US 20060102423A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2006/0102423 A1**

Lang et al. (43) **Pub. Date: May 18, 2006**

(54) **SAFETY HARNESSES**

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(21) Appl. No.: **11/231,020**

(22) Filed: **Sep. 20, 2005**

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/179,228, filed on Jul. 12, 2005.

(60) Provisional application No. 60/587,130, filed on Jul. 12, 2004. Provisional application No. 60/611,438, filed on Sep. 20, 2004.

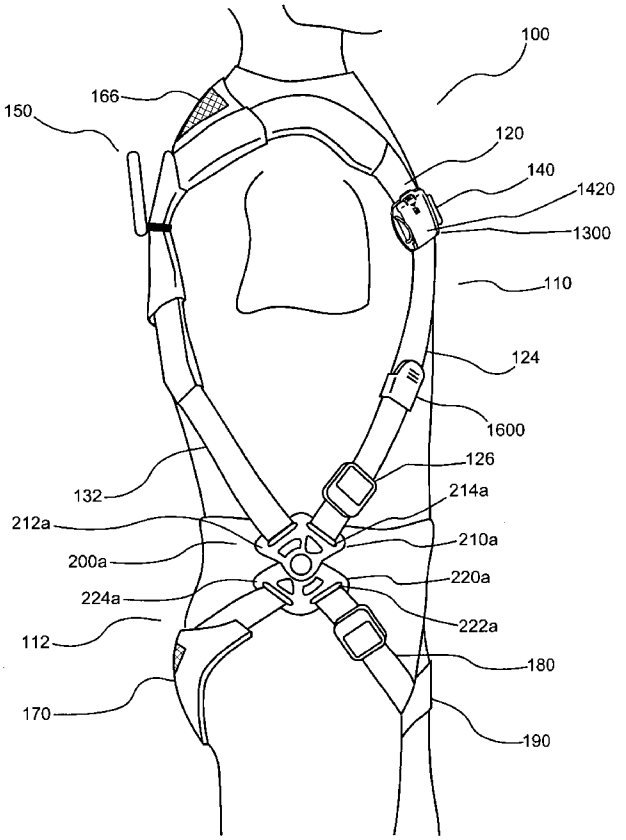
Publication Classification

(51) **Int. Cl.**
E04G 3/28 (2006.01)

(52) **U.S. Cl.** **182/36**

(57) **ABSTRACT**

A back pad for use in connection with a safety harness including at least two spaced back straps. The back pad includes a shield covering at least a portion of each of the back straps of the safety harness. The shield extends between the back straps to cover a portion of a user's back when the safety harness is worn. A full body safety harness to be worn by a person includes an upper torso portion and a lower seat portion. The upper torso portion is operatively connected to the lower seat portion by a first connector on a first lateral side and a second connector on a second lateral side thereof. The first connector and the second connector can, for example, enable forward and rearward rotation of the upper torso portion relative to the lower seat portion (for example, without causing a significant increase in tension in the upper torso portion or the lower seat portion). At least one of the first connector and the second connector includes a shaft. The upper torso portion includes at least one connecting member having a passage formed therein. The lower seat portion includes at least one connecting member have a passage formed therein. The shaft passes through the passage of the at least one connecting member of the upper torso portion and through the passage of the at least one connecting member of the lower torso portion.



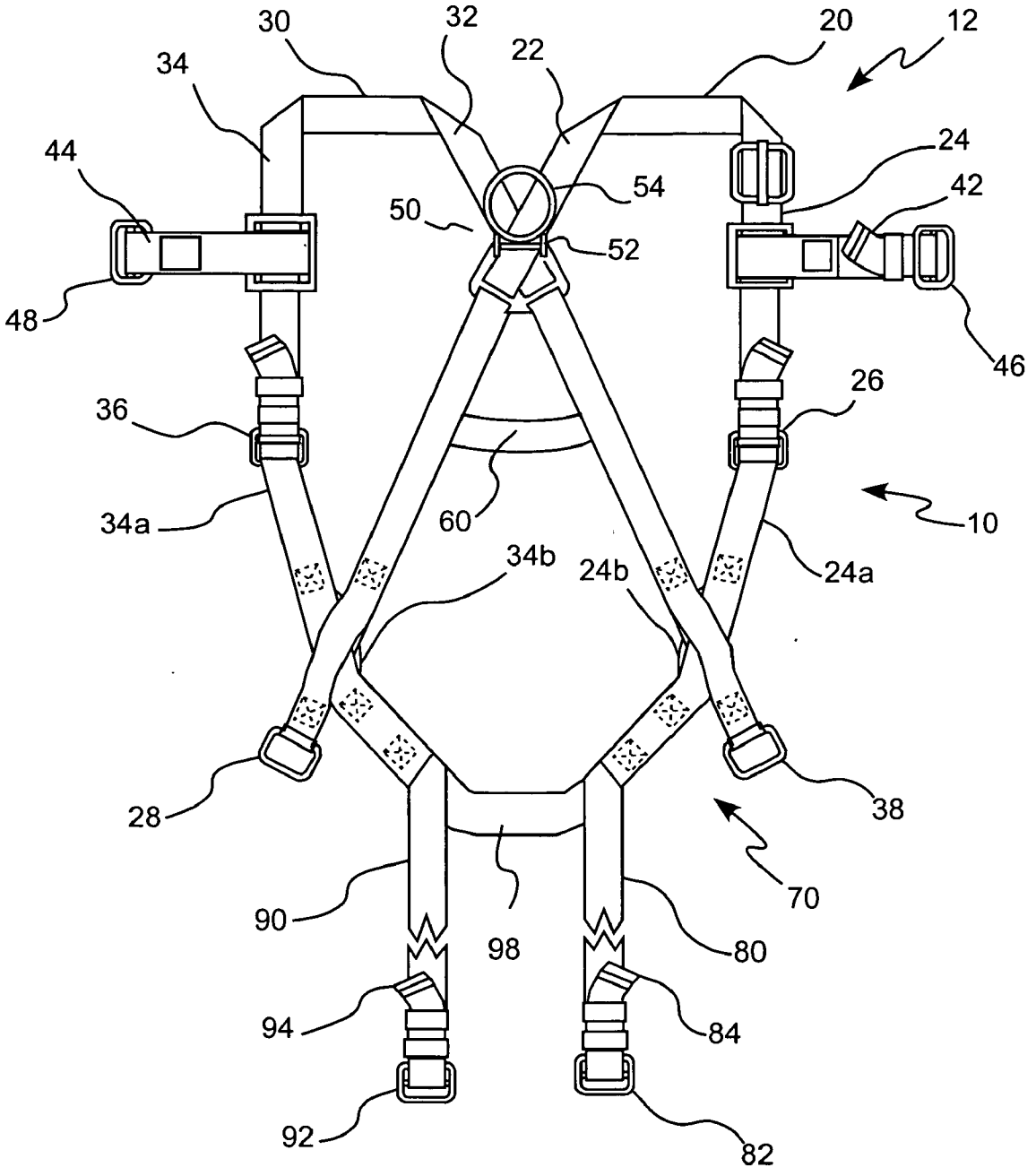


Fig. 1
(Prior Art)

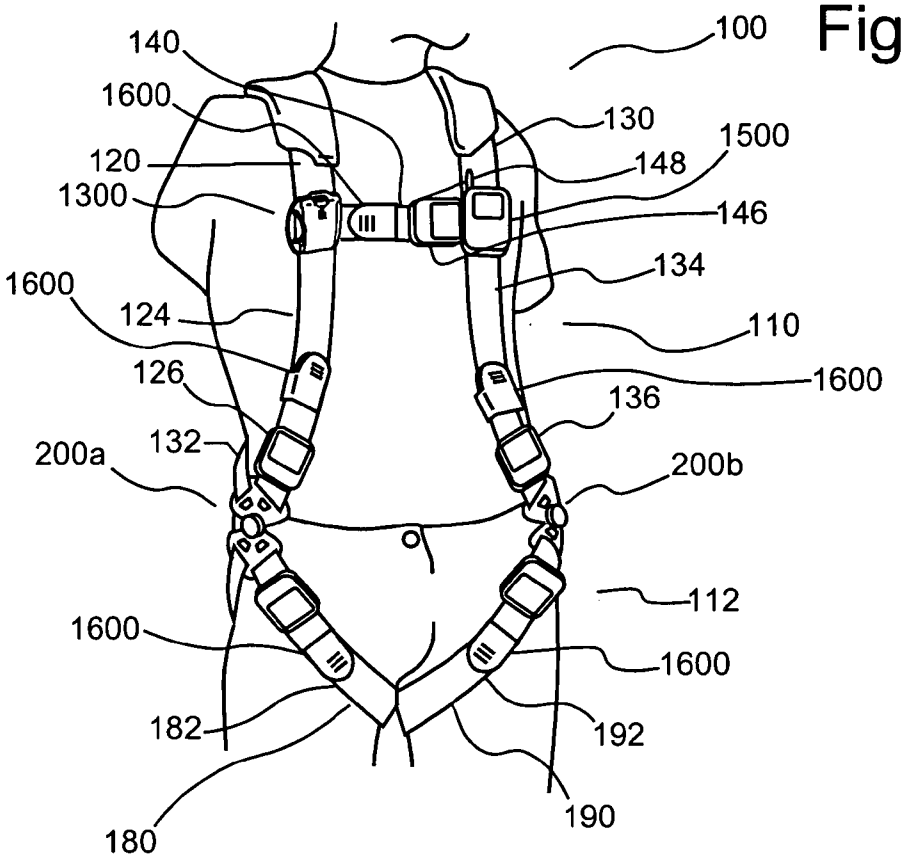

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Fig. 2A

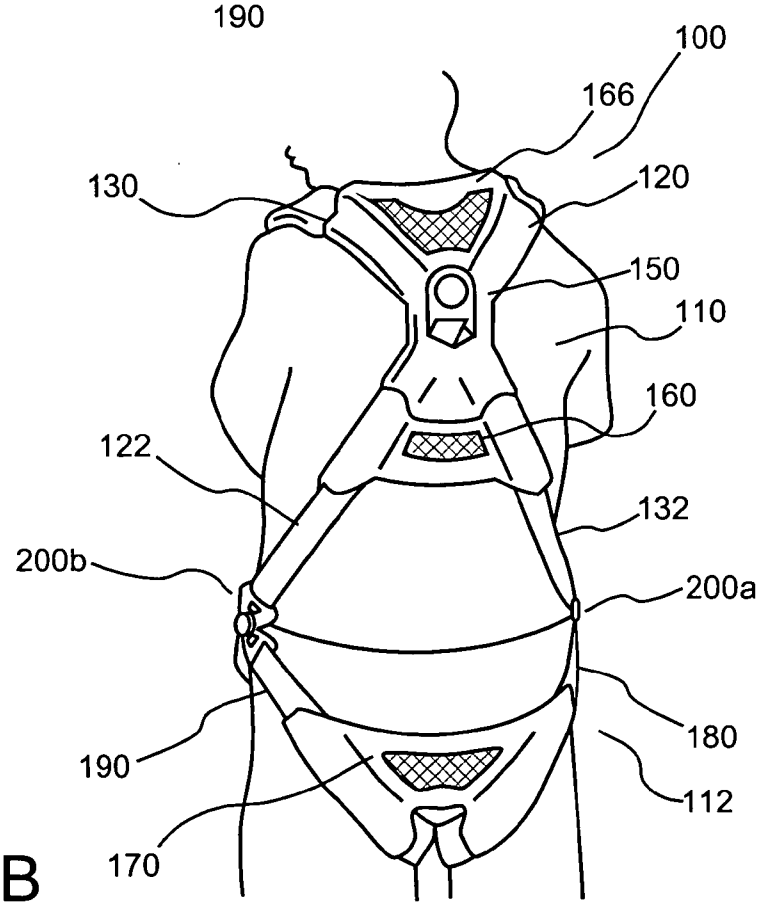
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Fig. 2B

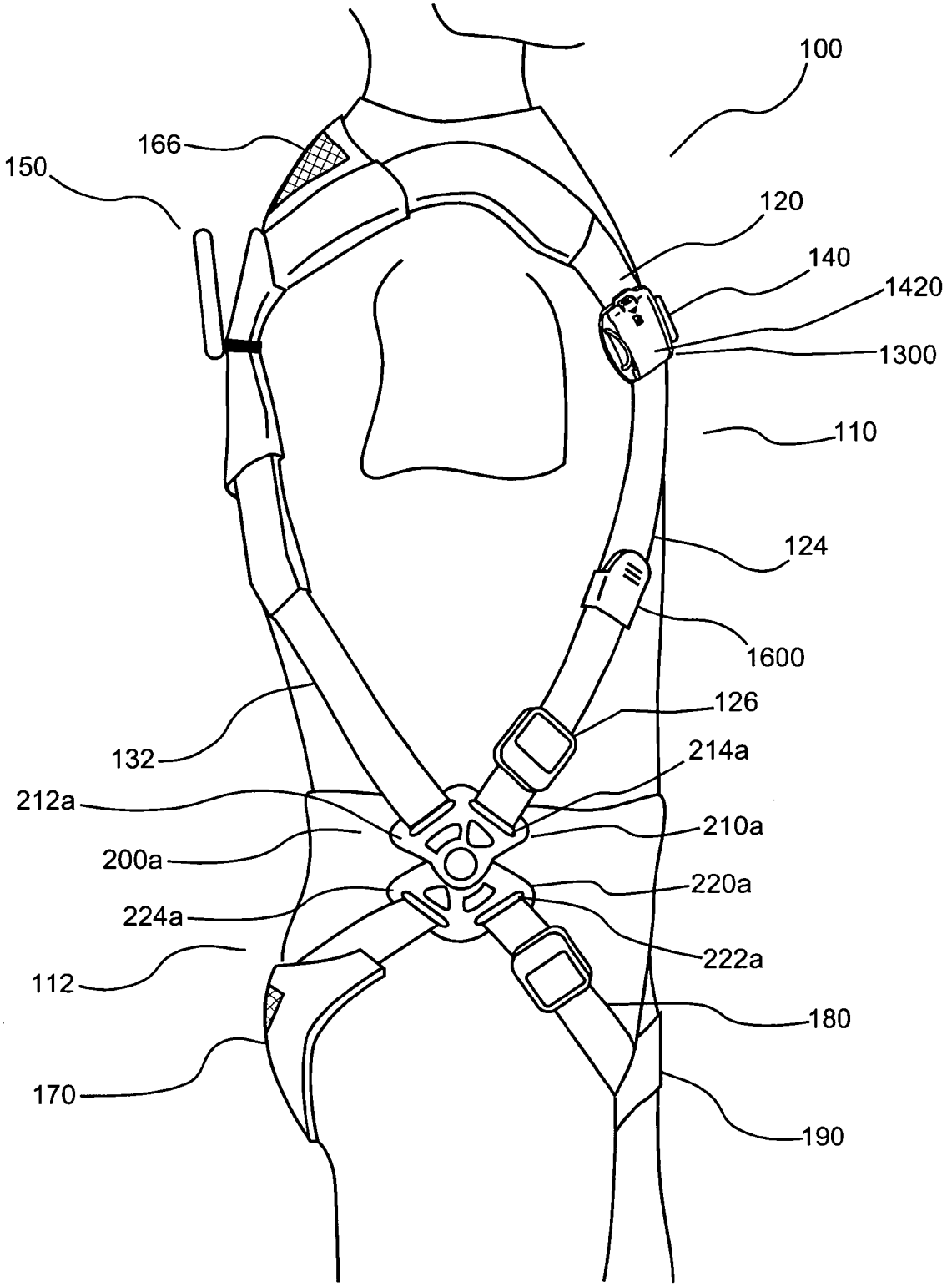
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Fig. 2C

