the bearings 210. Shaft locks 214 may be carried by the female splined shafts 212. Drive and idler pulleys 216, 218 may be locked to corresponding female splined shafts 212 by the shaft locks 214. A tensioner 220 may be pivotally supported relative to the pulley plate 200 and may carry tension bearings or pulleys 222. The drive and idler pulleys 216, 218 may carry a belt 224, and the tension pulleys 222 may keep tension on the belt 224 via one or more springs 226, which may be connected between the pulley plate 200 and the tensioner 220. A motor 184 may be connected to the dual rotary power recline mechanism 186, opposite the pulley plate 200, via, for example, a motor

mount 228. A male splined drive shaft 230 may engage the female splined shaft 212 supporting the drive pulley 216. A male splined idler shaft 232 may engage the female splined shaft 212 supporting the idler pulley 218. The male splined drive shaft 230 may have a spud 234 on its end that engages a flex coupling 236 on the shaft 176, which may extend between the dual rotary recline mechanisms 186 on opposing sides of the seat portion of the center frame (not shown).

[0079] In operation, the motors 184 may drive the male splined drive shafts 230, which may drive a first one of the two rotary recline mechanisms 186a, while driving the drive pulley 216. The drive pulley, in turn, may drive the idler pulley 218, which may drive the male splined idler shaft 234, which in turn may drive a second one of the two rotary recline mechanisms 186b. It should be noted that the belt 224 may cause the idler pulley 218 to be driven in a direction opposite that of the drive pulley 216. This may cause the second rotary recline mechanism 186b to be driven in a direction opposite that of the first rotary recline mechanism 186a. It should also be noted that the idler pulley 218 may be larger than the drive pulley 216. In the illustrated embodiment, the idler pulley 218 is twice the size of the drive pulley 216, thus producing a 2:1 ration between the idler pulley 218 and the drive pulley 216. This ratio may vary depending on the desire operation profile for the reclining seat assembly. This ratio may affect the rate that the backrest (not shown) reclines. It should be appreciated that the belt 224 can be omitted and both recline mechanisms 186a, 186b may be driven independently by separate motor (not shown).

[0080] The operation of the dual rotary recline mechanisms 186 is illustrated in Figs. 26-30. As the drive pulley 216 is driven clock wise, the idler pulley 218 is driven counter-clockwise. Due to the 2:1 ratio between the pulleys 216, 218, the idler pulley 218 is driven twice as fast as the drive pulley 216. Consequently, the motors 184 can operate at a reduced rate to achieve a desired rate of recline.

[0081] It should be appreciated that the dual rotary recline mechanism shown in Fig. 25 and described above is only provided for illustrative purposes and that the

invention can be practiced with configurations other than that shown and described. The operation of the dual rotary recline mechanisms 186 is illustrated in Figs. 26-30. In a general context, the invention may be practiced via any configuration suitable for producing a rotary movement in a first or clock wise direction coupled which a configuration suitable for producing a rotary movement in an opposite, or second or counter-clock wise, direction. That is to say, a first rotary configuration may support for orbital movement a second rotary configuration that rotates in a direction opposite its orbital travel. In essence, the invention may be broadly practiced with a rotary configuration that moves or travels along a curved or arcuate path and that rotates, preferably simultaneously, in a direction opposite its curved or arcuate travel.

[0082] Finally, with reference to Fig. 31, there is illustrated a pair of leg rest assemblies 240 according to the present invention. The leg rest assemblies 240 may be adapted to be attached to the center frame (not shown) of the seat assembly. The leg rest assemblies 240 may include leg rests 240a that are free to rotate up (i.e., along the line 242 in Fig. 31).

[0083] As shown in Fig. 32, the leg rest assemblies 240 may include a roller-clutch 244 that rolls free in one direction, locking on a ring shaft 246 of a fixed diameter. A housing 248 may be attached to the roller-clutch 244 via a spring-loaded ring 250. The ring 250 may be adapted to slide axially in-and-out of engagement of the roller-clutch 244. While engaged, the roller-clutch 244 can only rotate in a first direction. Pushing on a push button 252 (and holding the button 252 in place) may slide the ring 250 axially out of engagement with the roller-clutch 244. This may allow the housing 248 to rotate back down. When the button 252 is released, the ring 250 may be pushed back into engagement with the roller-clutch 244, which will again only allow rotation of the roller-clutch 244 in the first direction.

[0084] The roller-clutch 244 is preferably a unidirectional mechanism that functions to replace conventional large cam locking assemblies. The spring-loaded ring 250 is a

release mechanism that allows push button engagement and disengagement of the roller-clutch 244.

[0085] The roller-clutch 244 is not intended to be limited in its application to the leg rest assembly, as described above, but instead has other applications, such as but not limited to a swing-away latch, a backrest, a flip-back armrest, and "grade aids".

[0086] The principle and mode of operation of this invention have been explained and illustrated in its preferred embodiment. However, it must be understood that this invention may be practiced otherwise than as specifically explained and illustrated without departing from its spirit or scope.

CLAIMS

What is claimed is:

1. A seat assembly for a wheelchair, wherein the seat assembly can be mounted on various wheelchair bases.
2. A seat assembly for a wheelchair, wherein the seat assembly has a seat and a backrest, the seat having a width that is adjustable and the backrest having a width that can be adjustable independently of the seat.
3. A backrest for a wheelchair, wherein backrest is adjustable to conform to the anatomical curves of a user.
4. The backrest of claim 3, wherein the backrest is adjustable in width, height, and depth.
5. The backrest of claim 4, further comprising a plurality of open slots, the number and orientation of which contributes to the depth, width, and height adjustment of the backrest as well as angular adjustment of lateral supports.
6. A backrest foam assembly comprising foam comprising multiple sections that are adapted to be positioned relative to each other and thereby vary the overall width of the foam.
7. The backrest foam assembly of claim 6, further comprising cover covering each of the foam sections.
8. A multi-position adjustable armrest assembly that combines large-scale and small-scale adjustments, which provides a broad range of adjustment for the armrest and its position.
9. A power recline mechanism with programmable shear reduction.

10. The power recline mechanism of claim 1 comprising a dual rotary recline mechanism.

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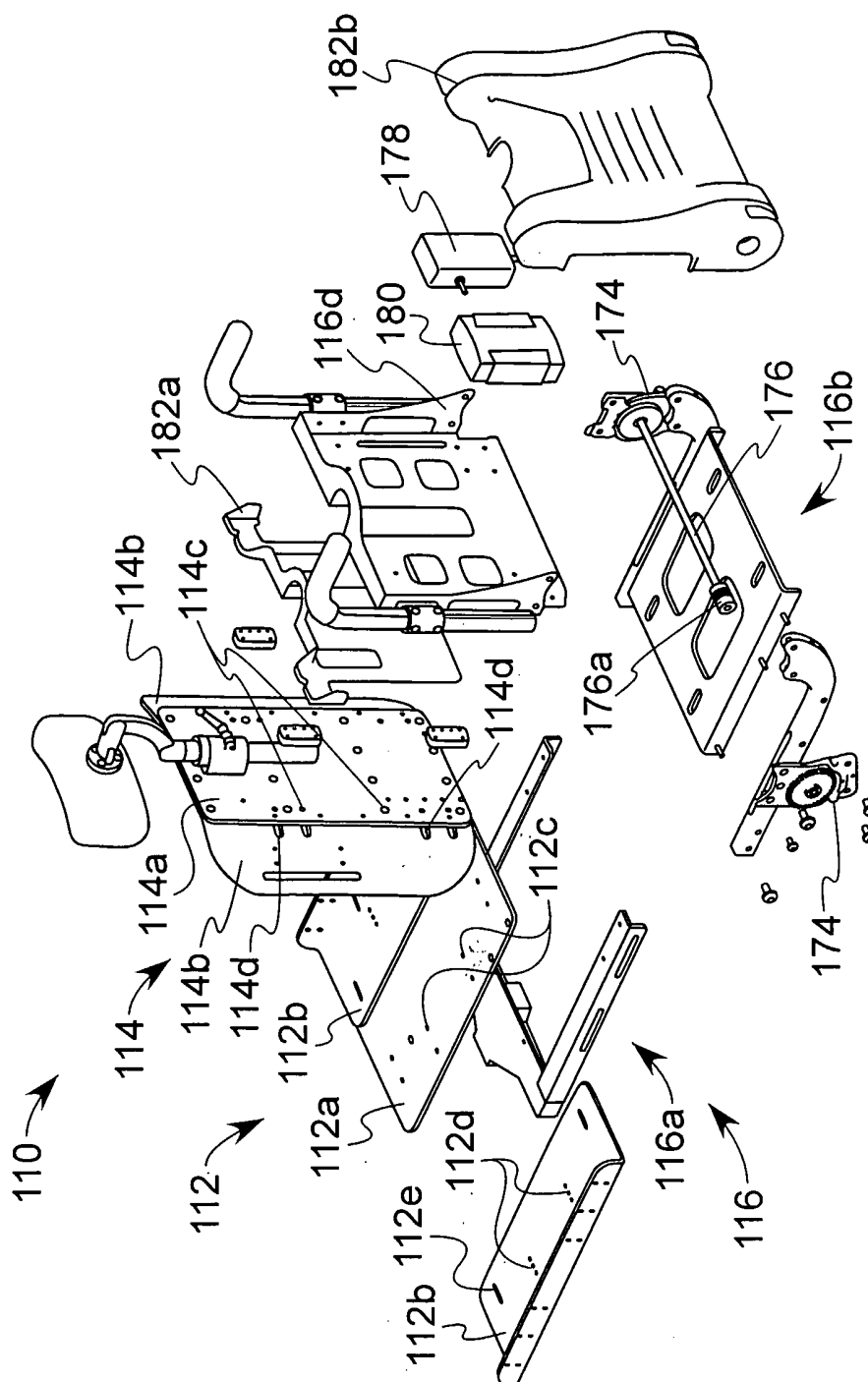


FIG. 1

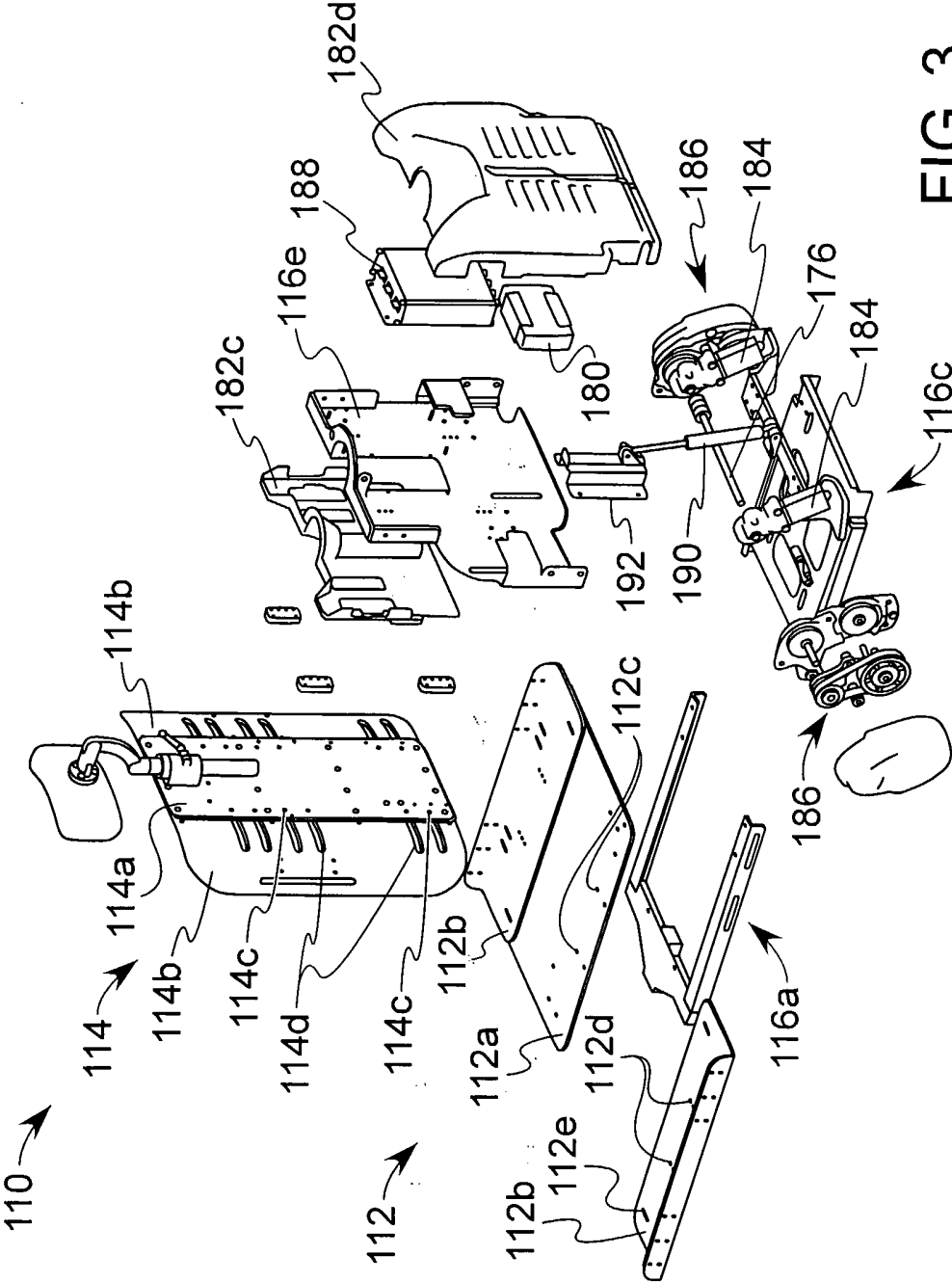


FIG. 3

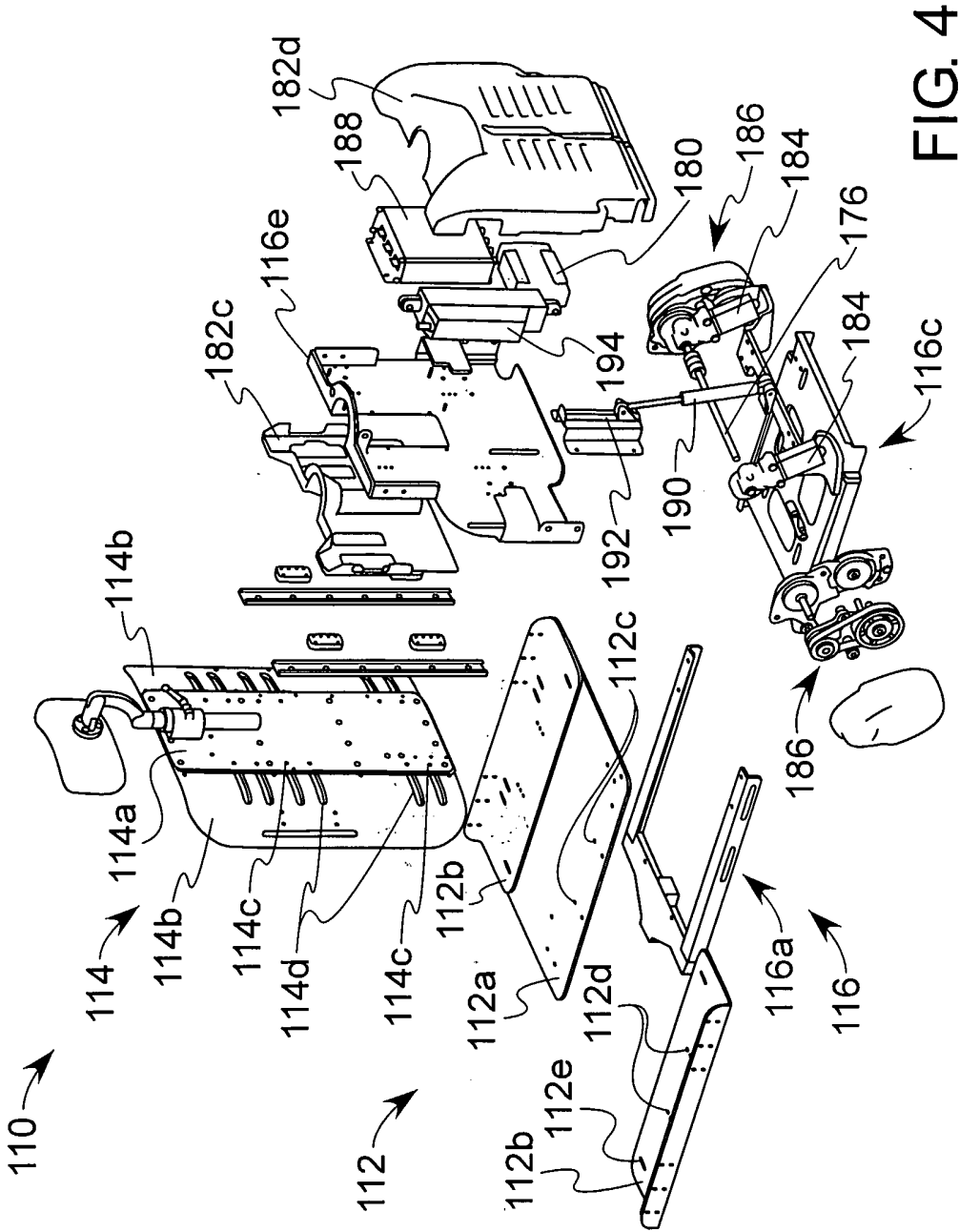
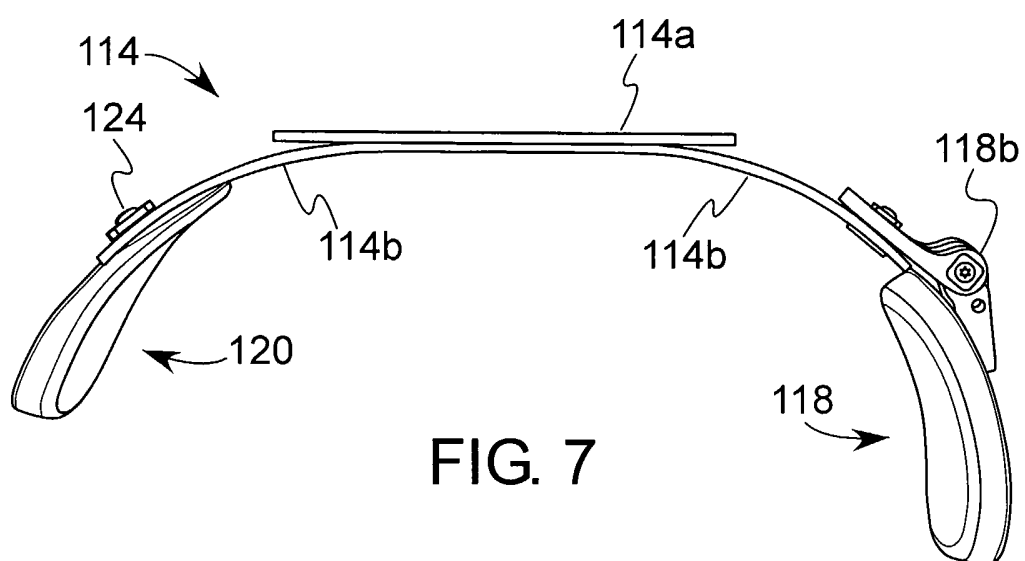
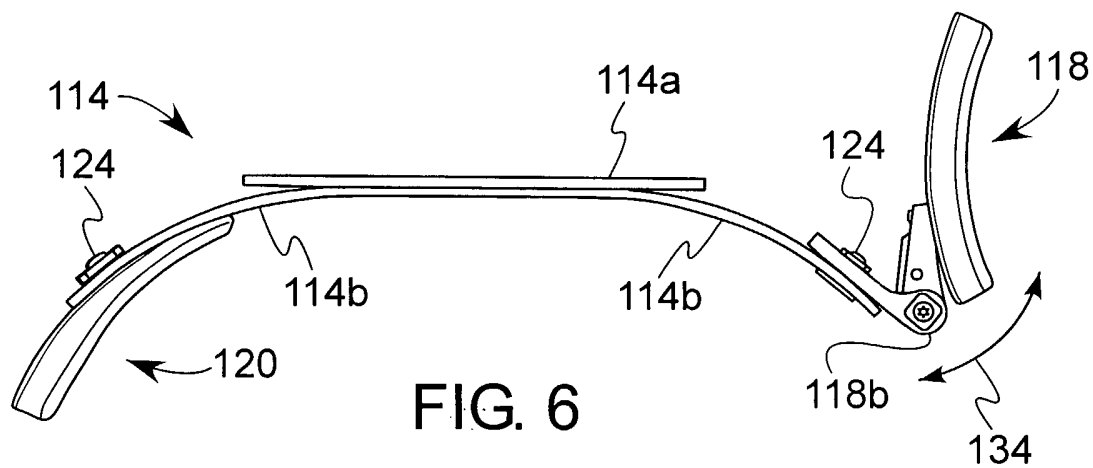
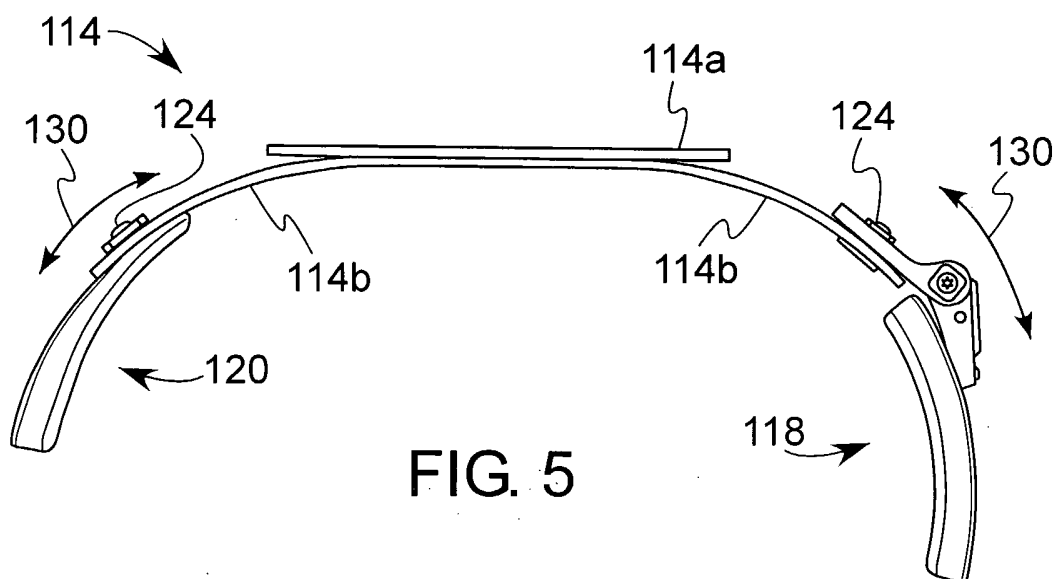