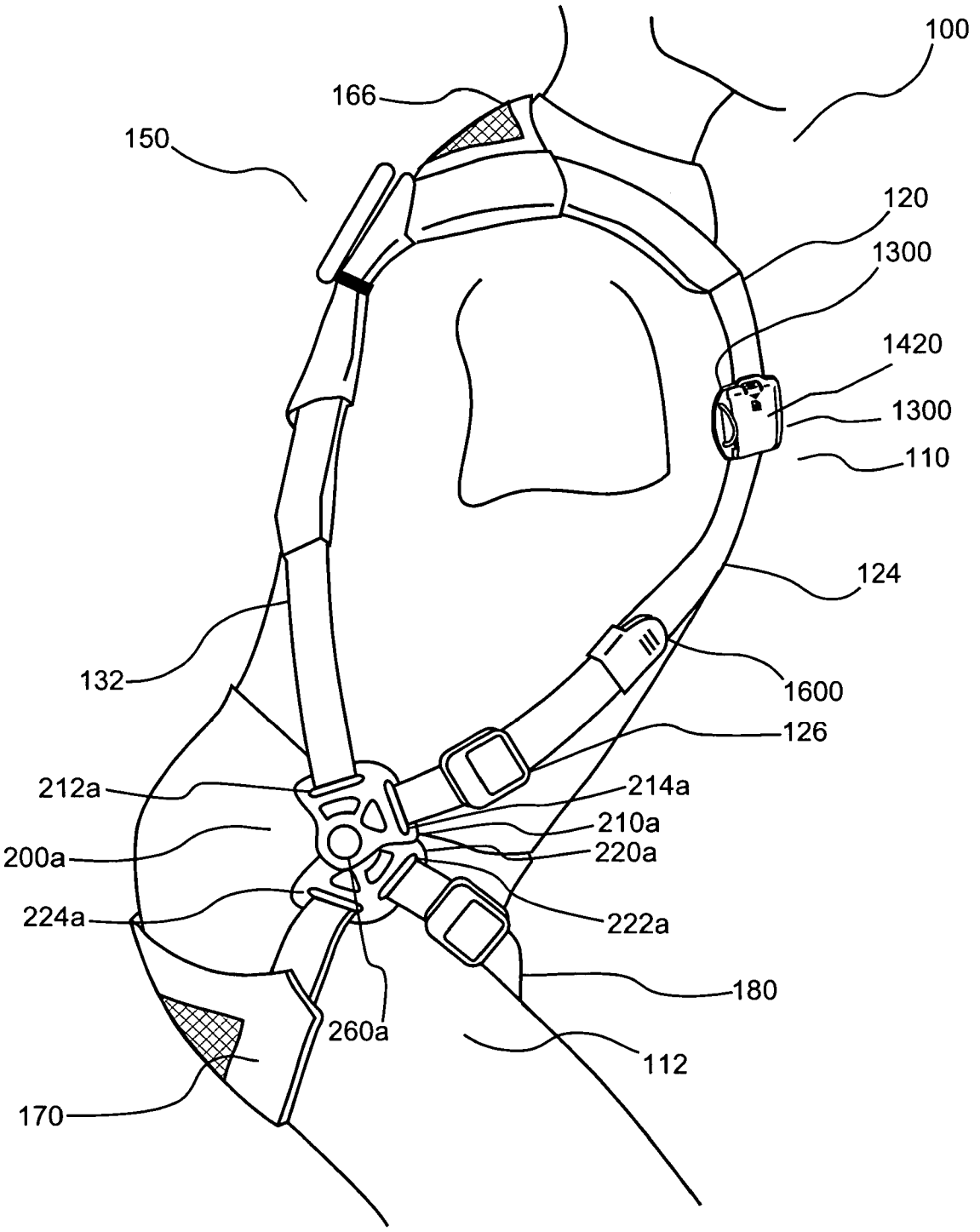
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Fig. 2D

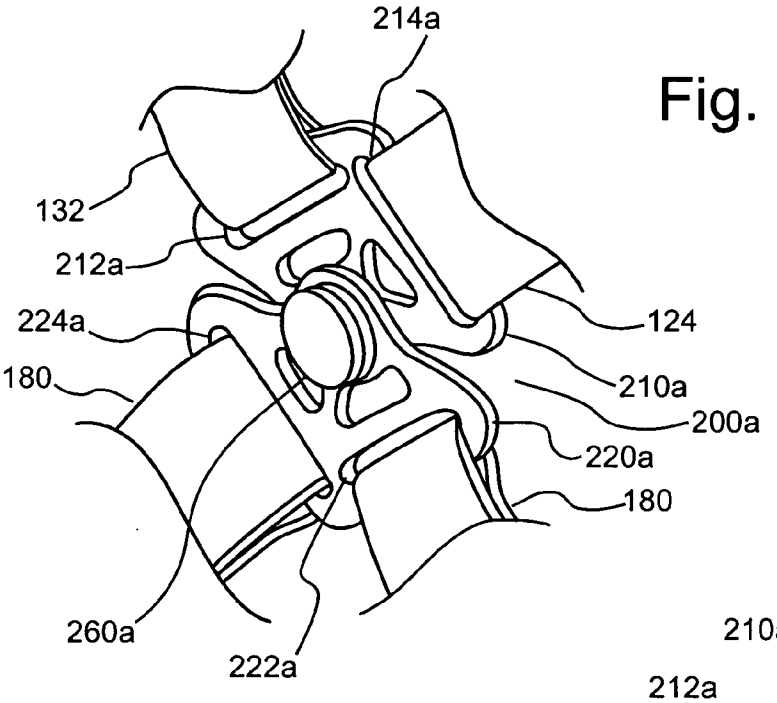


Fig. 2E

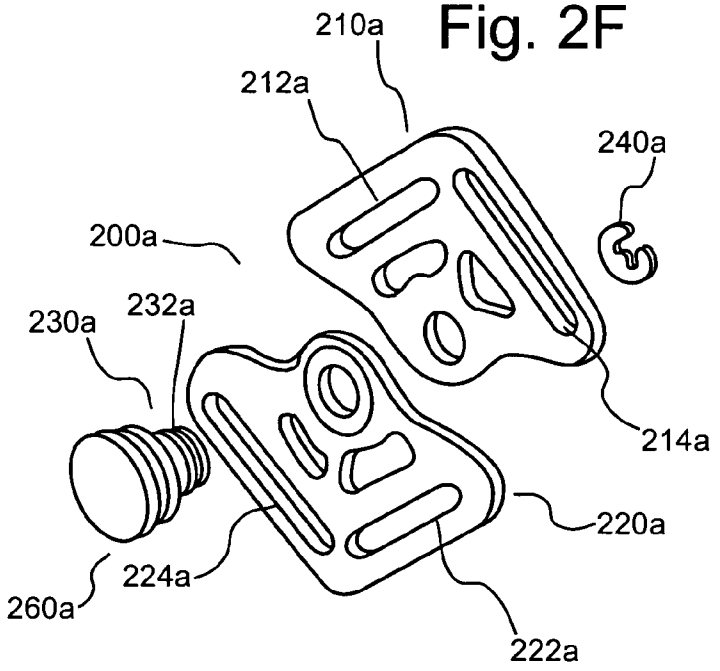


Fig. 2F

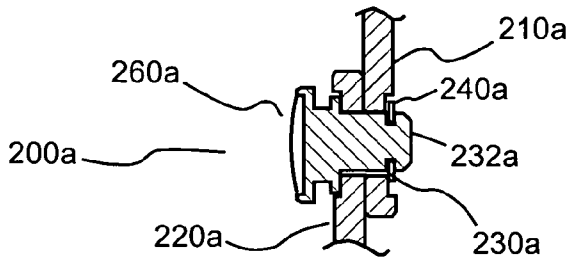
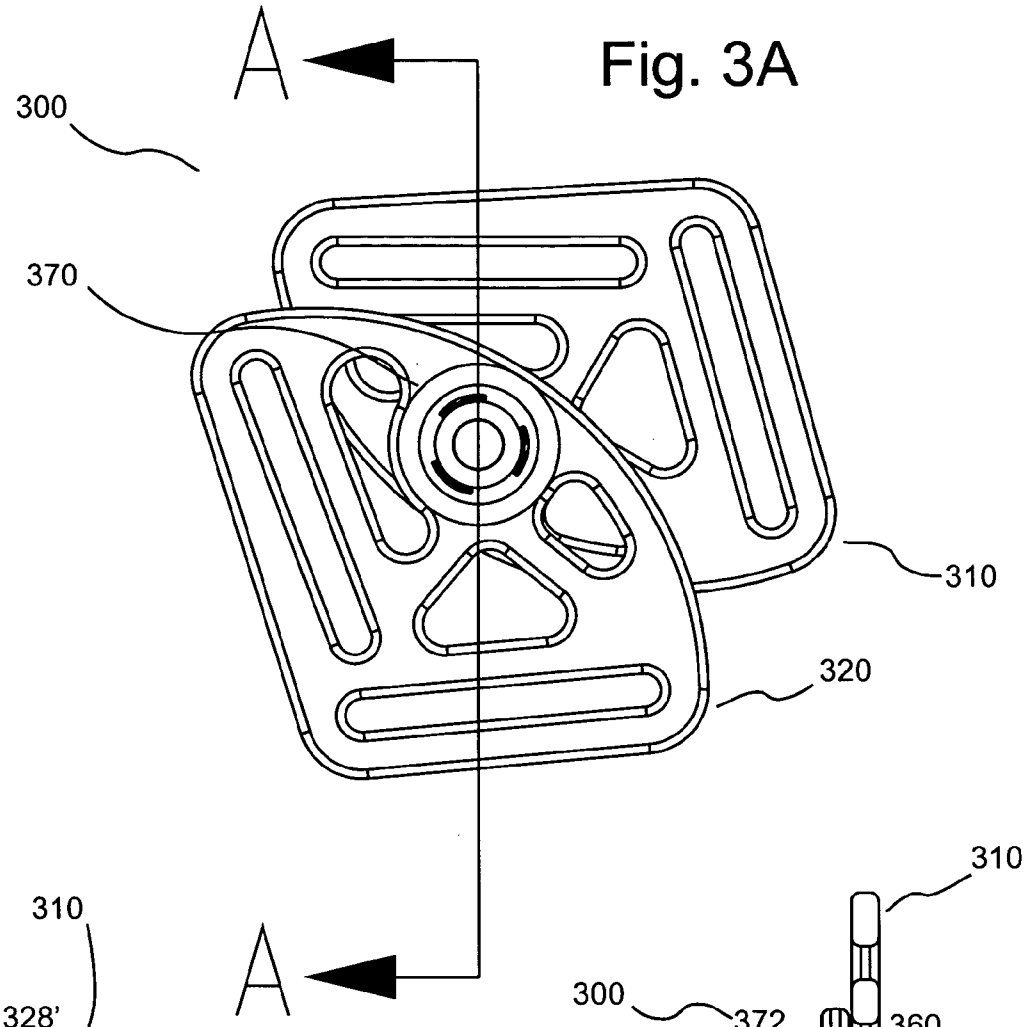


Fig. 2G



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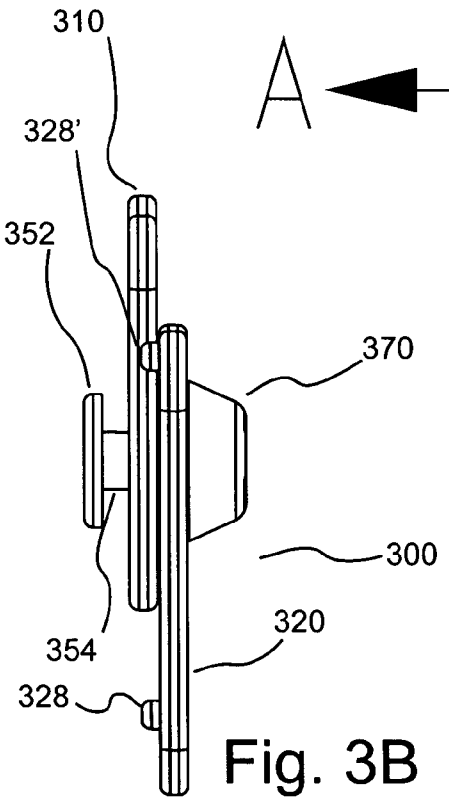

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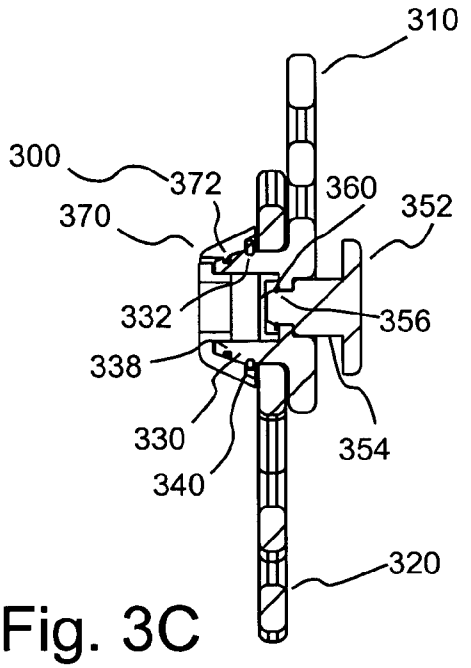
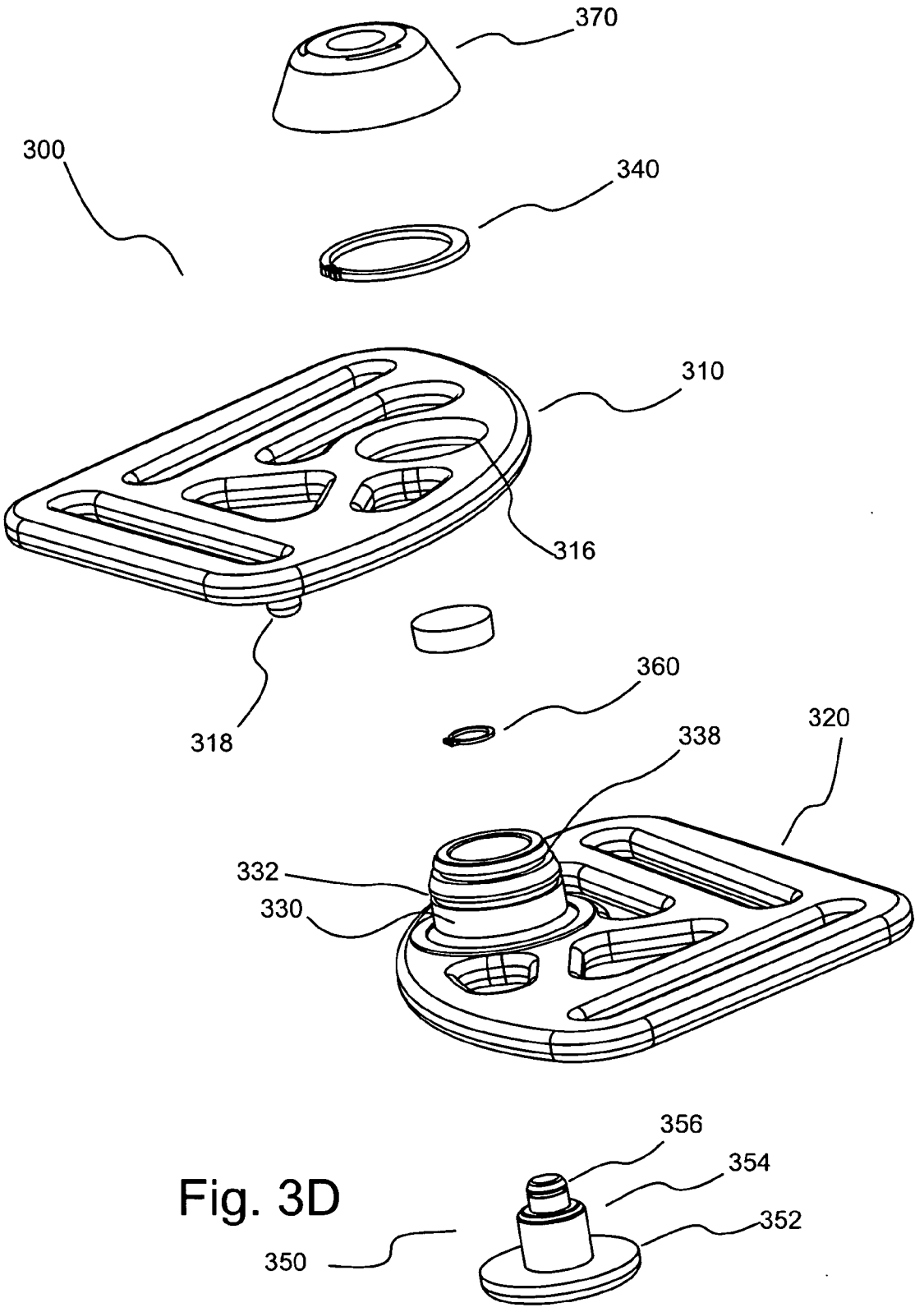