FIG. 4

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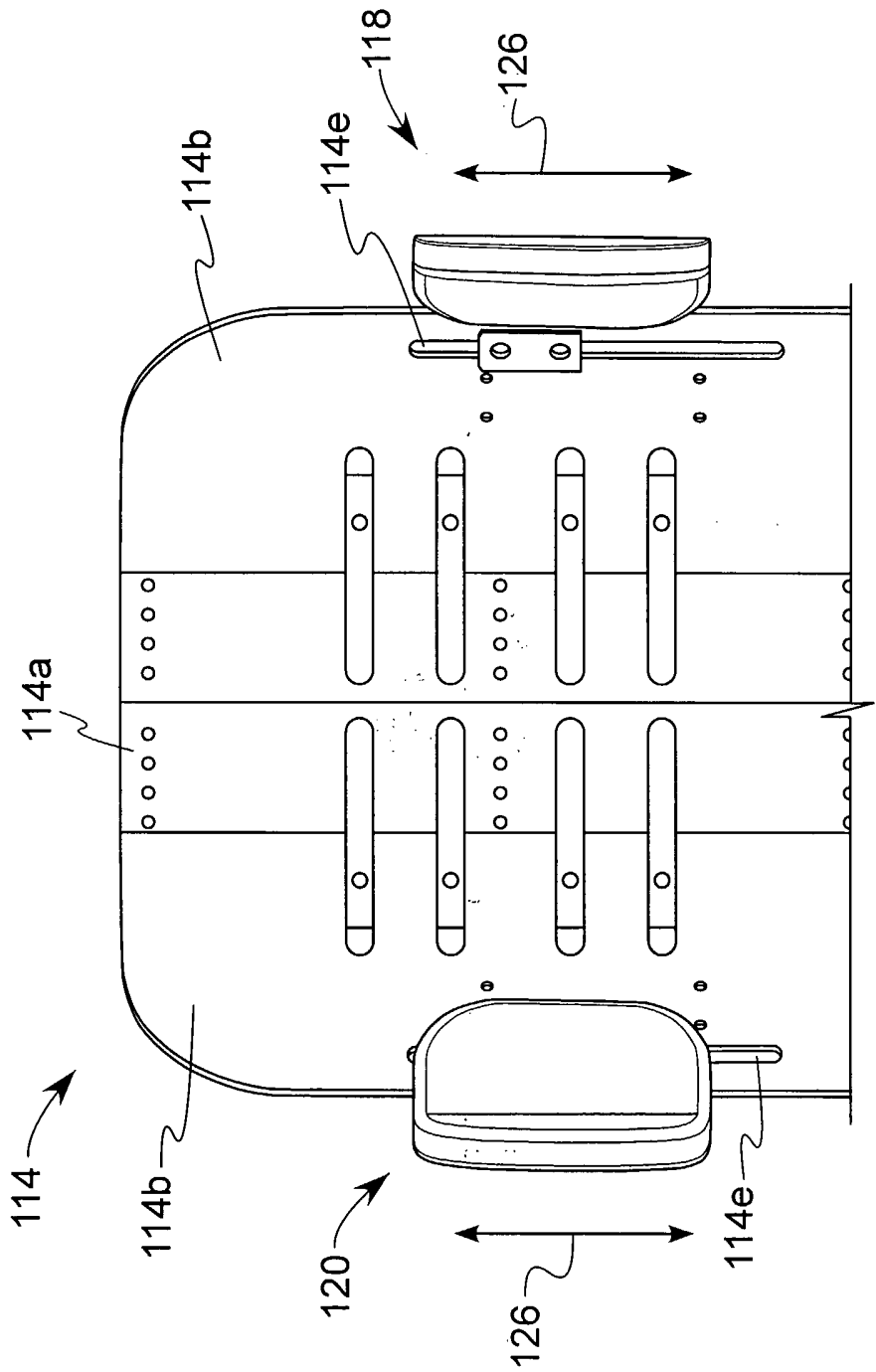