Fig. 3C

SECTION A–A



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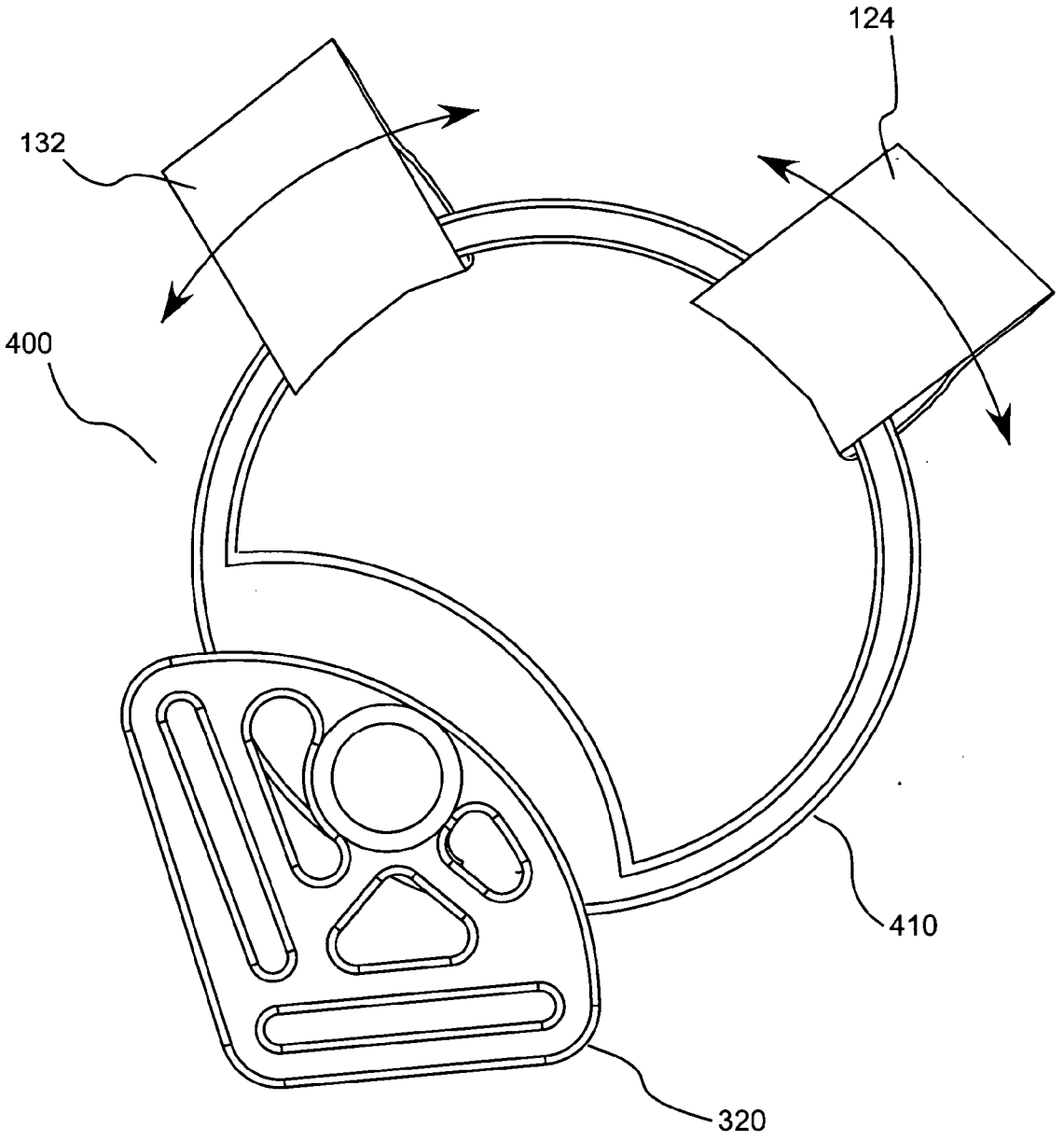

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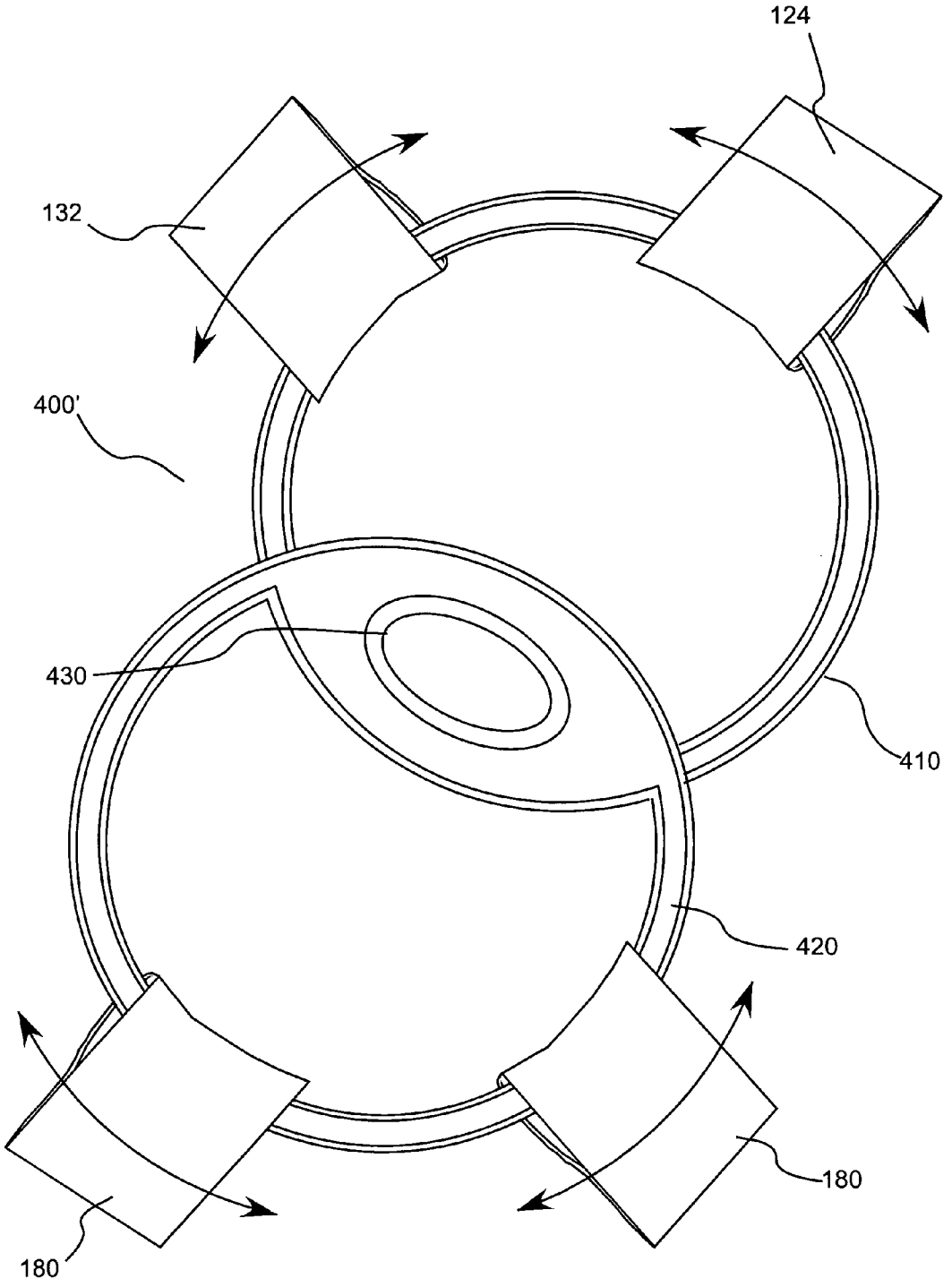

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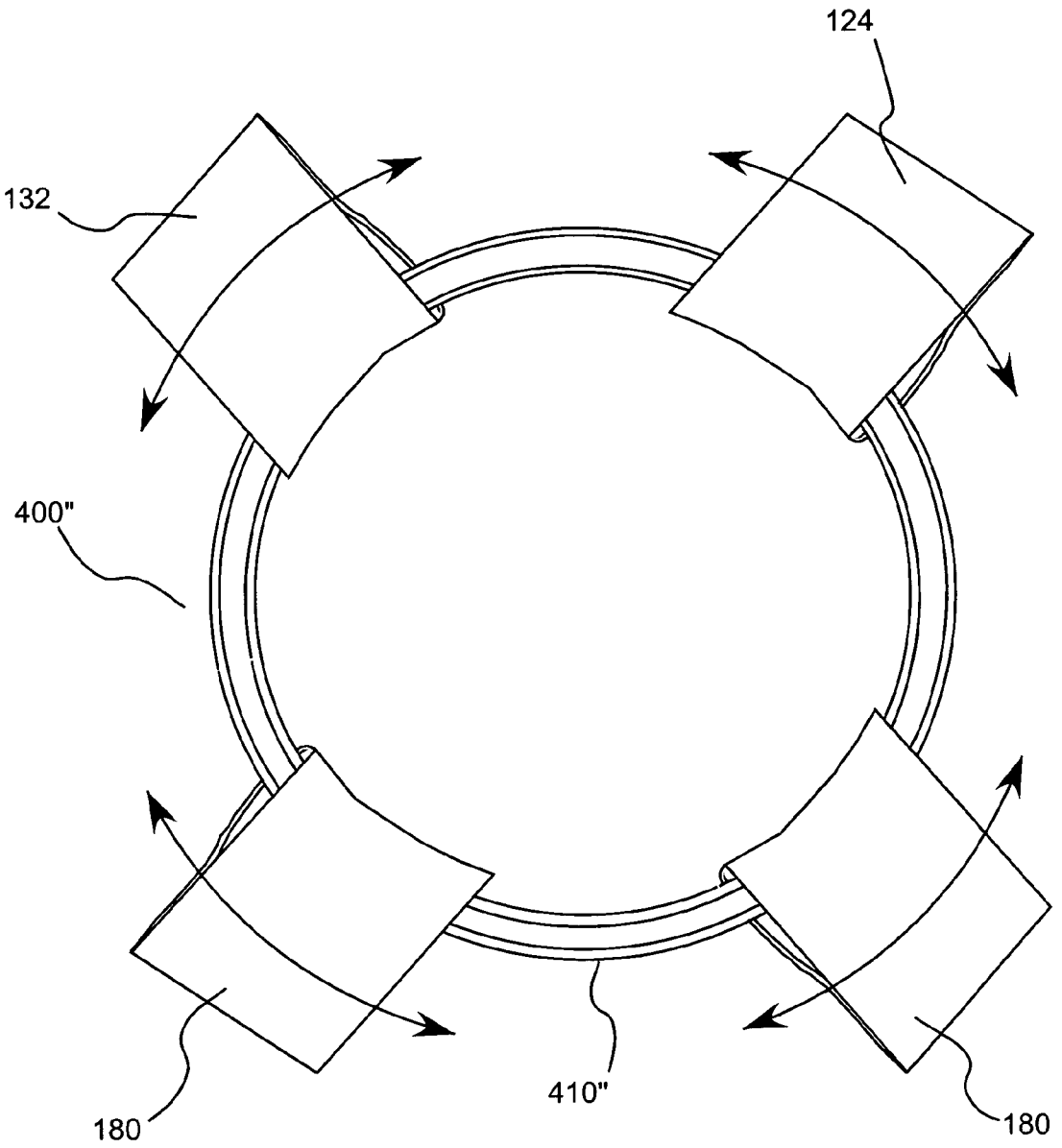

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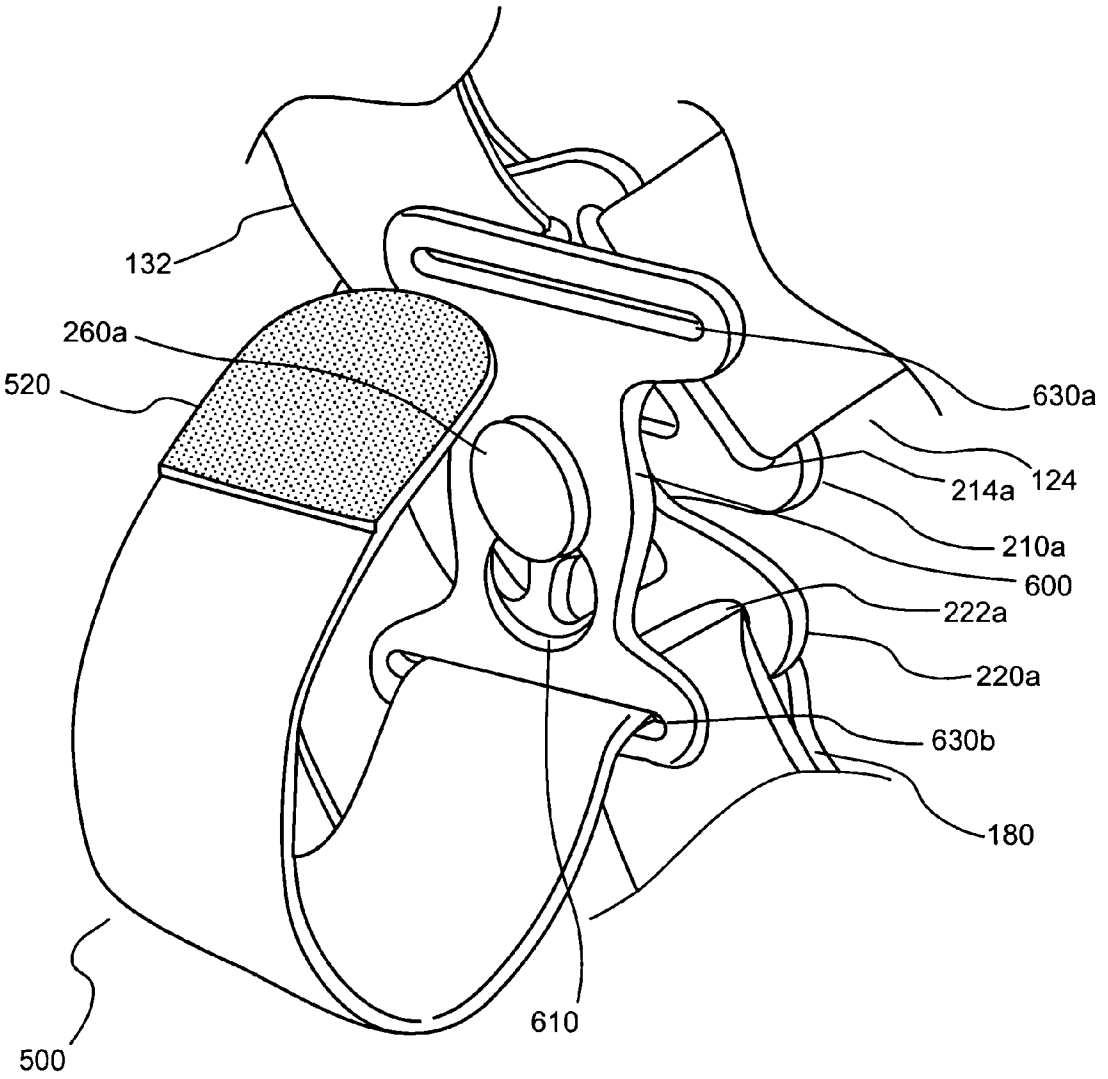
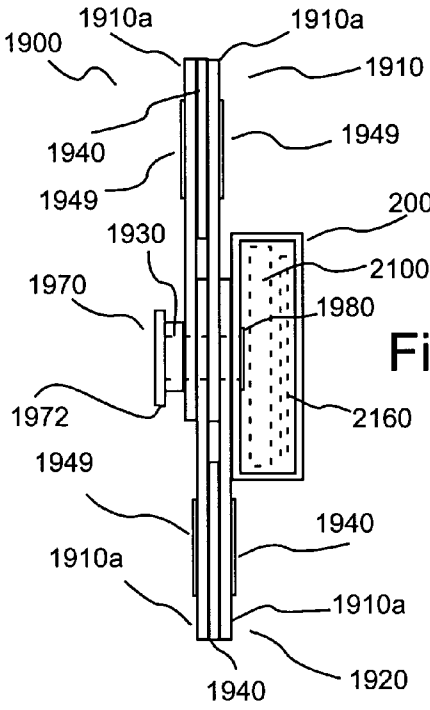


Fig. 5A



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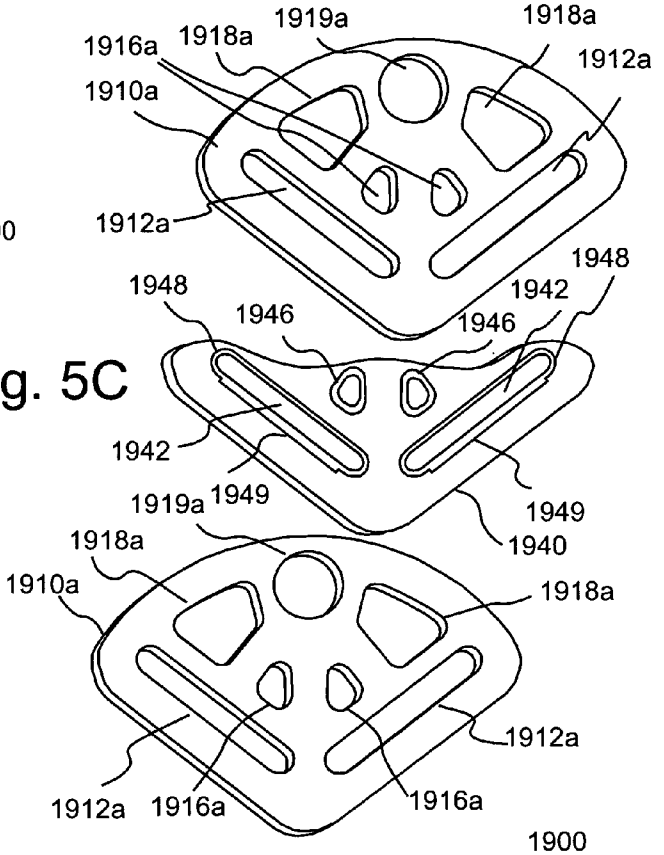

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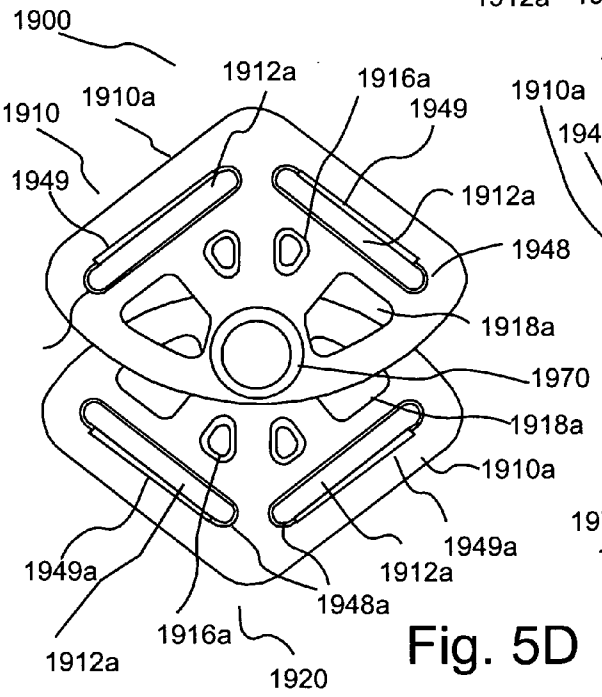

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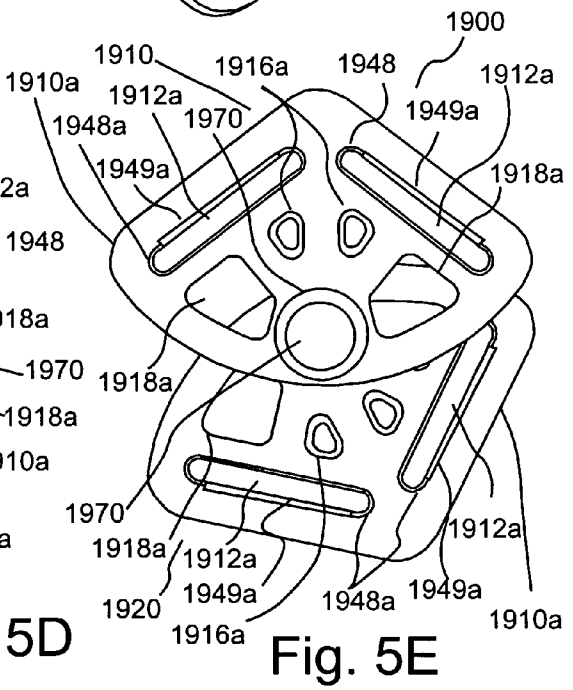

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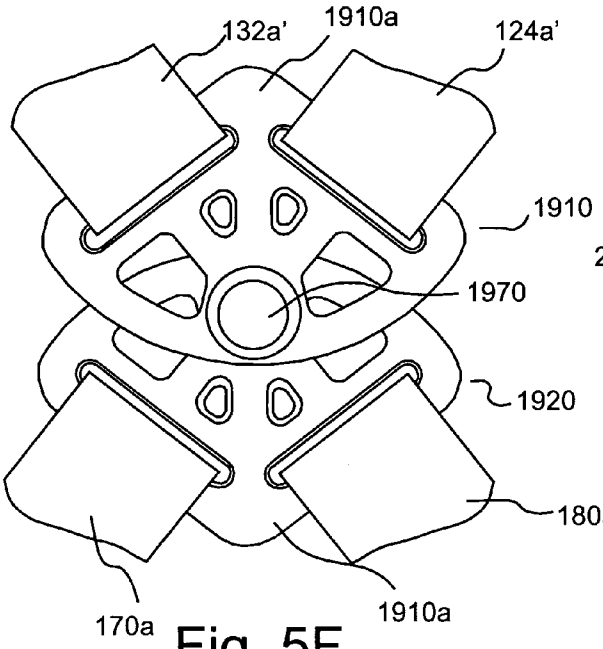
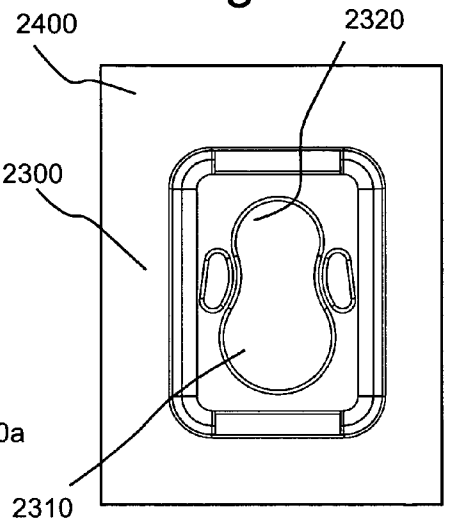


Fig. 5F

Fig. 5I



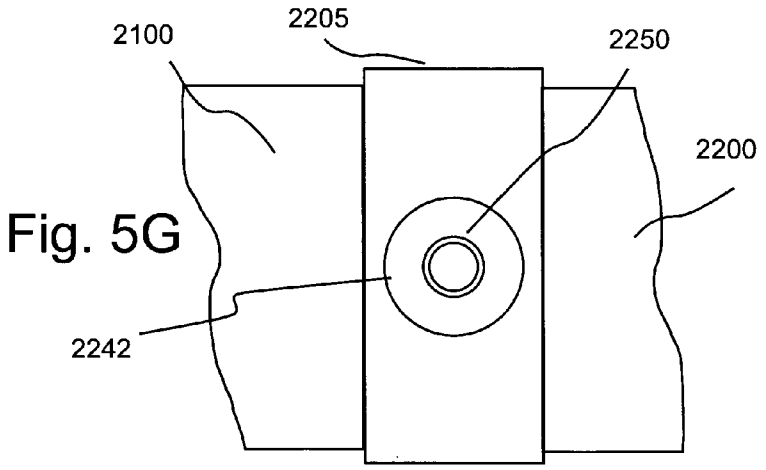
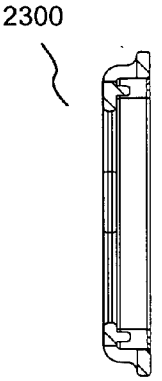


Fig. 5G

Fig. 5H



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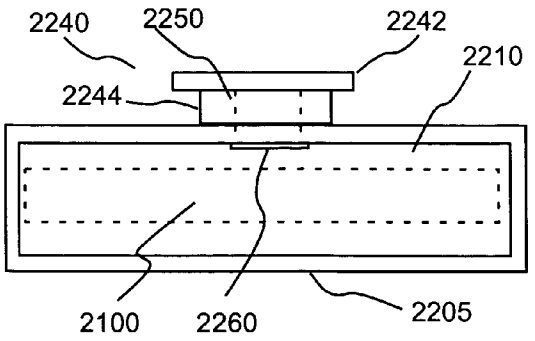

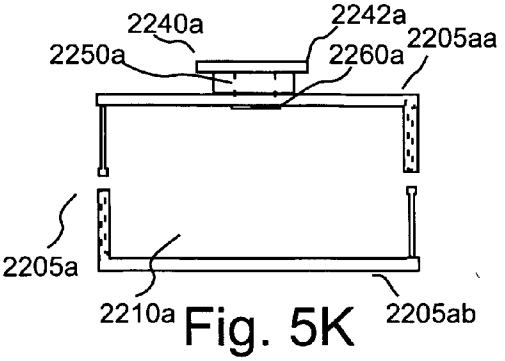

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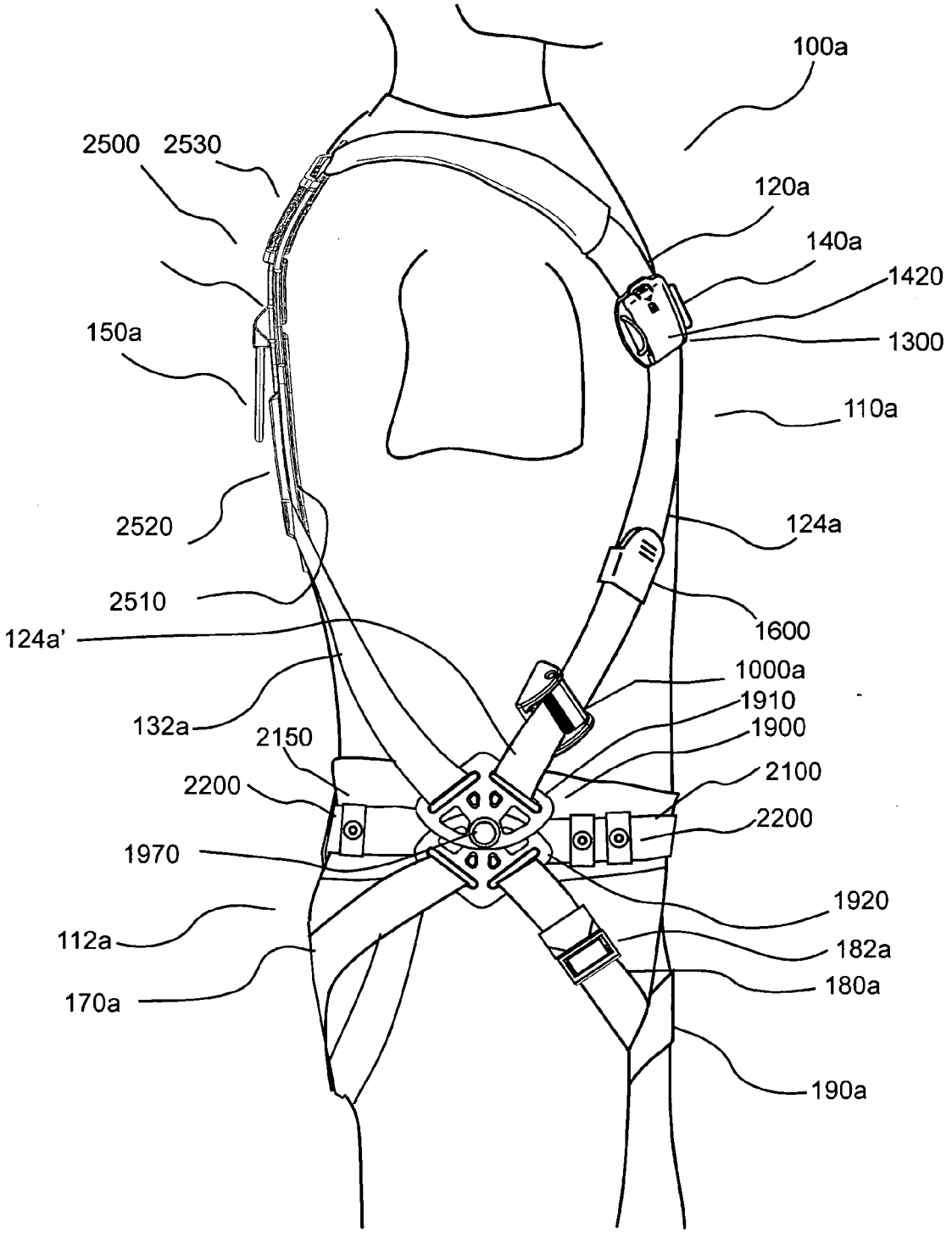
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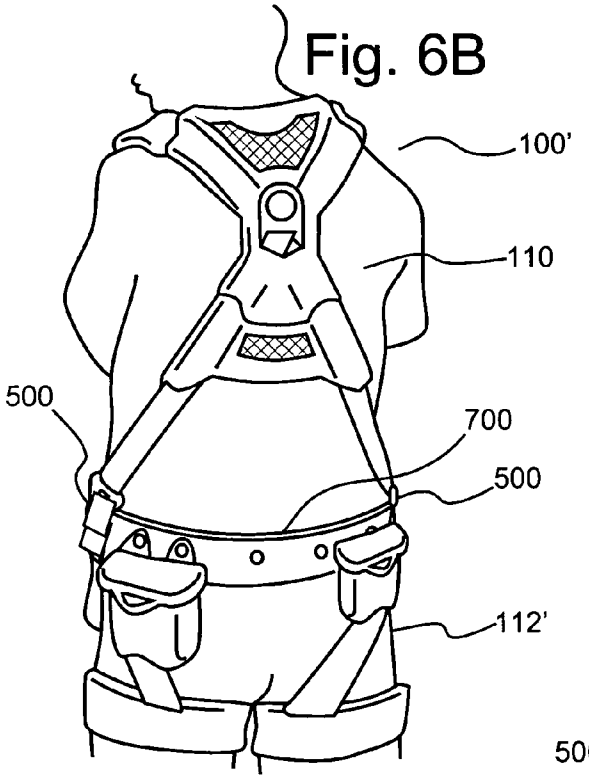
Fig. 5L

Fig. 6B



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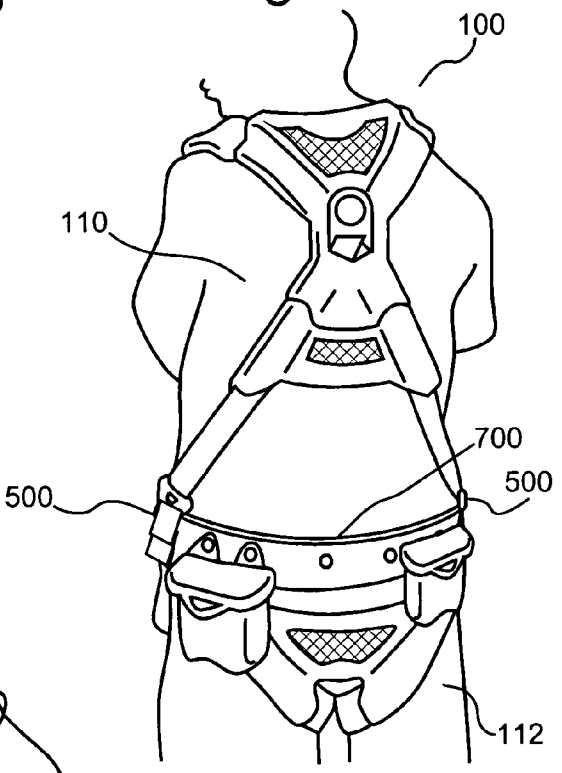

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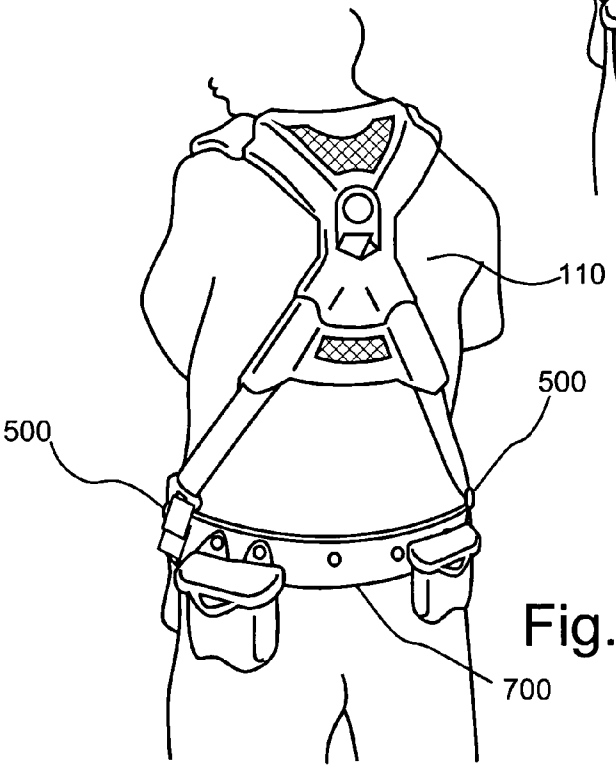