FIG. 8

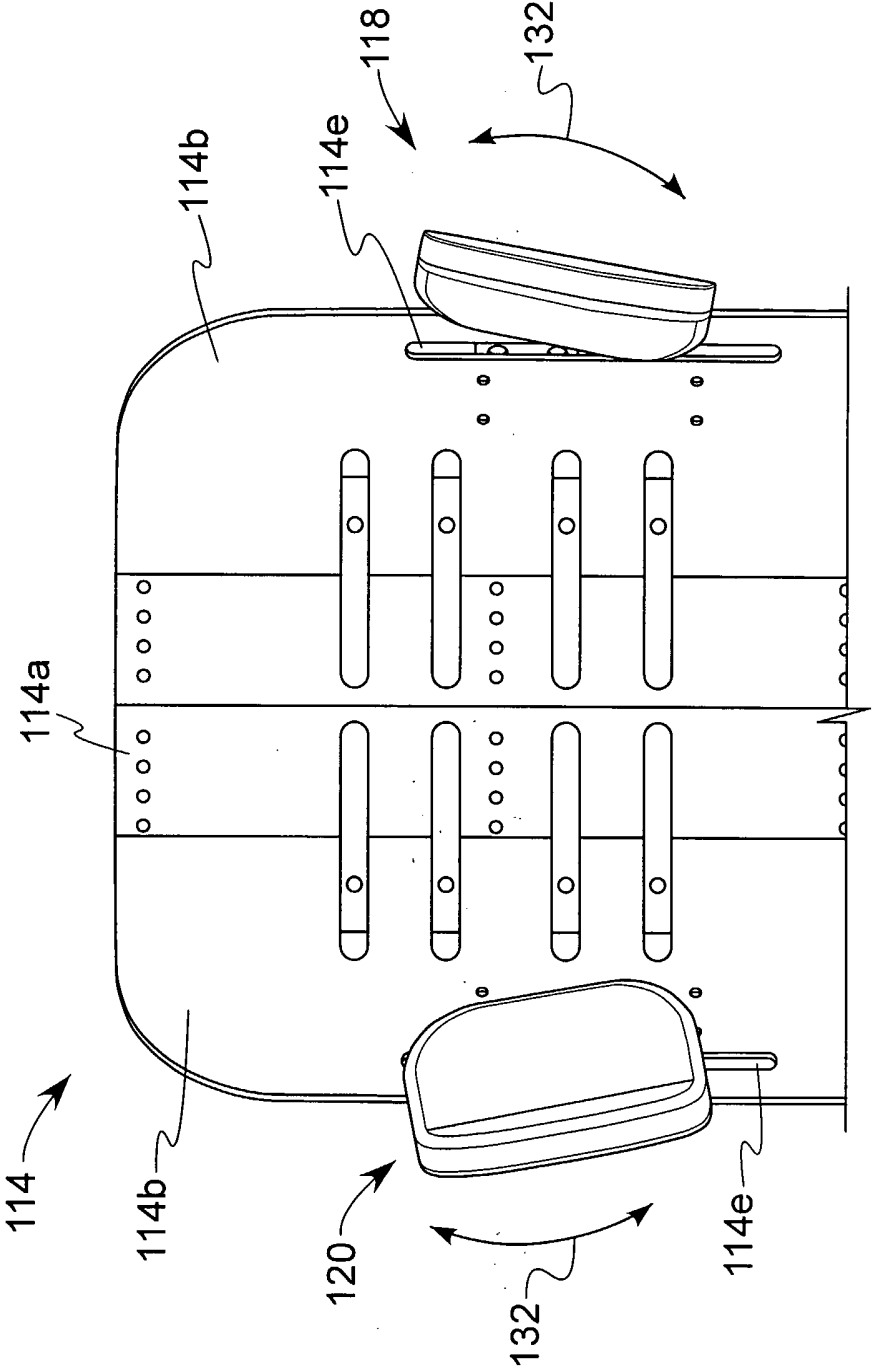


FIG. 9

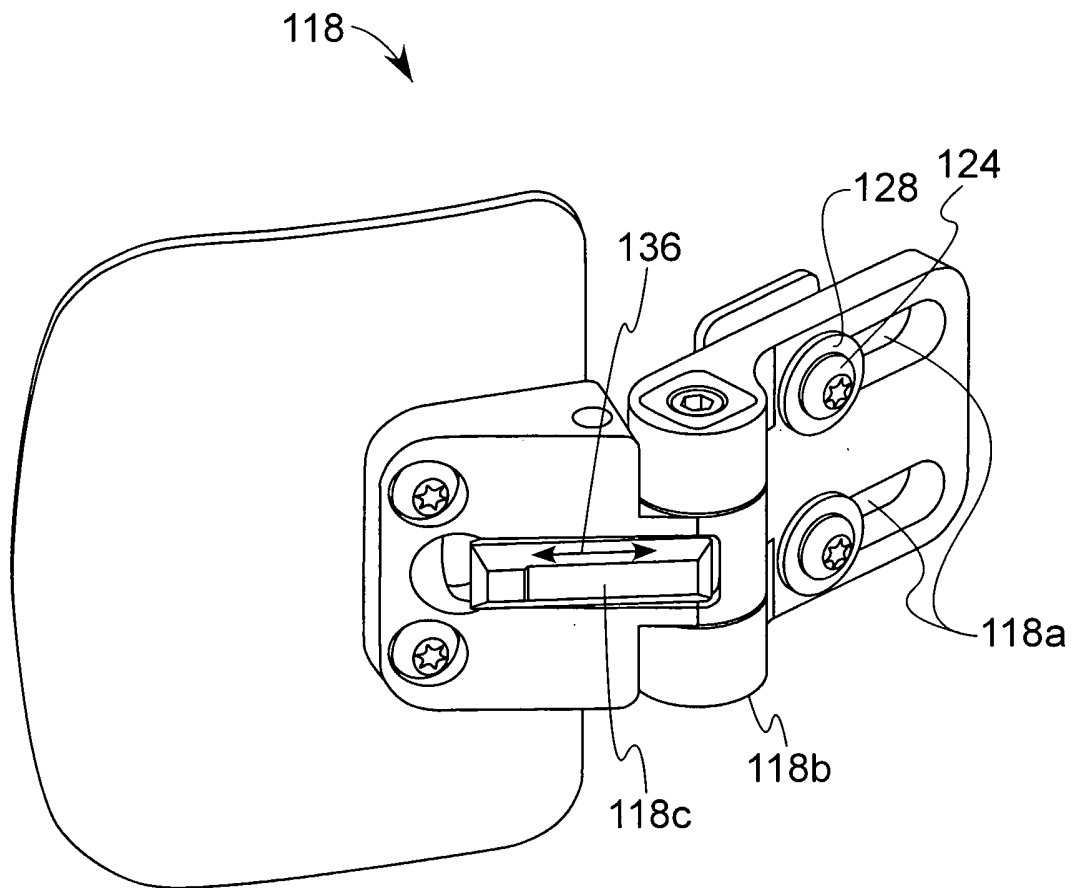


FIG. 10

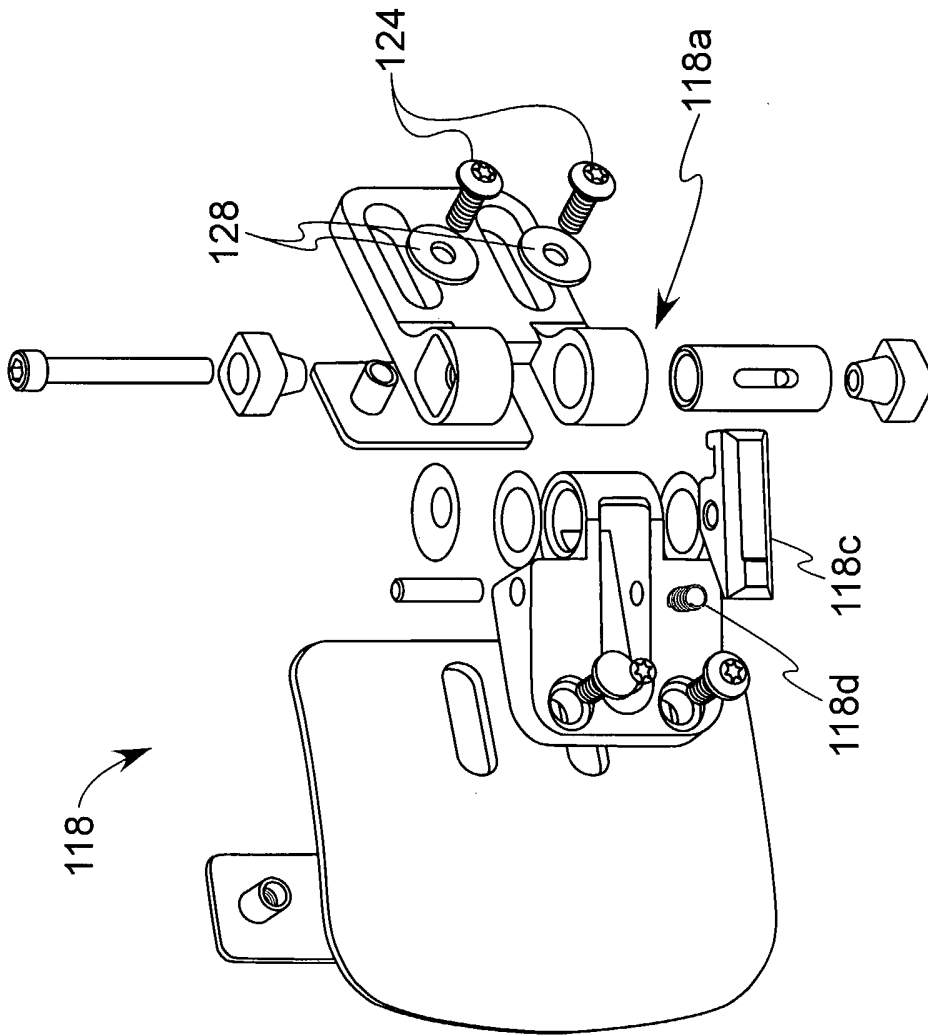


FIG. 11

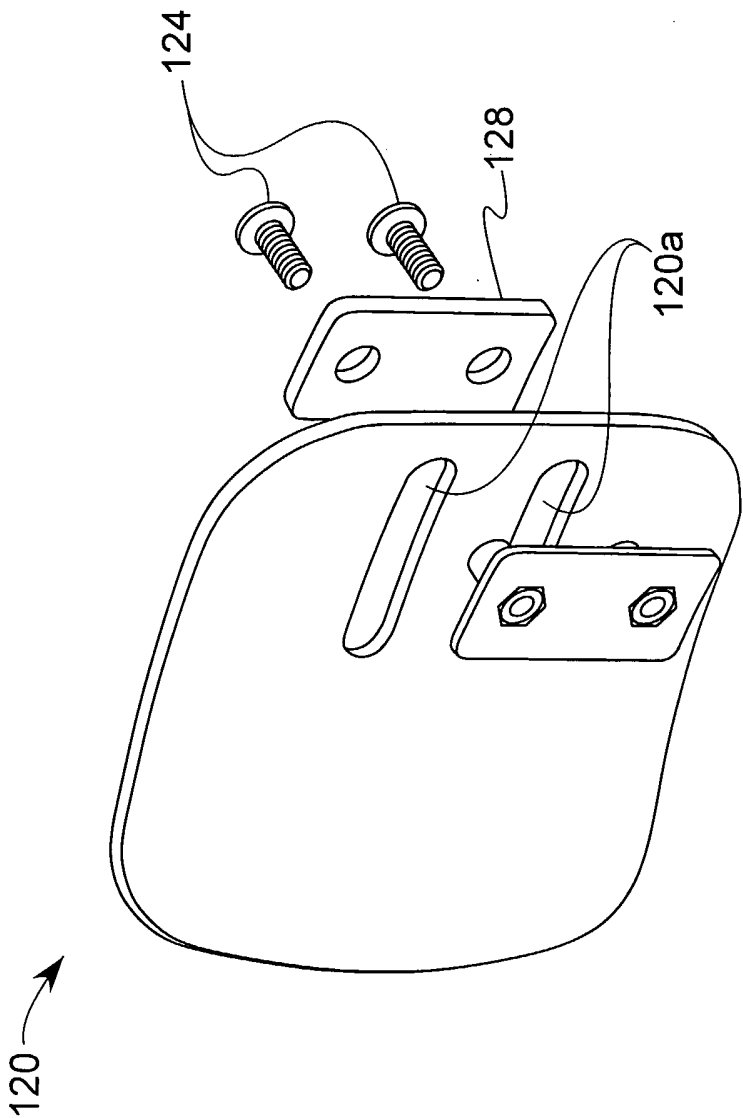
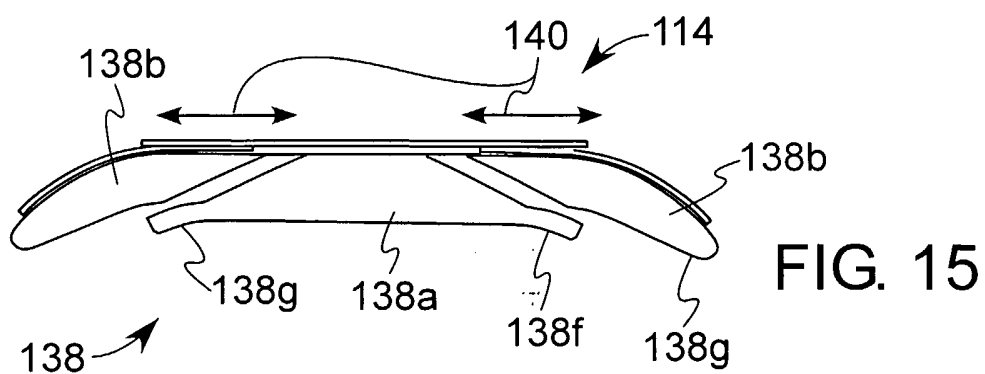