Fig. 6C

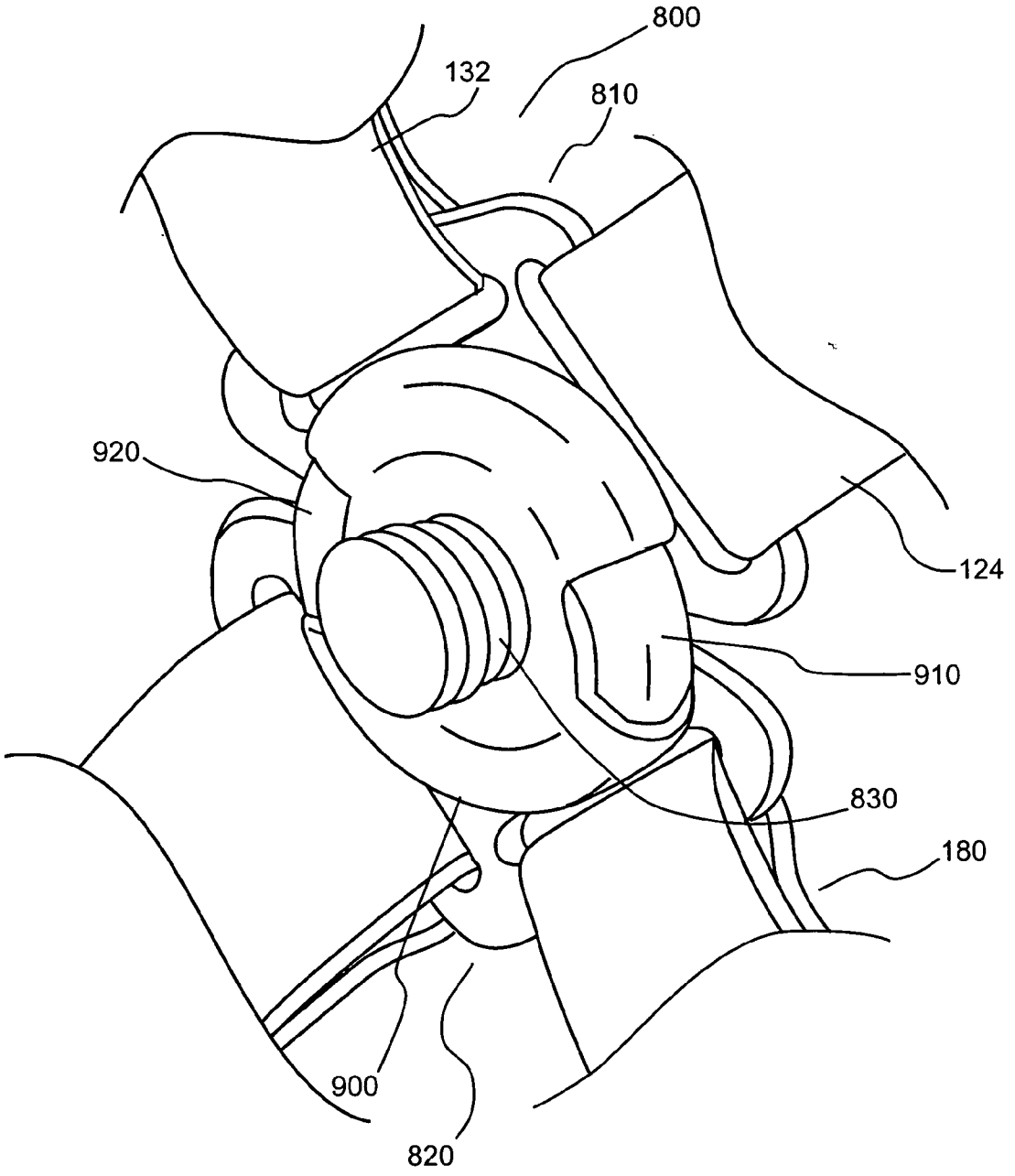
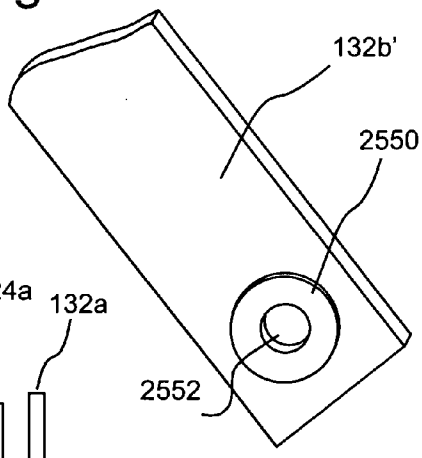


Fig. 7A

Fig. 7C



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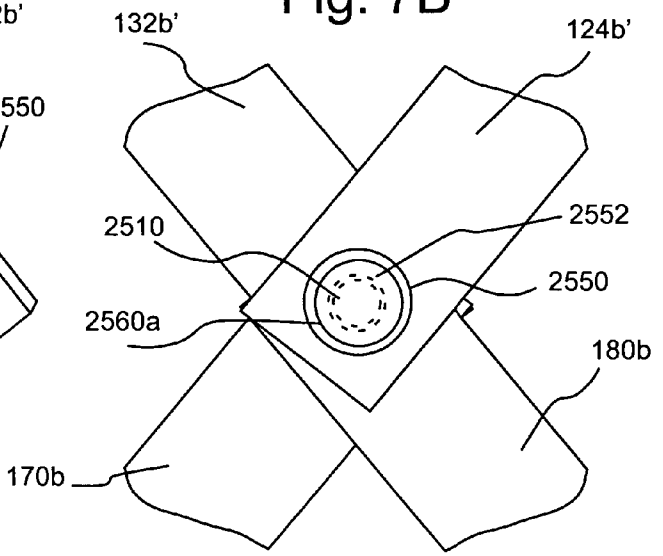

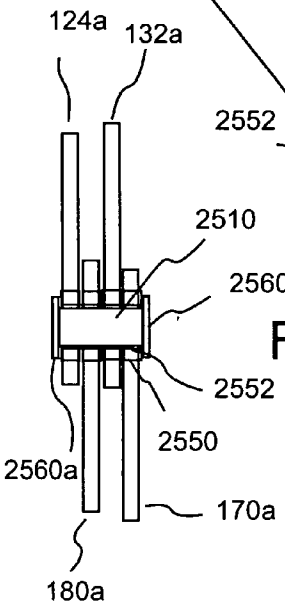

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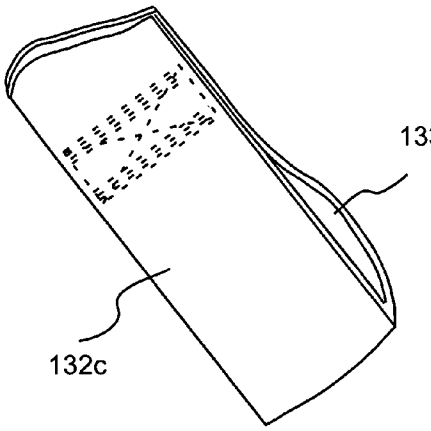

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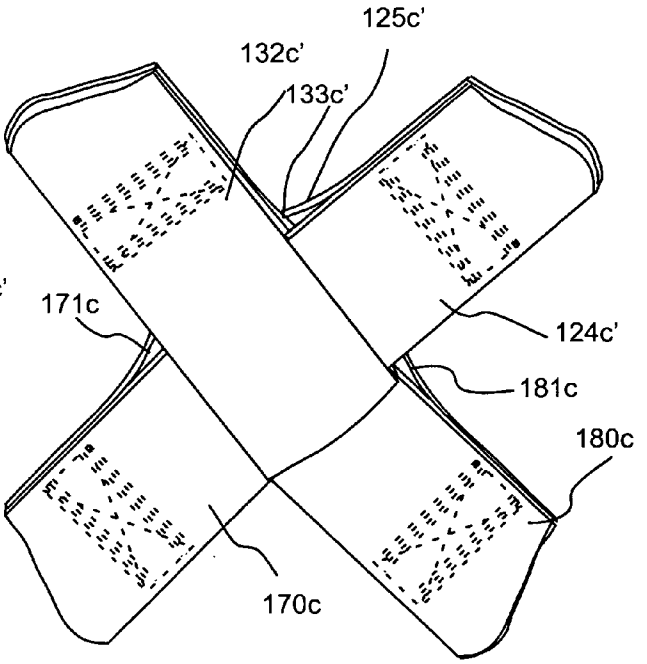

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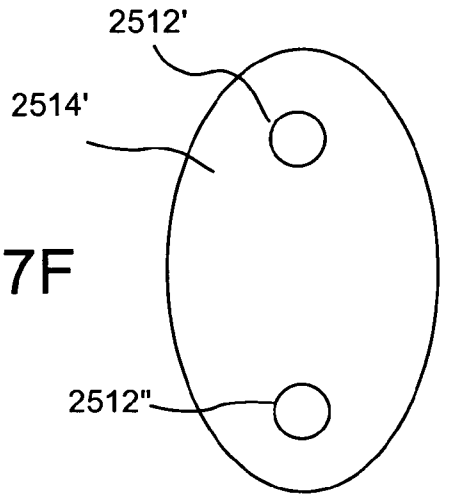

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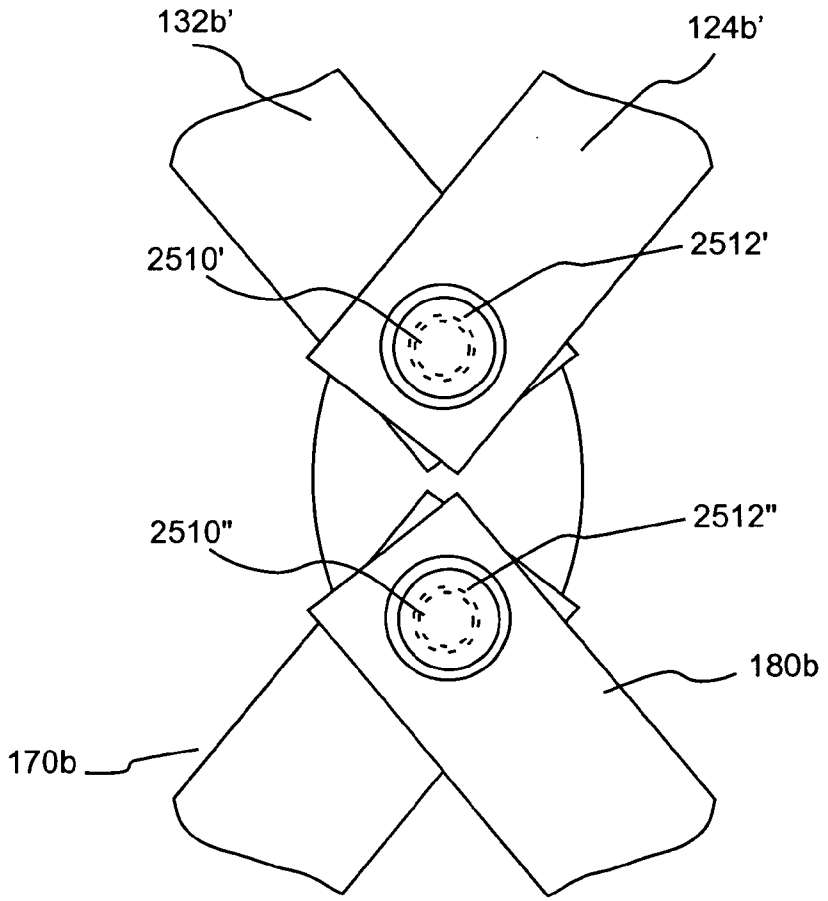

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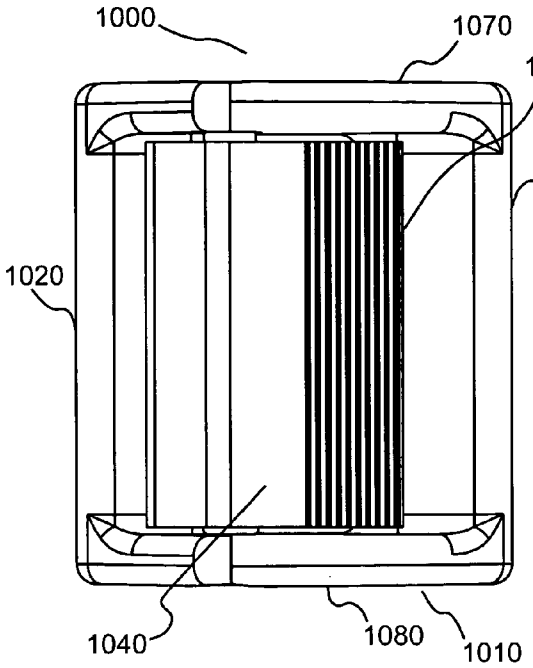


Fig. 8A

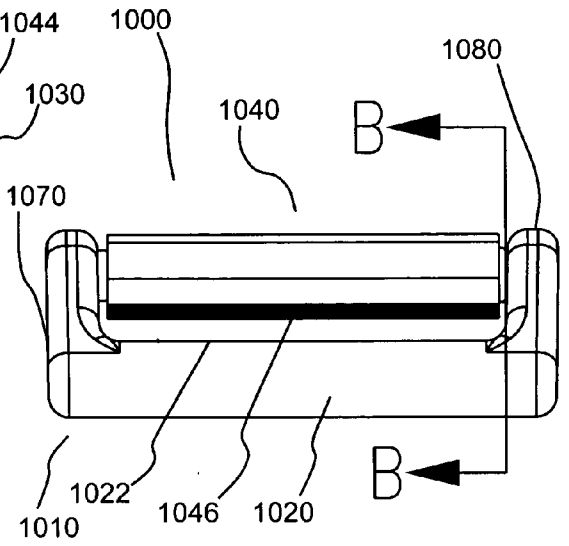
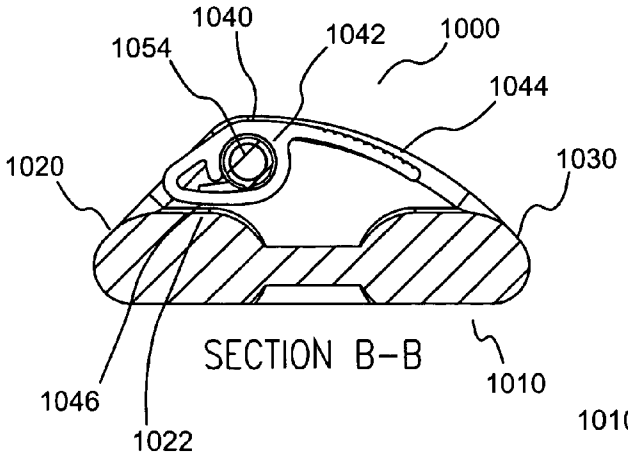


Fig. 8B



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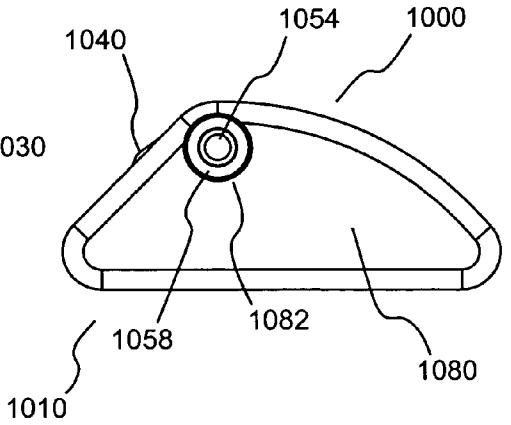