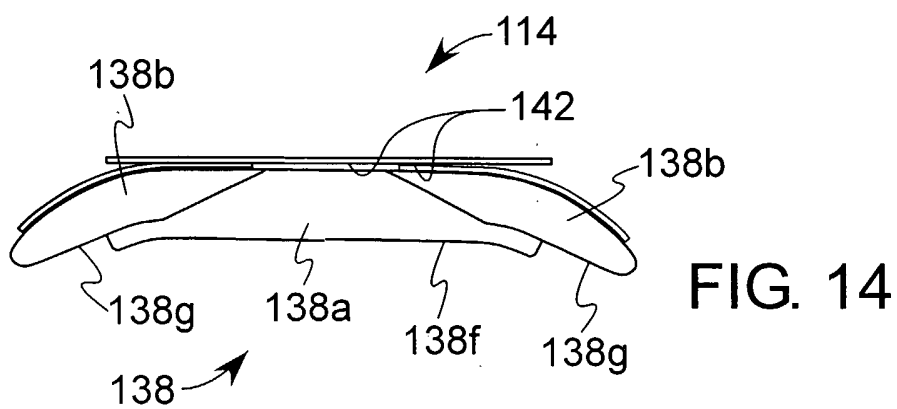
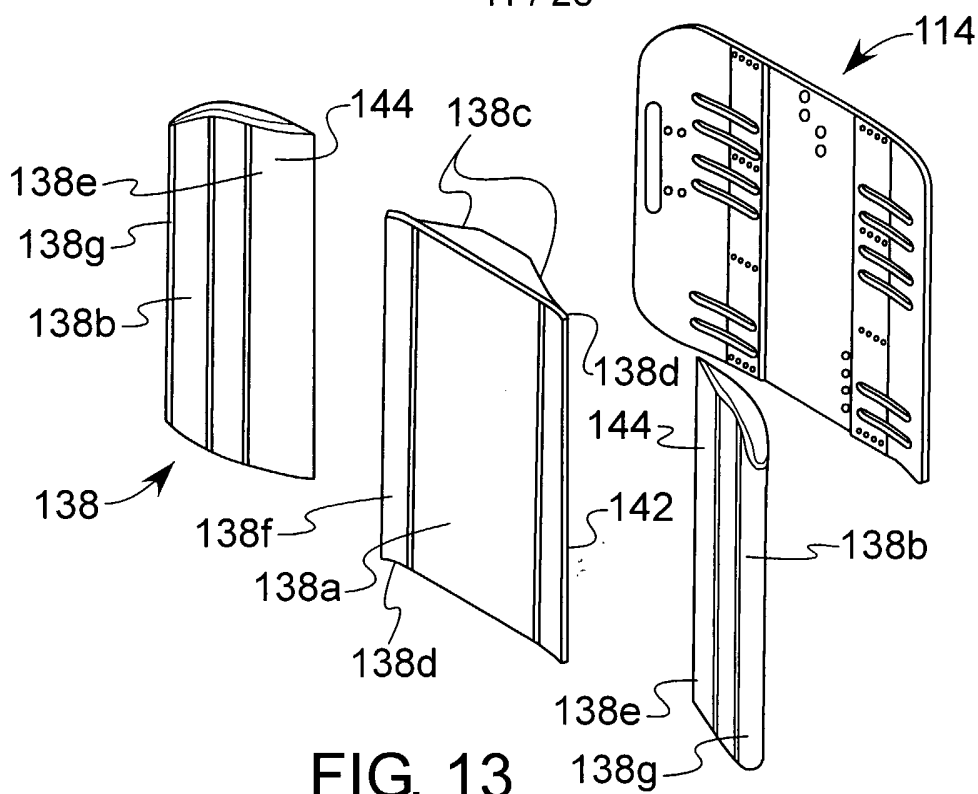


FIG. 12

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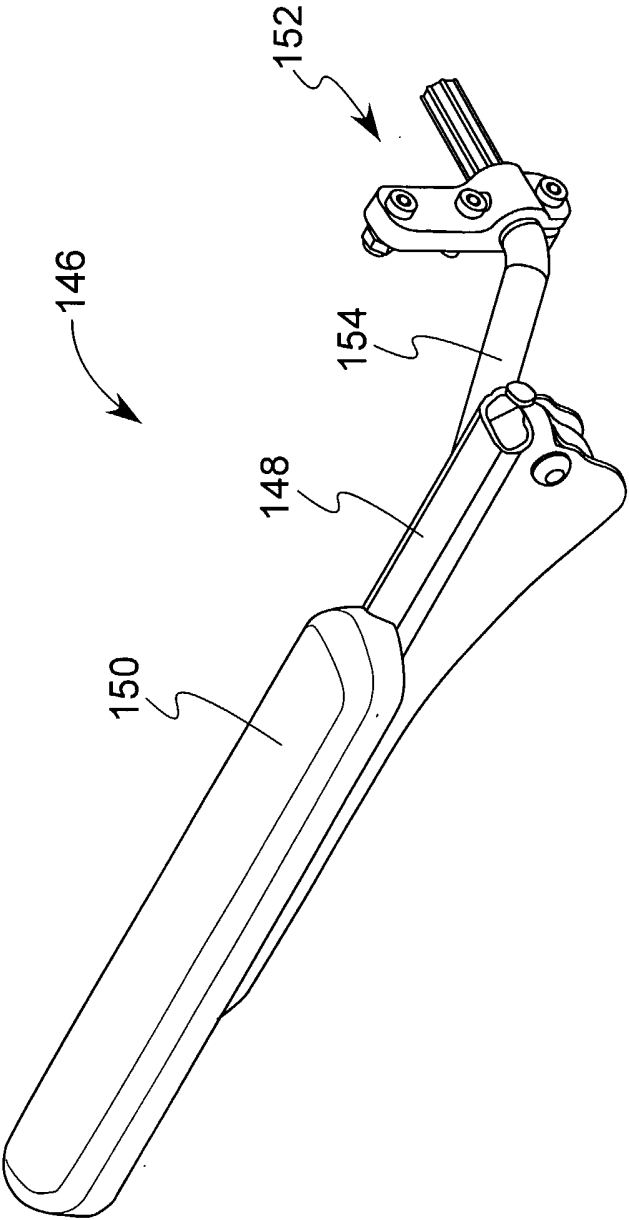
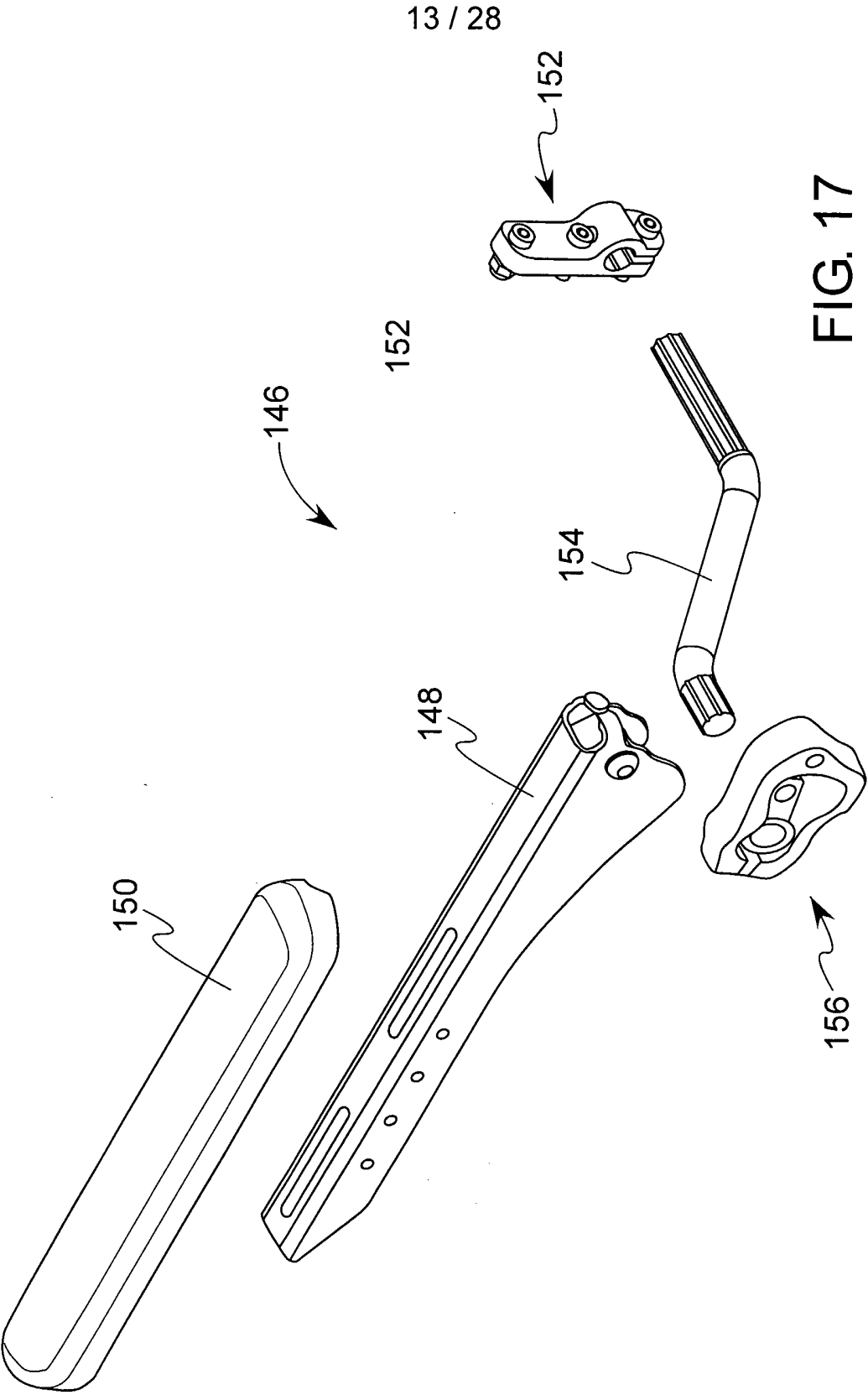