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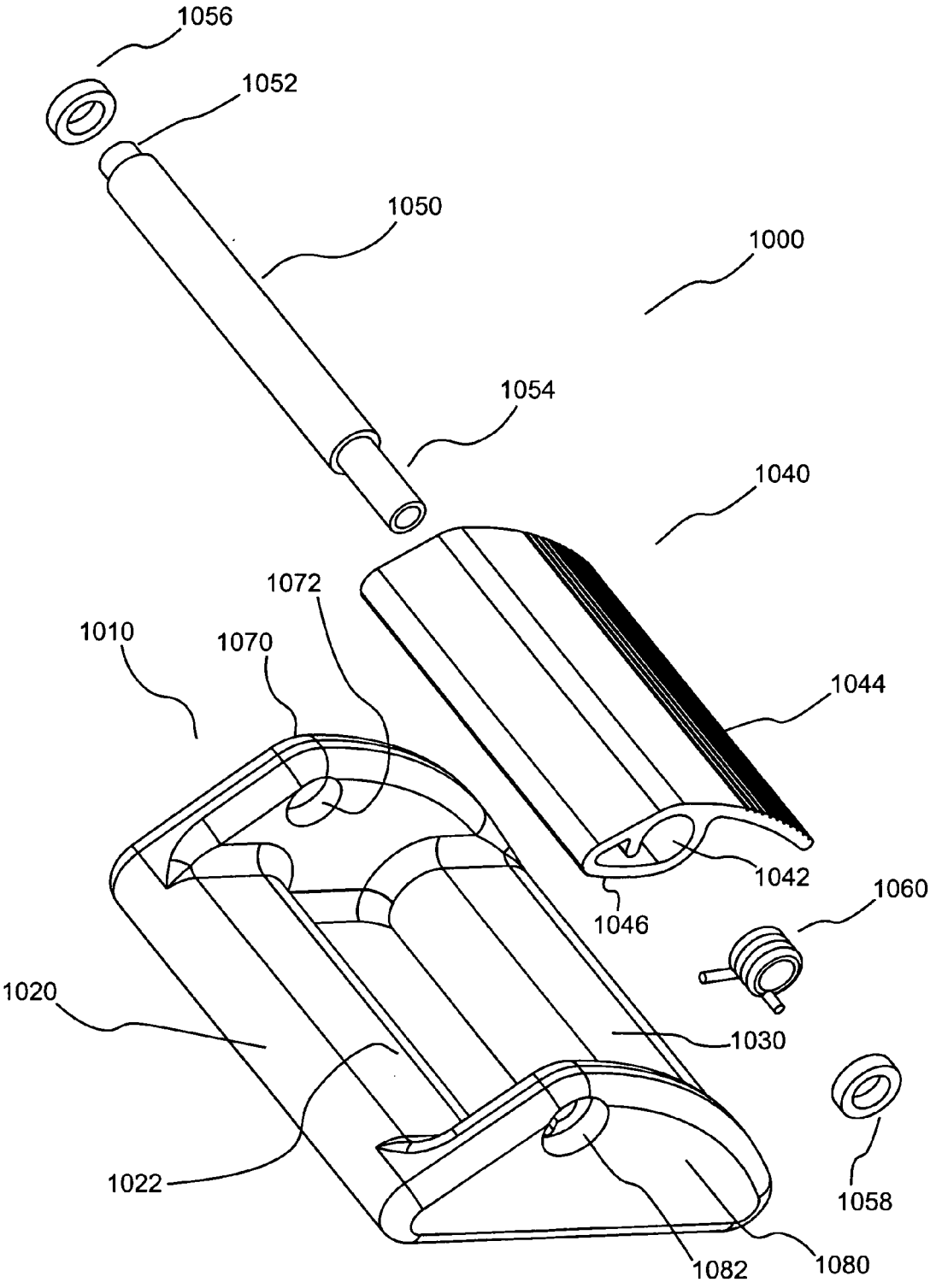
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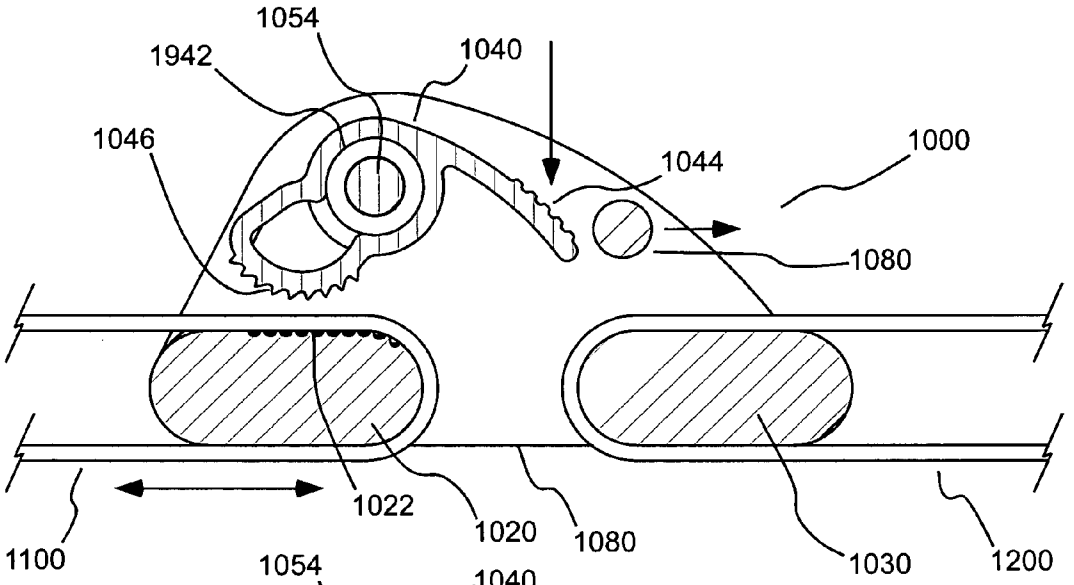
Fig. 8E

Fig. 8F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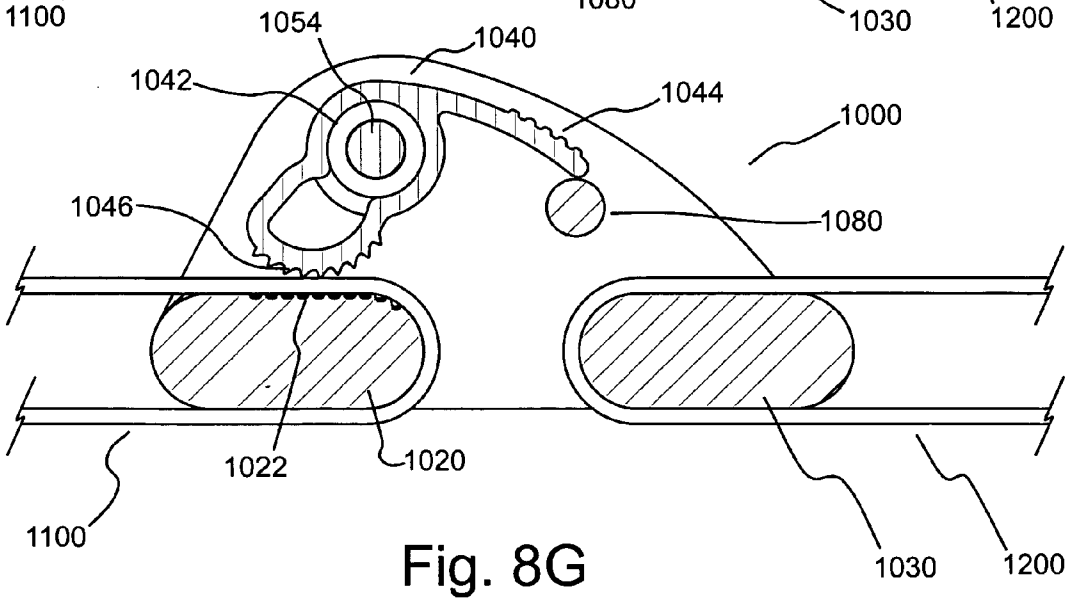
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Fig. 8G

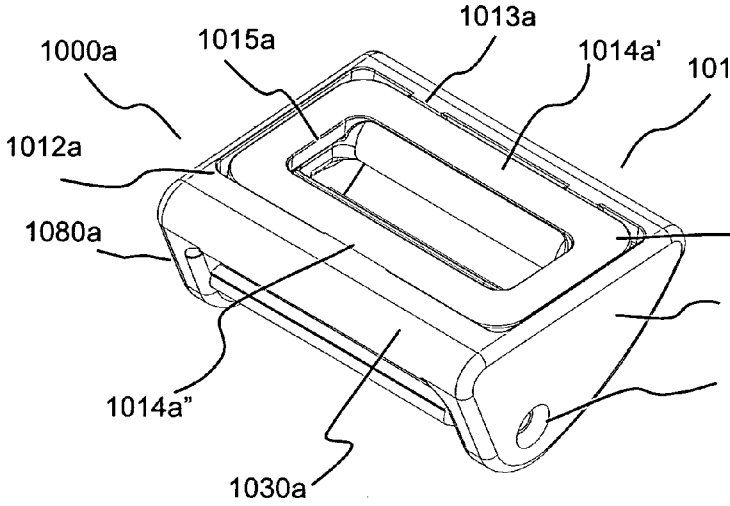
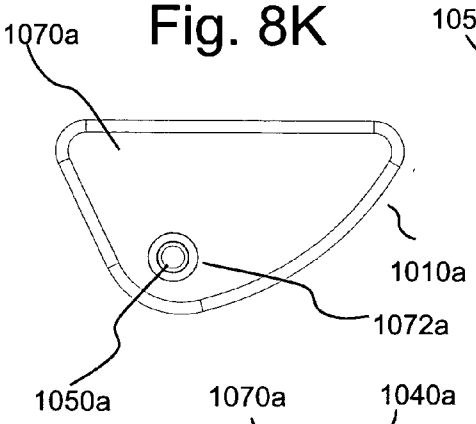


Fig. 8I

Fig. 8K



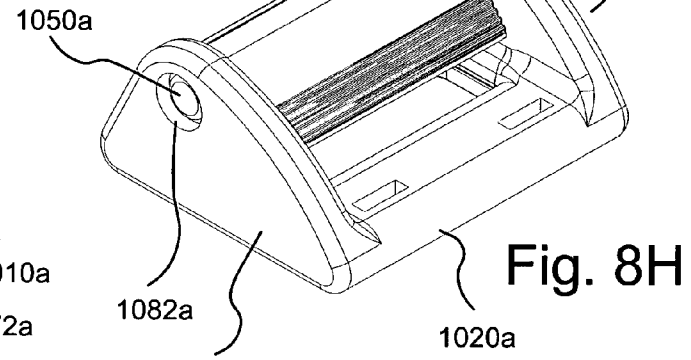


Fig. 8H

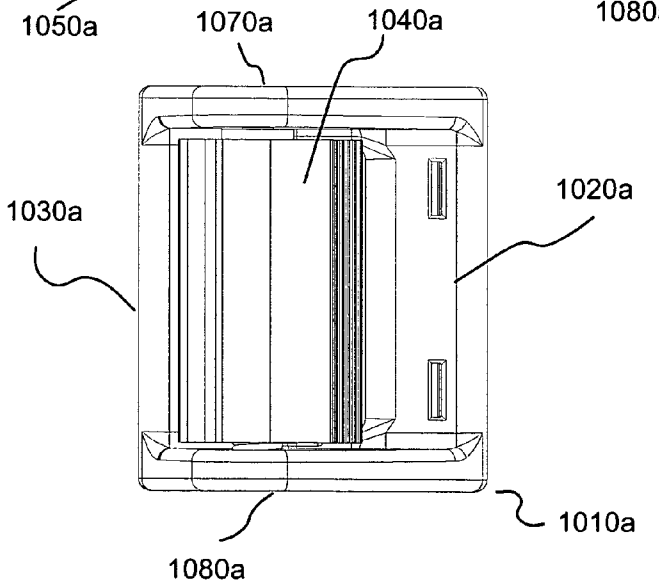


Fig. 8J

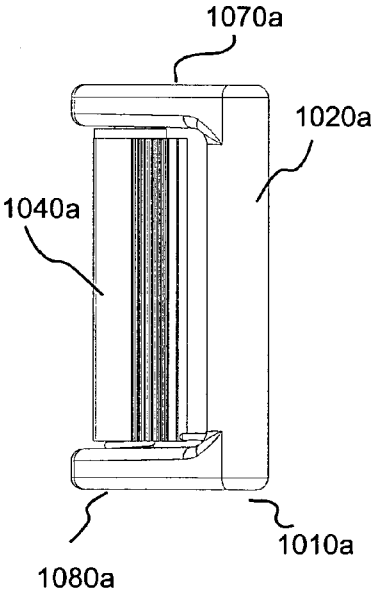
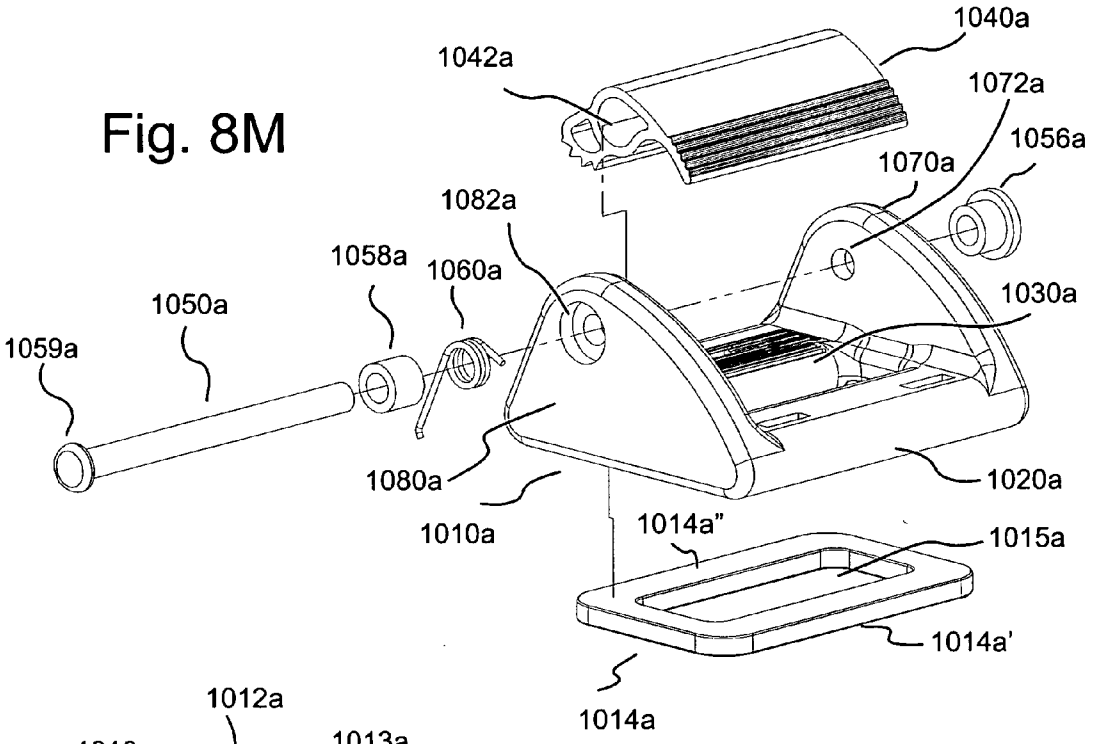


Fig. 8L

Fig. 8M



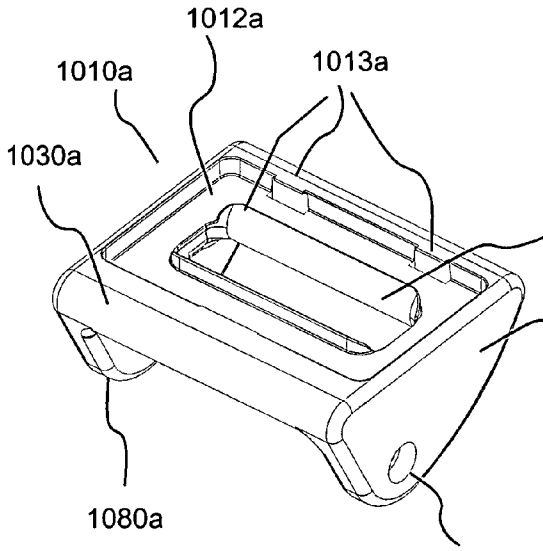


Fig. 8O

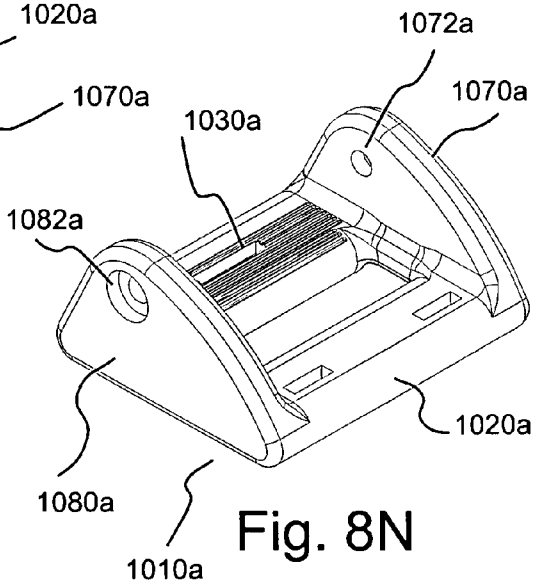


Fig. 8N

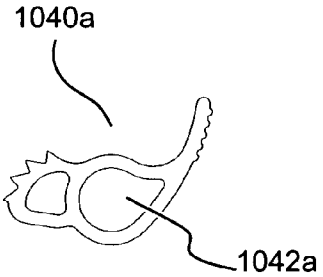


Fig. 8P

Fig. 8Q

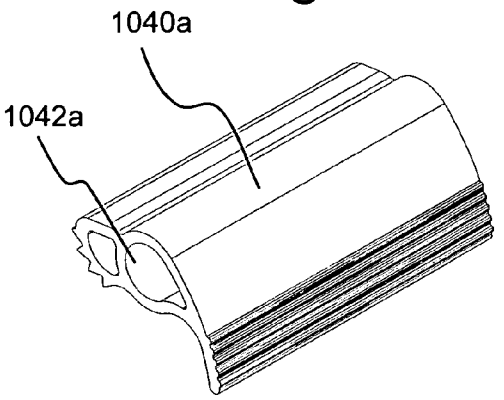


Fig. 8R

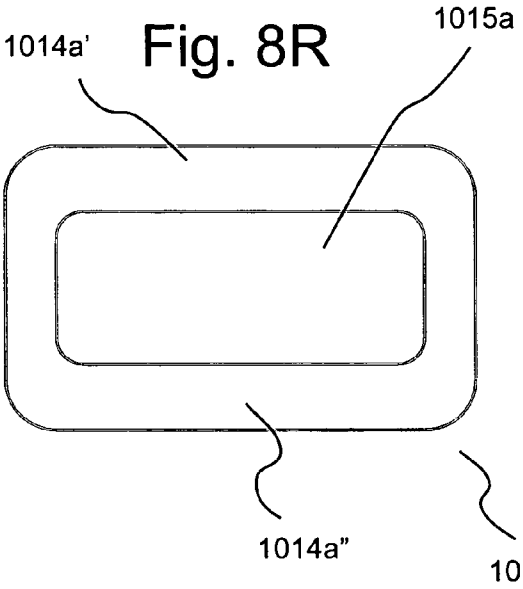
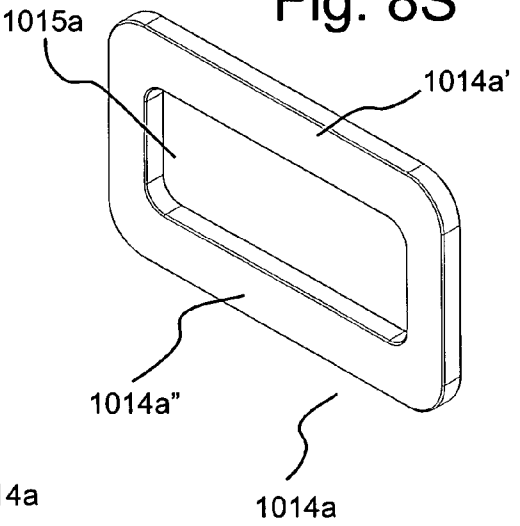