FIG. 16



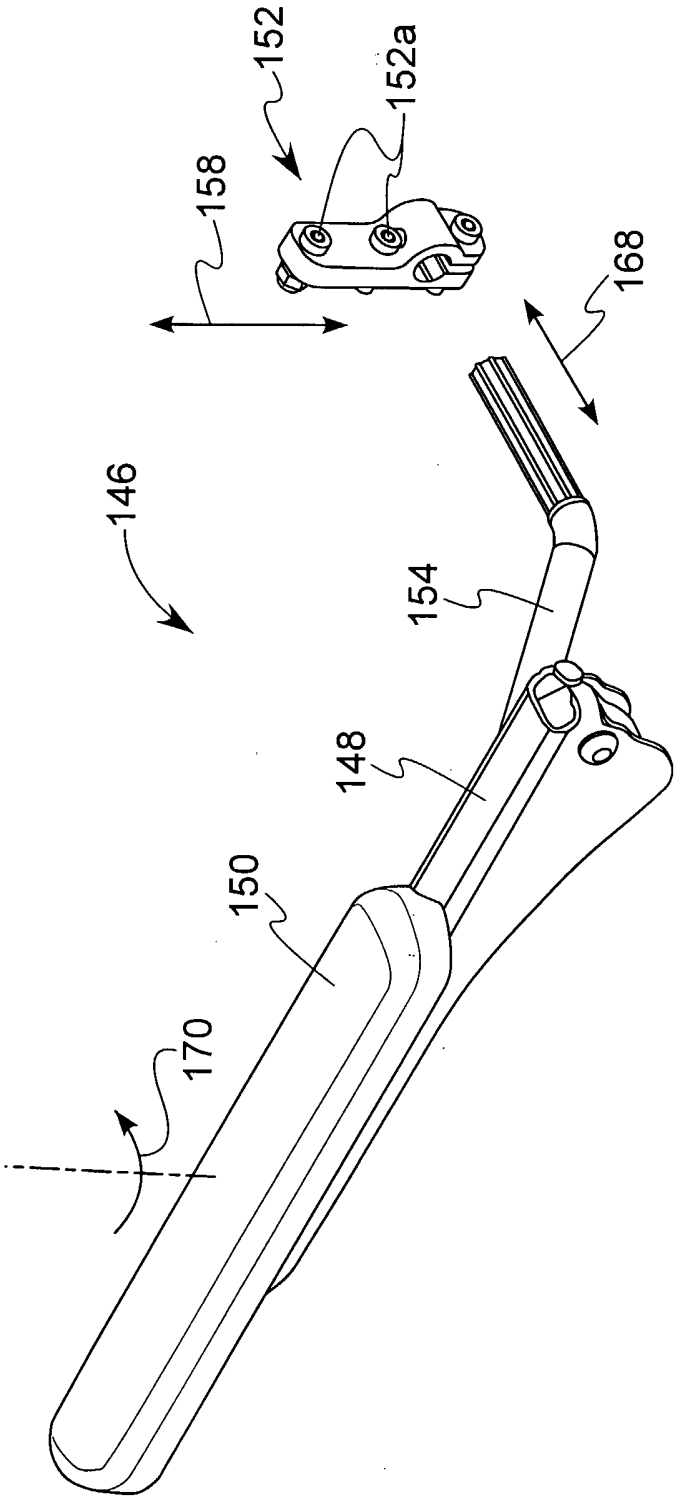


FIG. 18

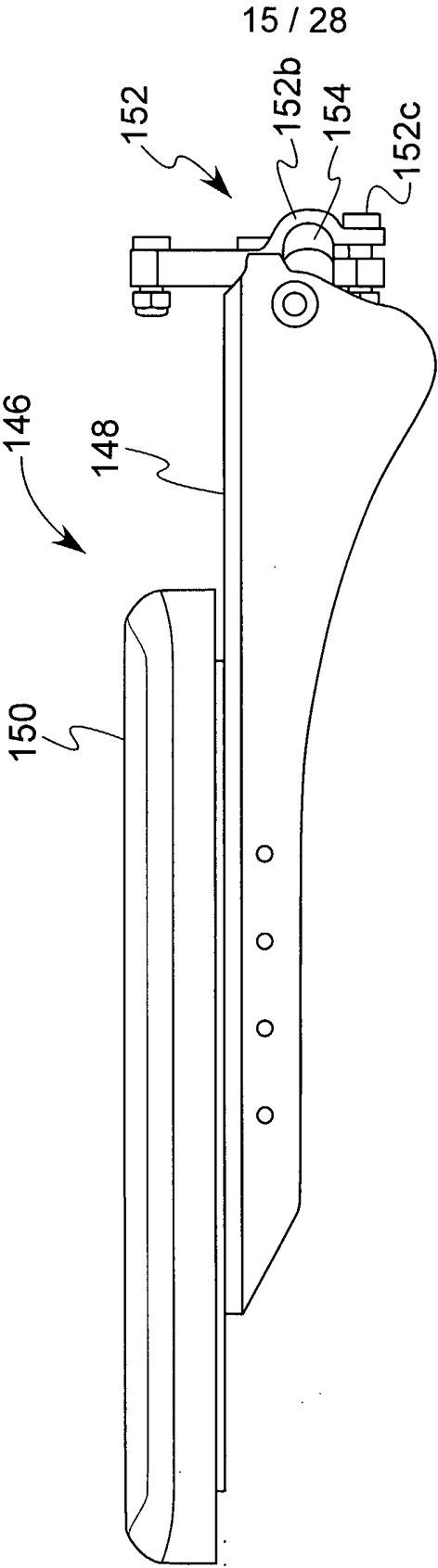


FIG. 19

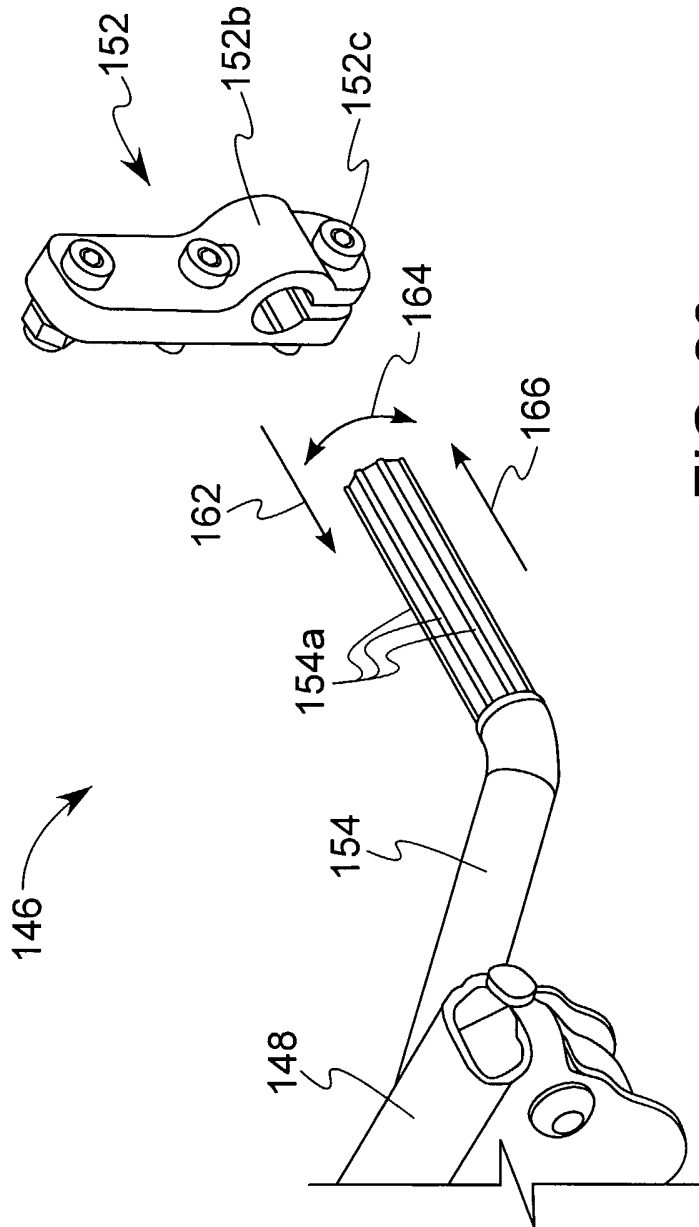


FIG. 20

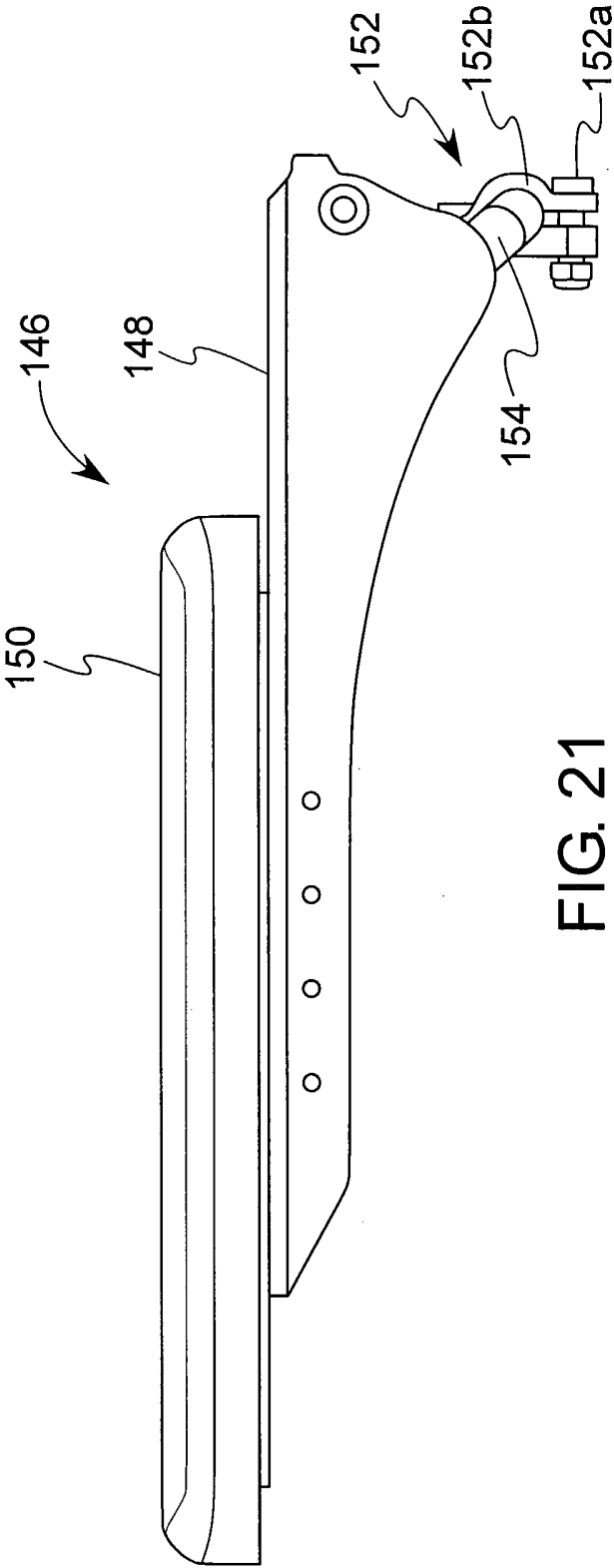


FIG. 21

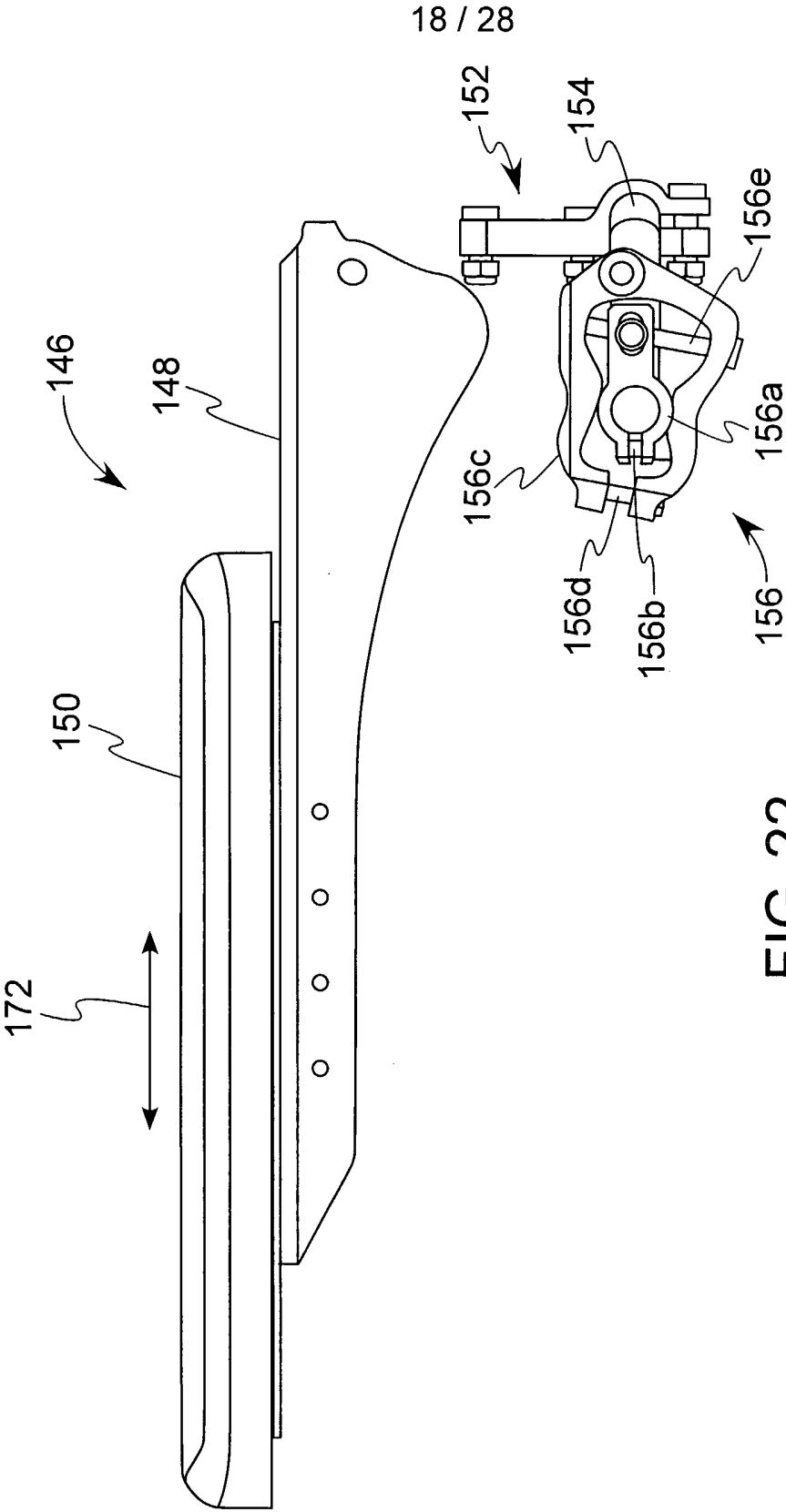


FIG. 22