Fig. 8S



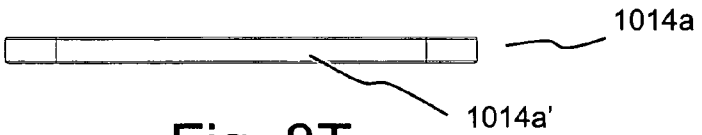


Fig. 8T

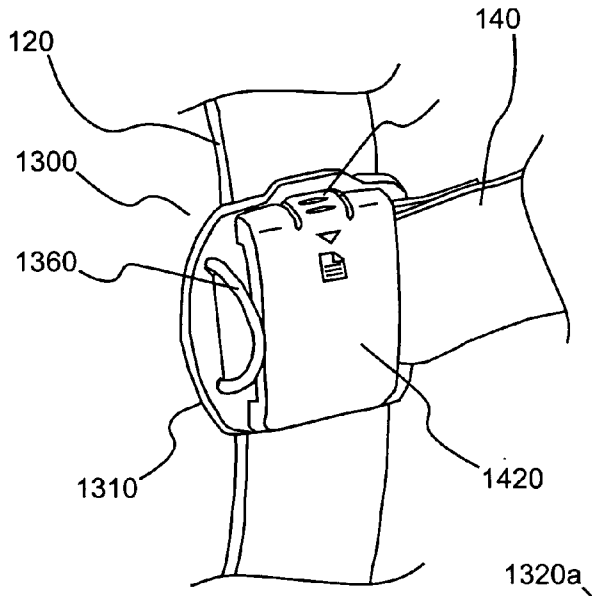


Fig. 9B

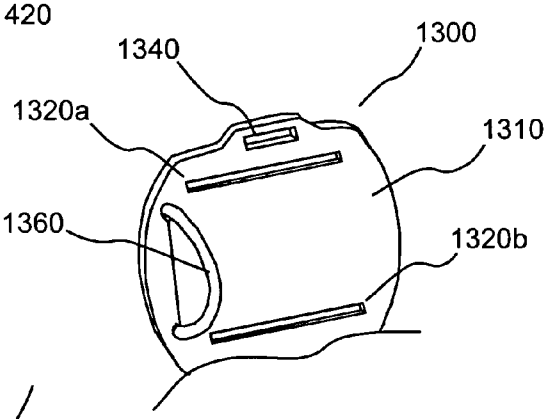


Fig. 9C

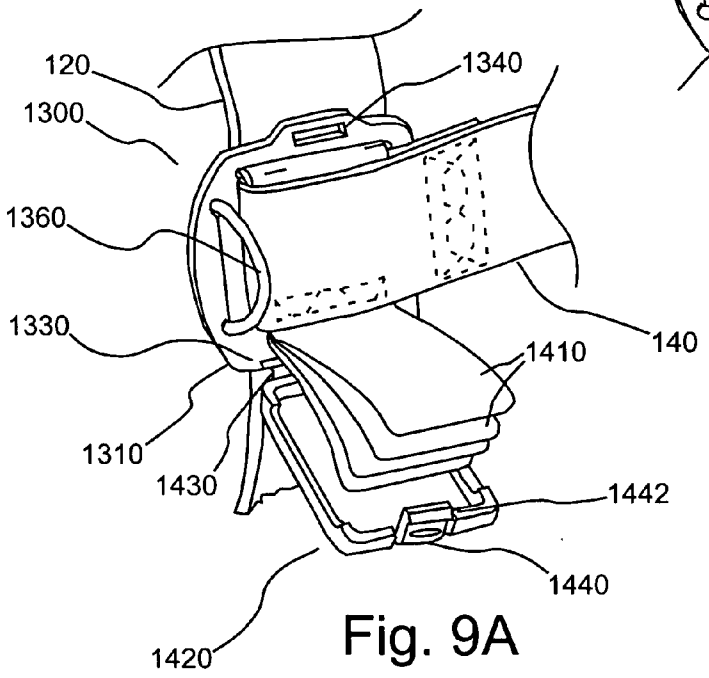
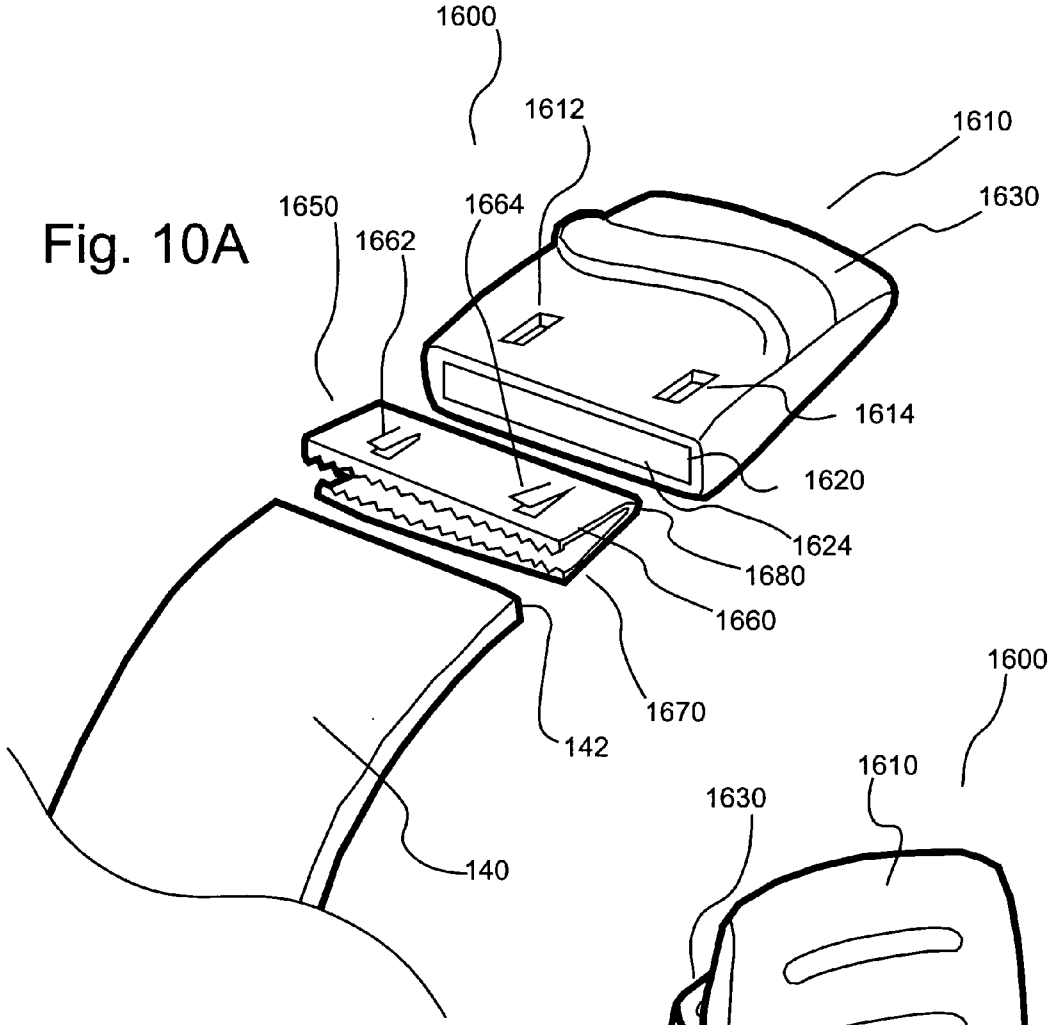