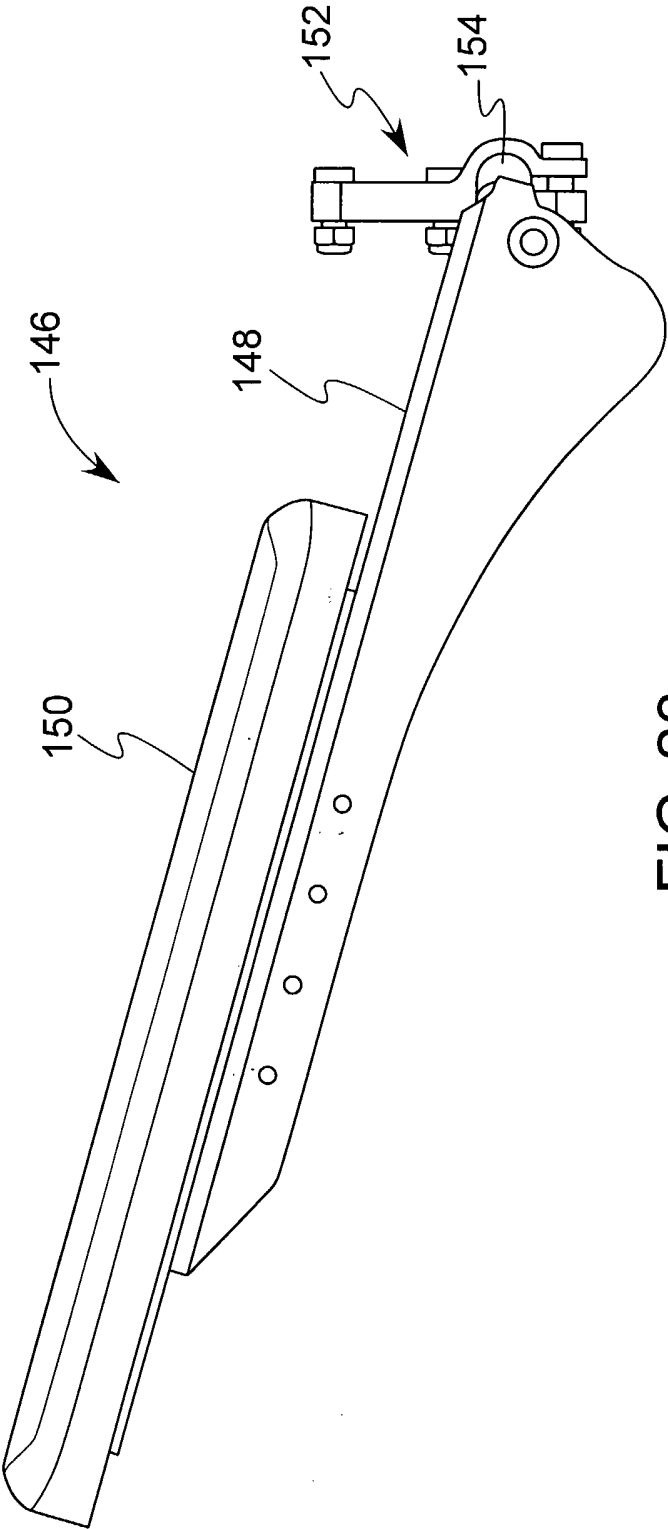


FIG. 23

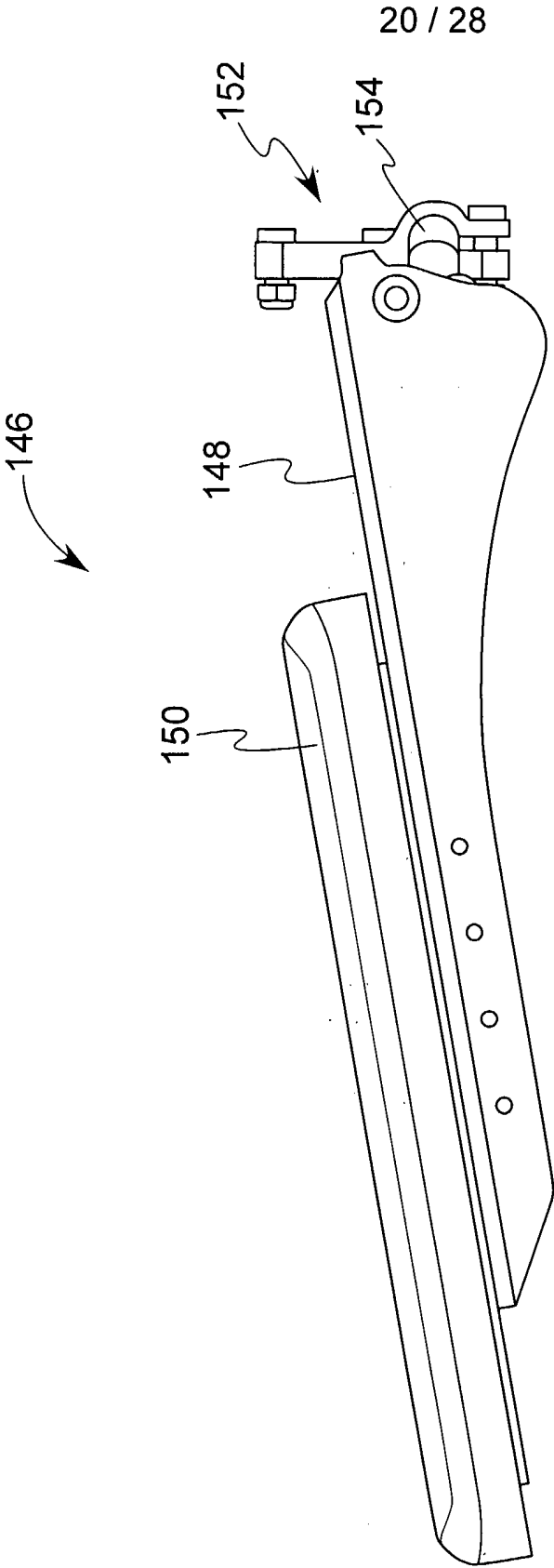


FIG. 24

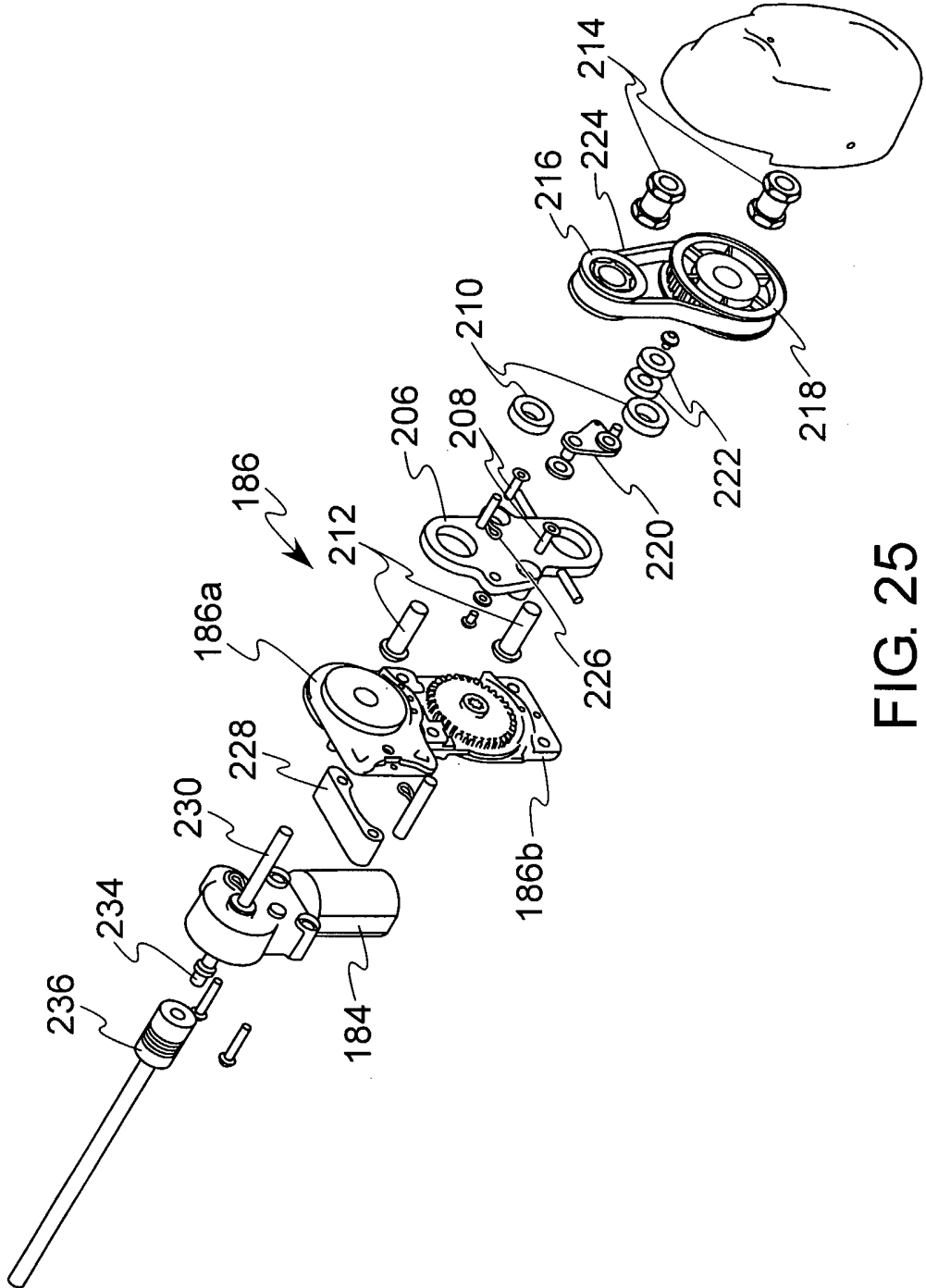
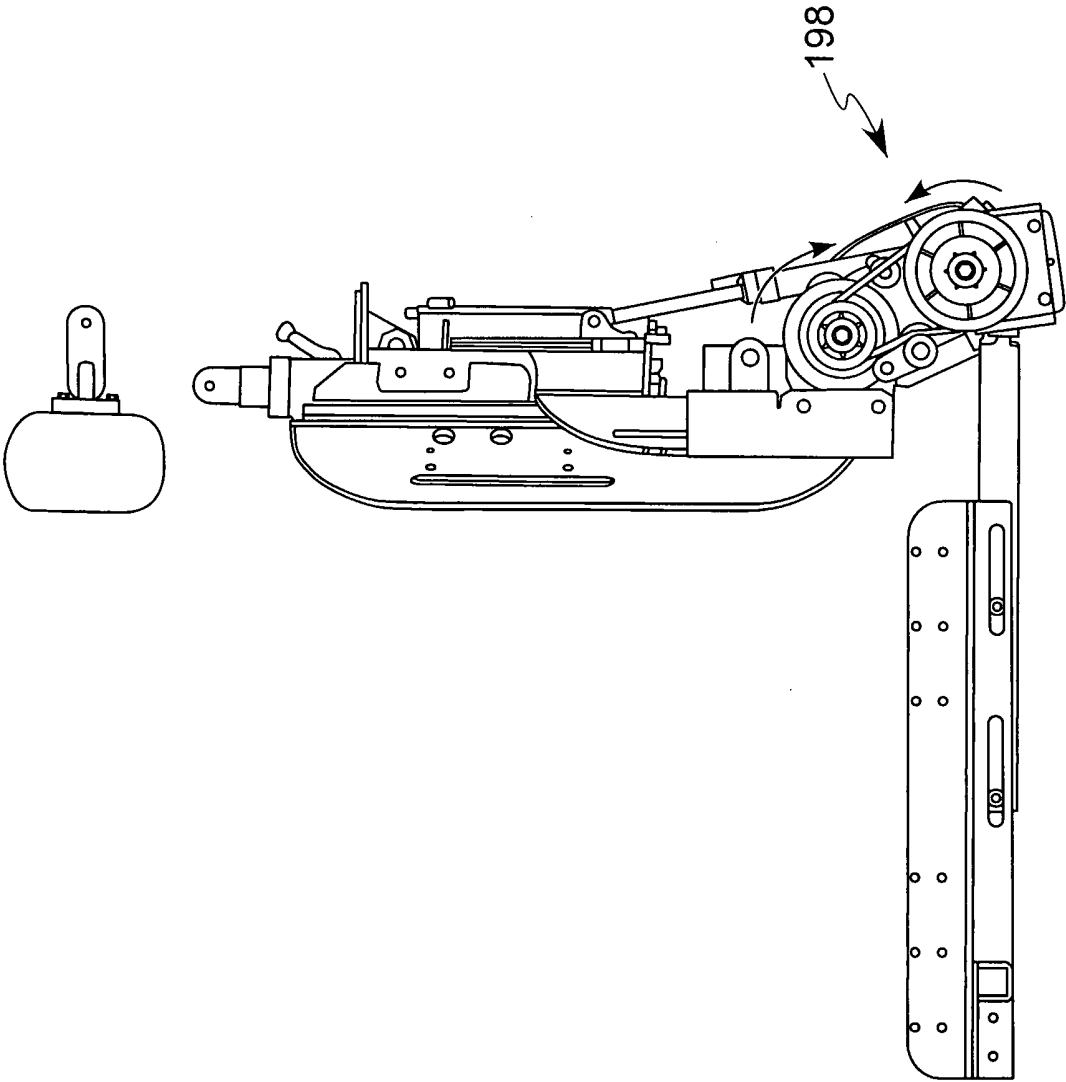
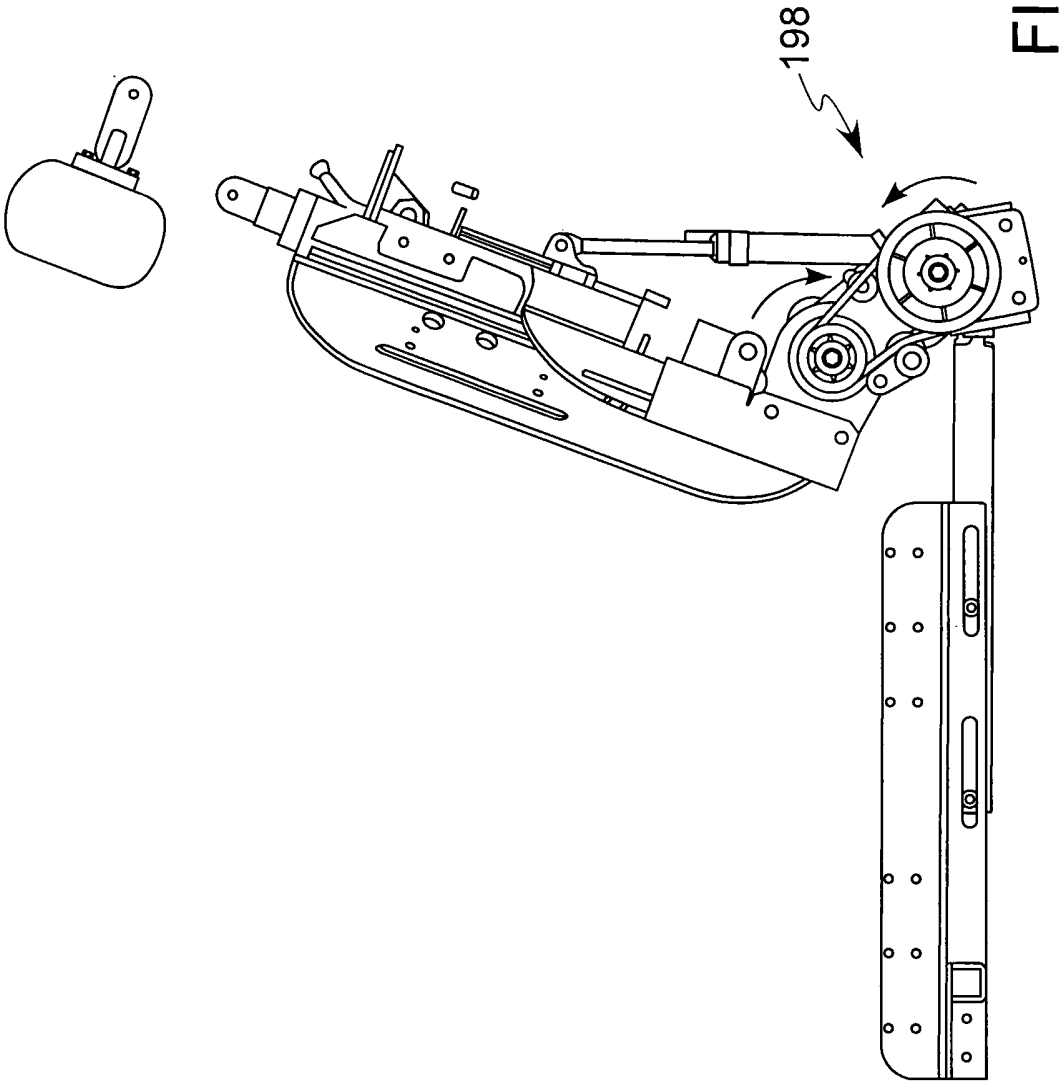
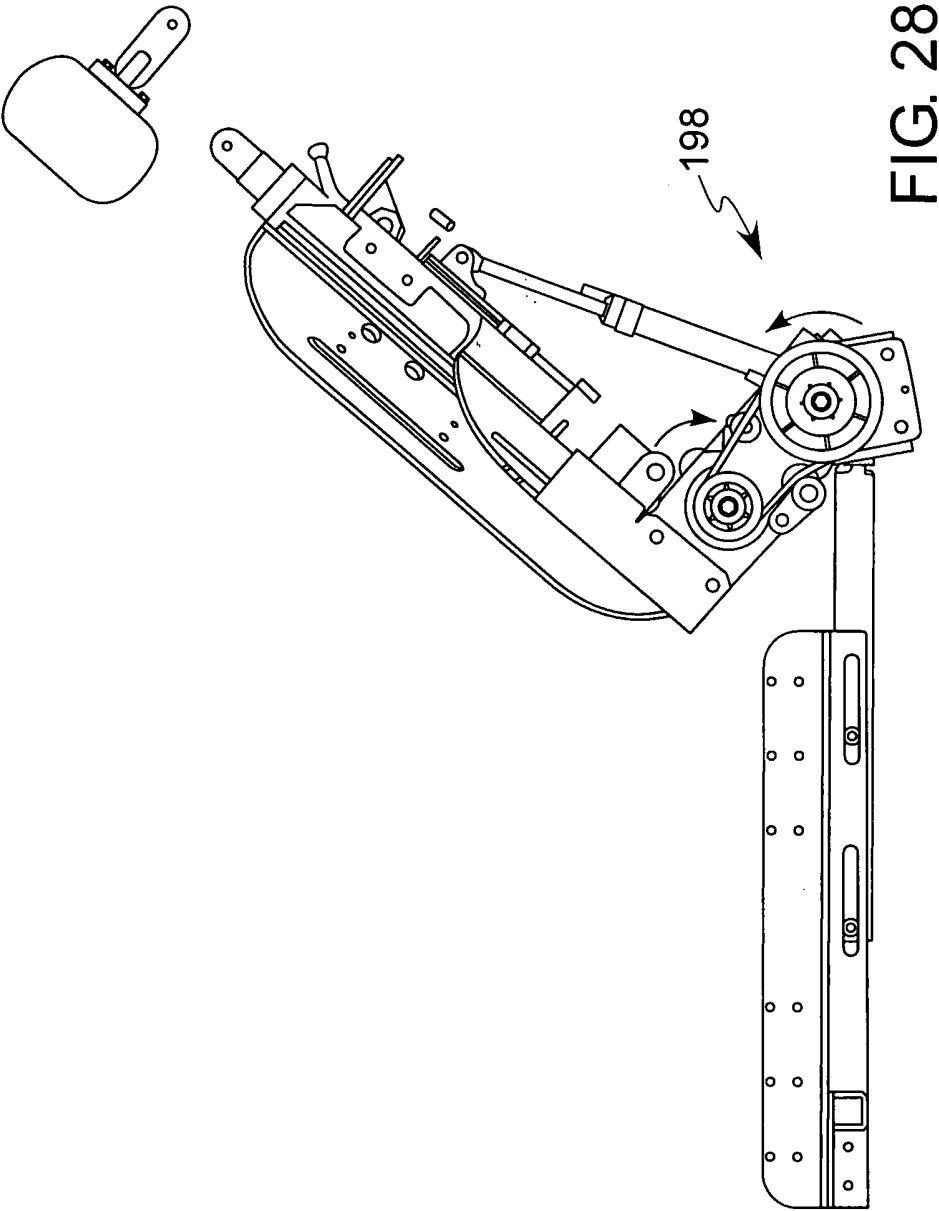


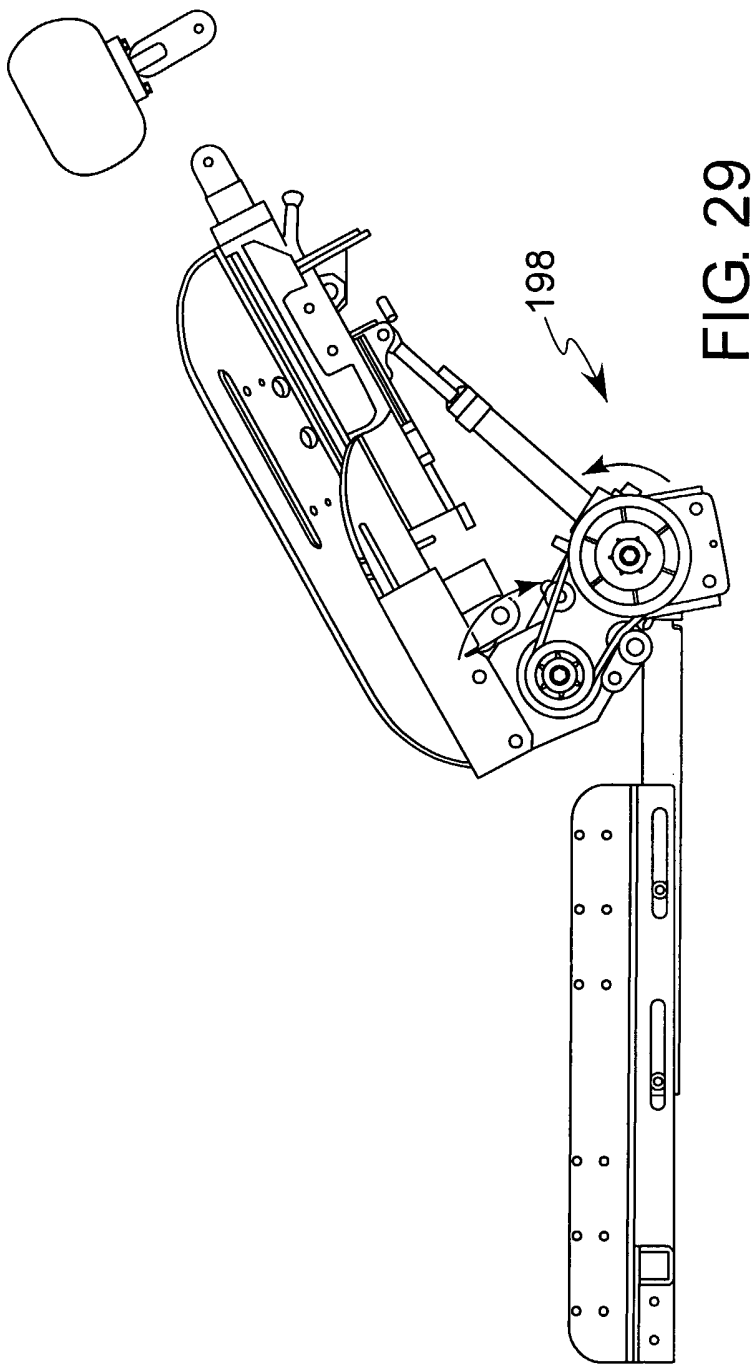
FIG. 25

FIG. 26









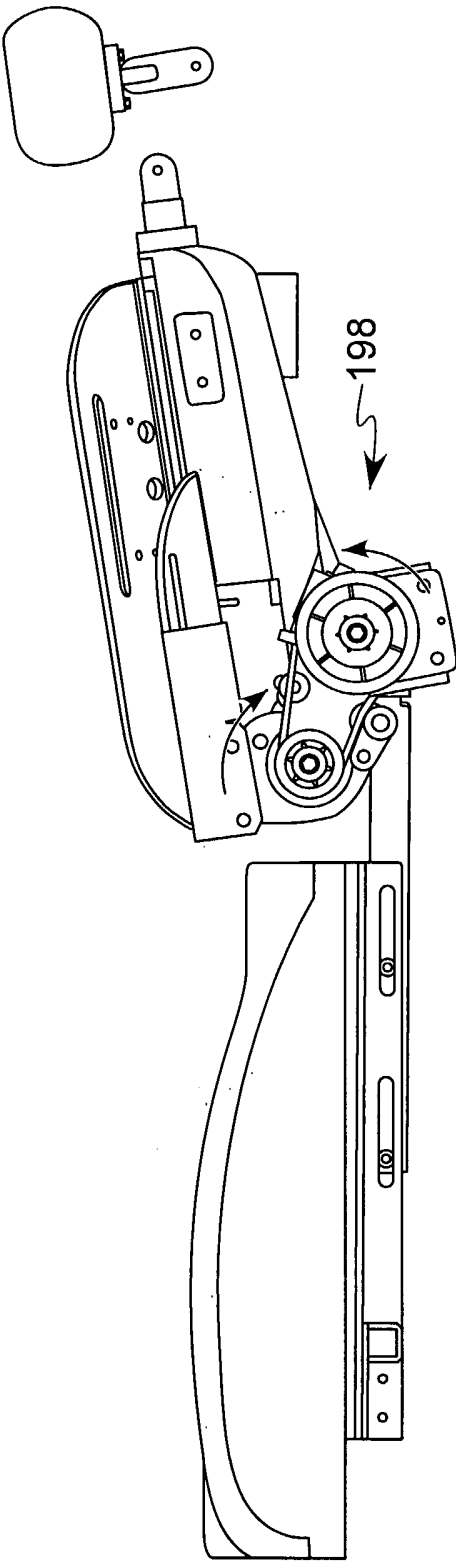


FIG. 30

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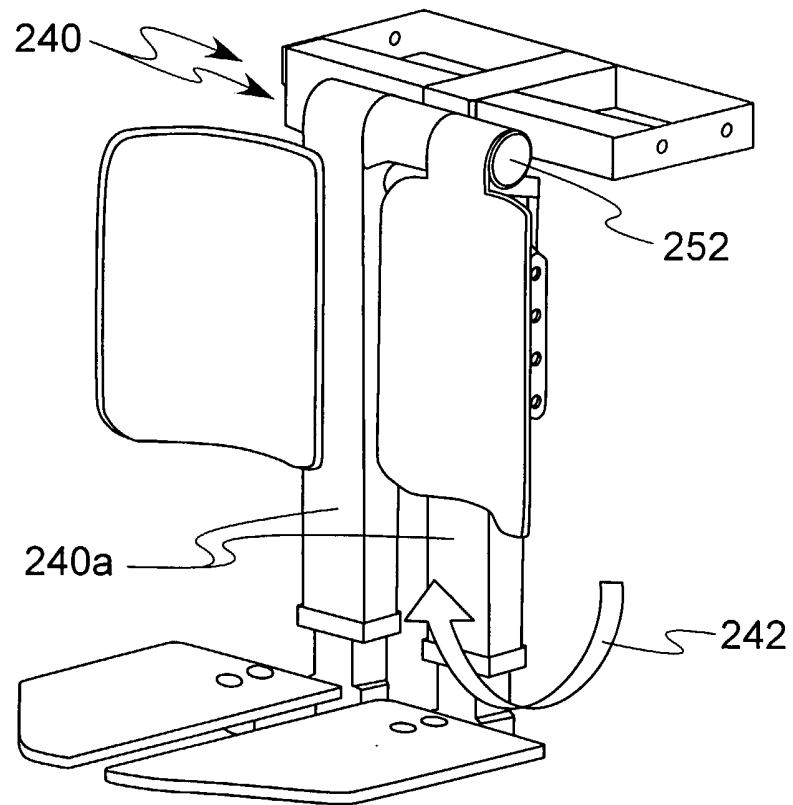


FIG. 31

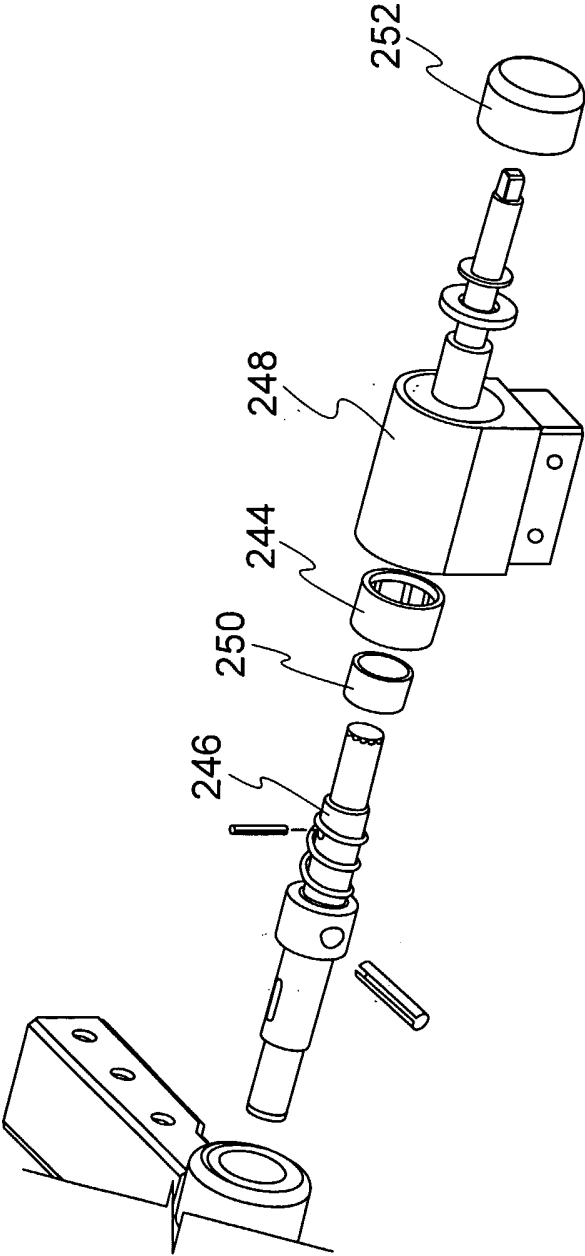


FIG. 32