Fig. 9A

Fig. 10A



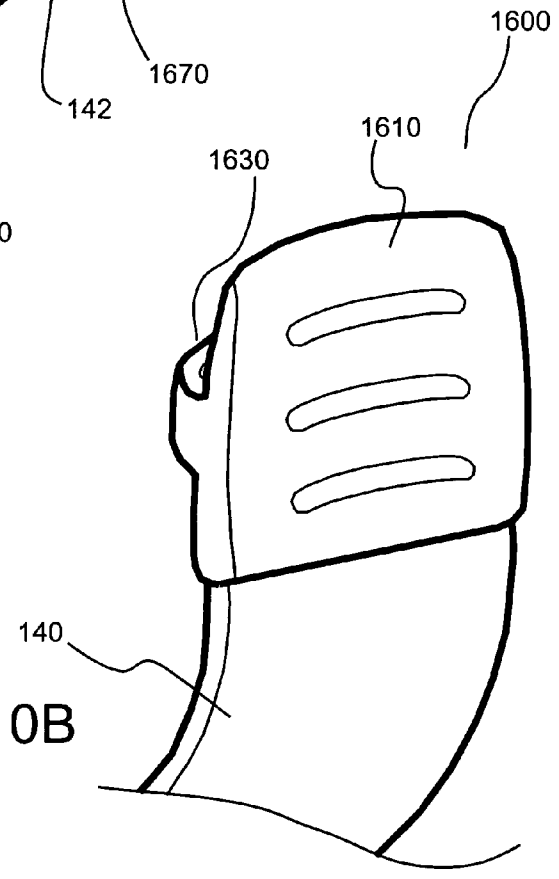


Fig. 10B

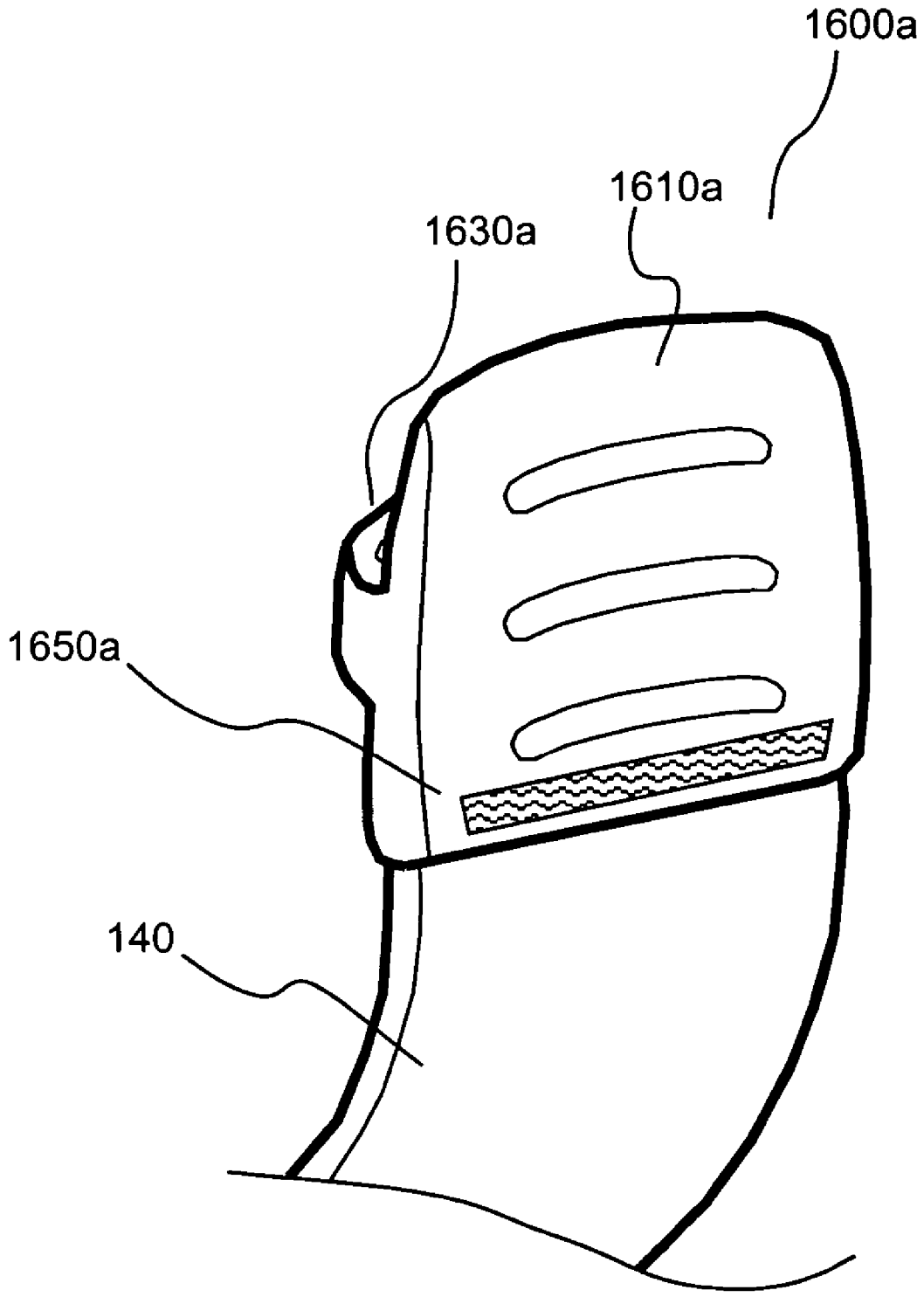


Fig. 10C

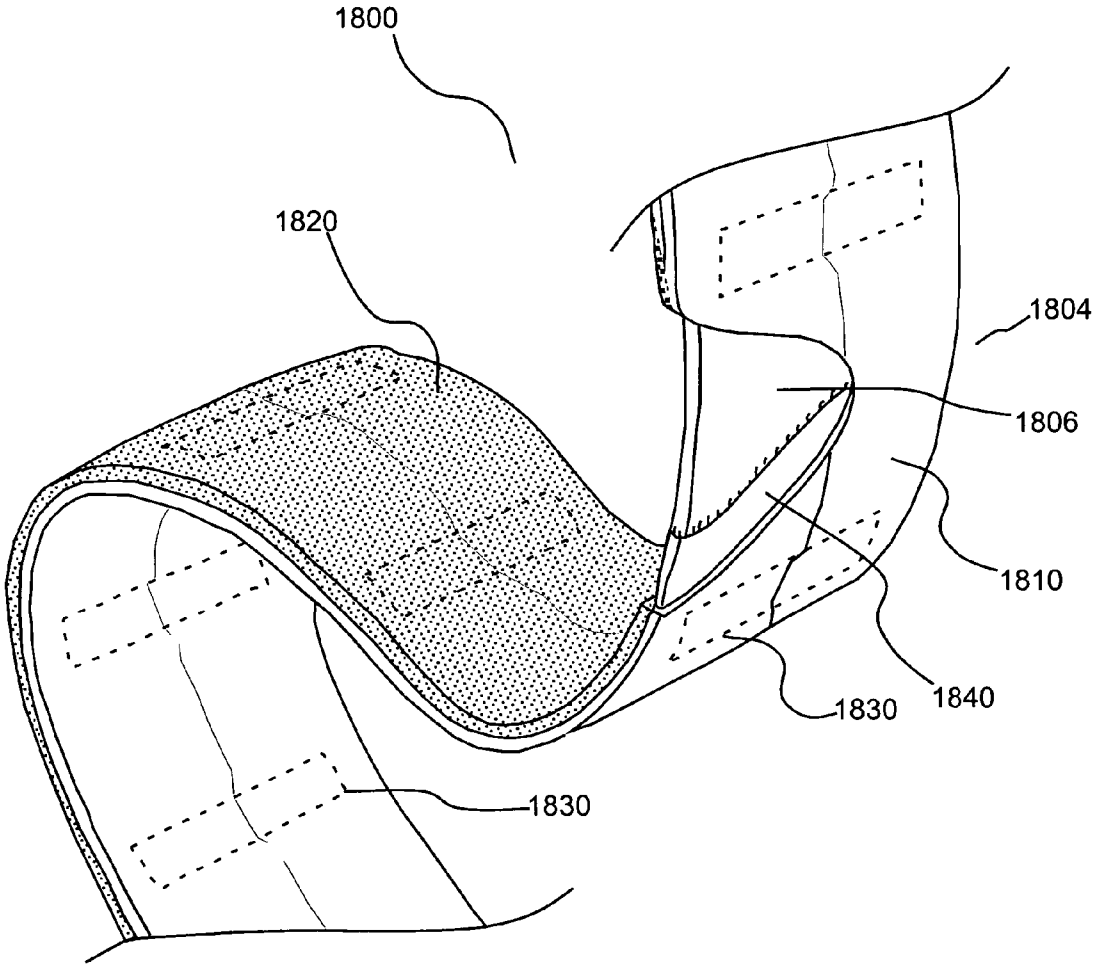
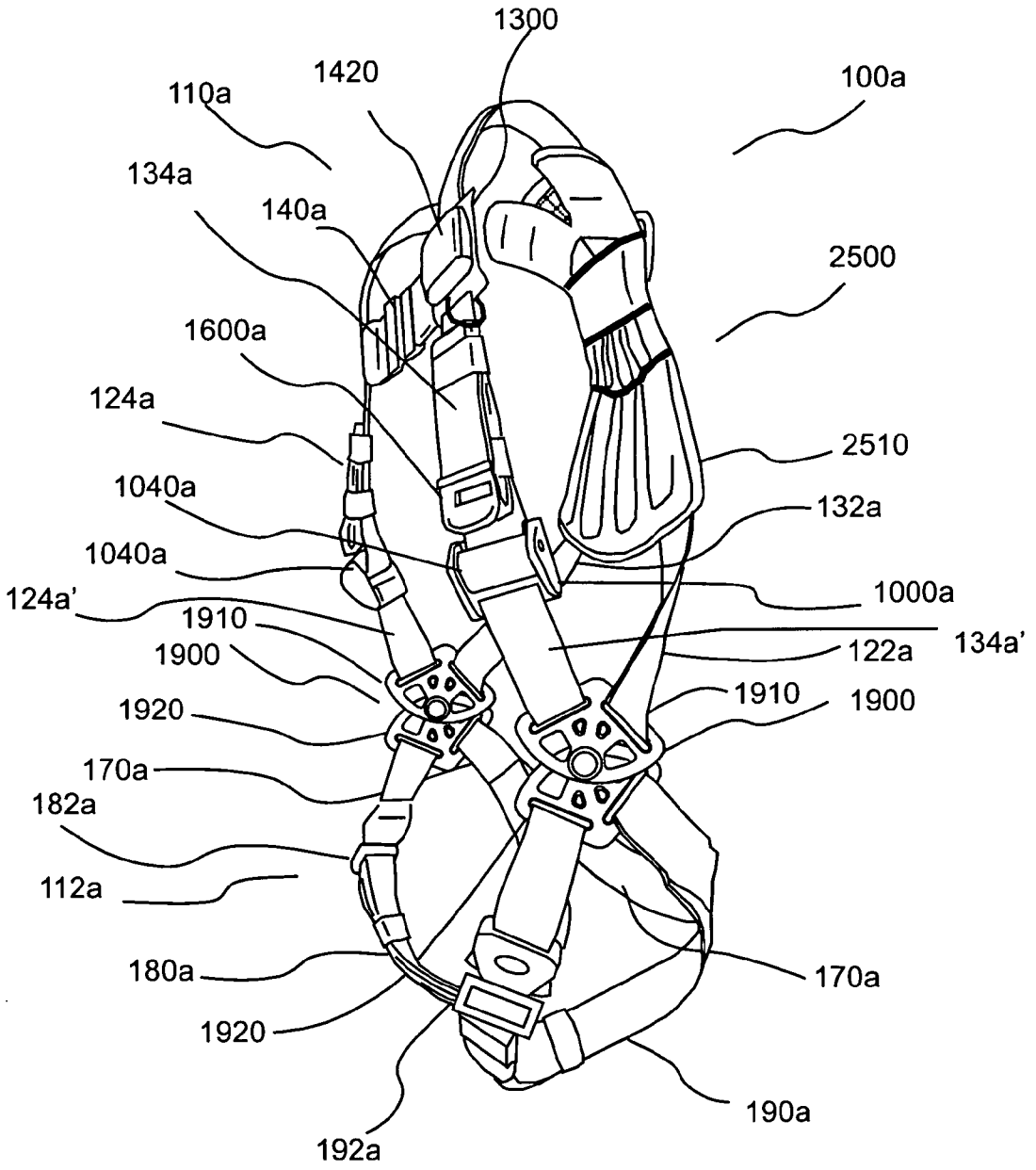


Fig. 11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112a
180a
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192a

Fig. 12A

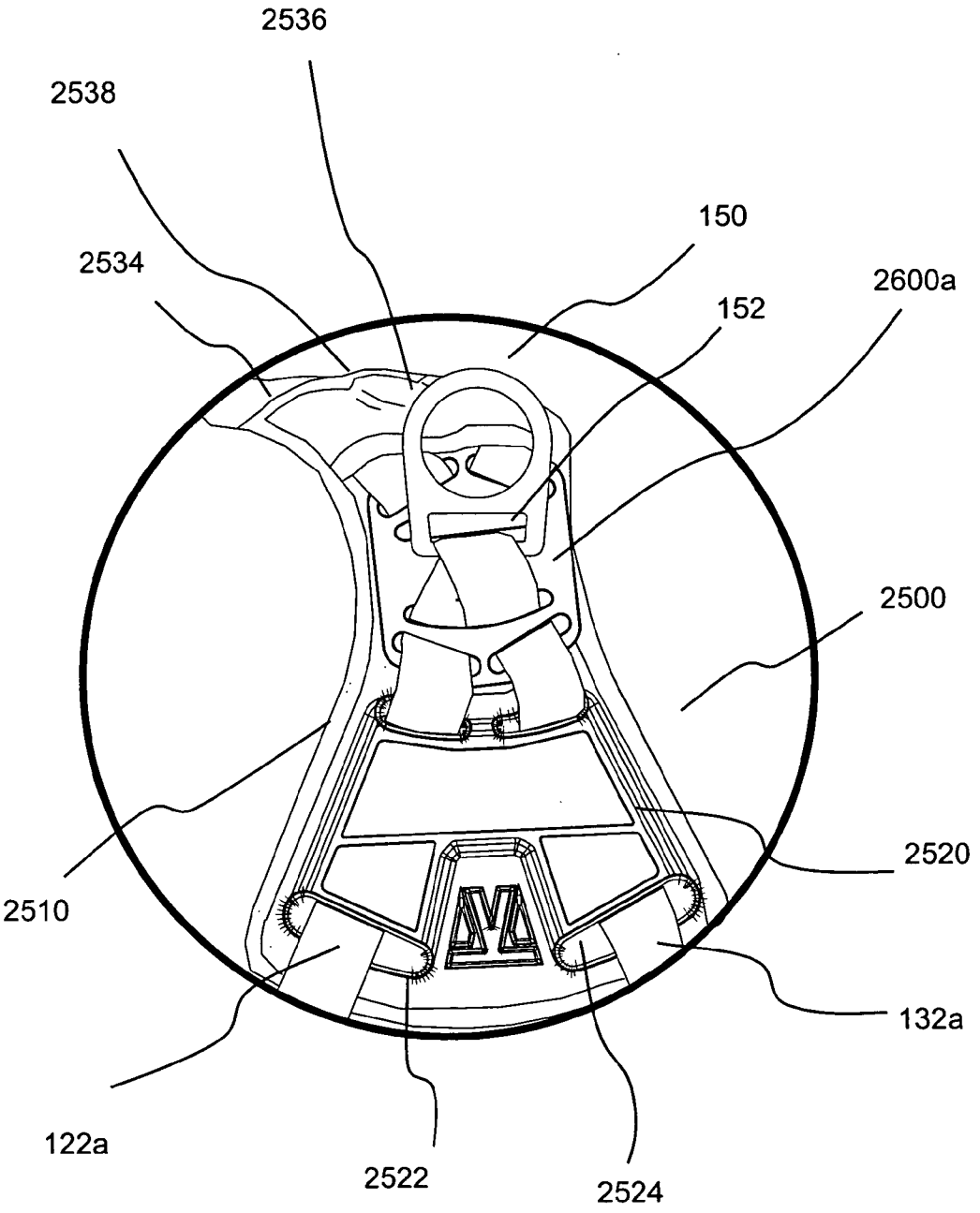
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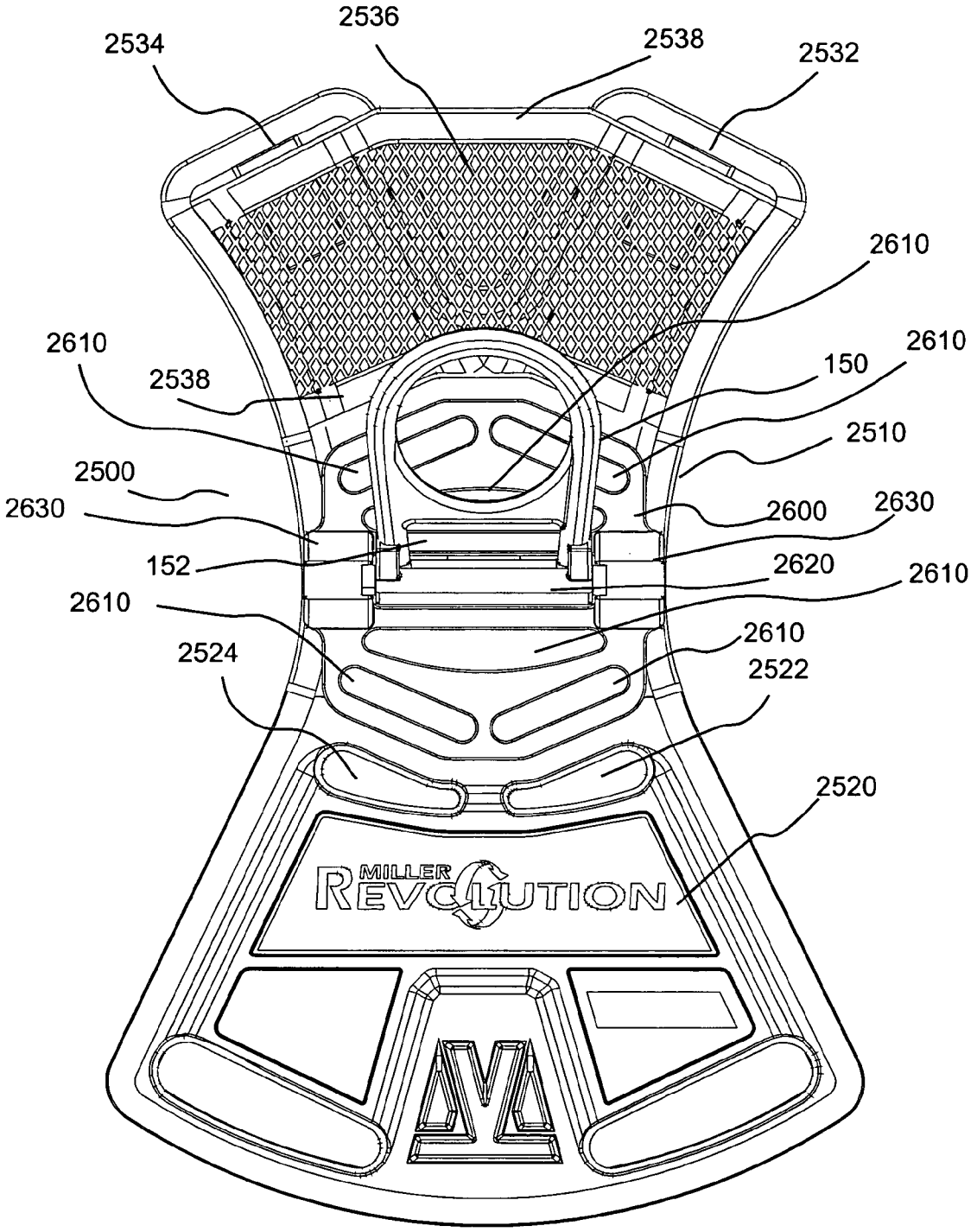
Fig. 12B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2520
MILLER
REVOLUTION

Fig. 12C

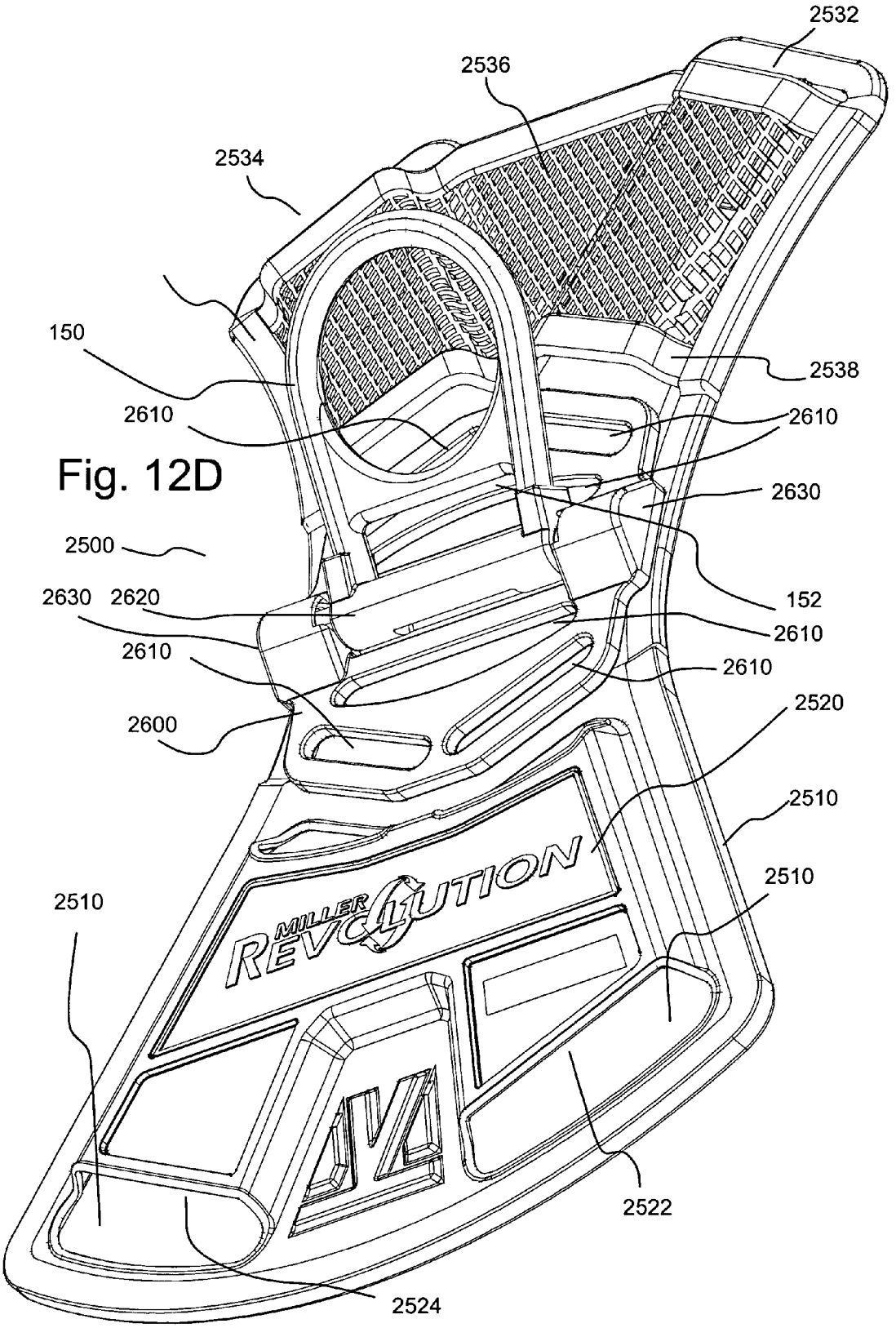
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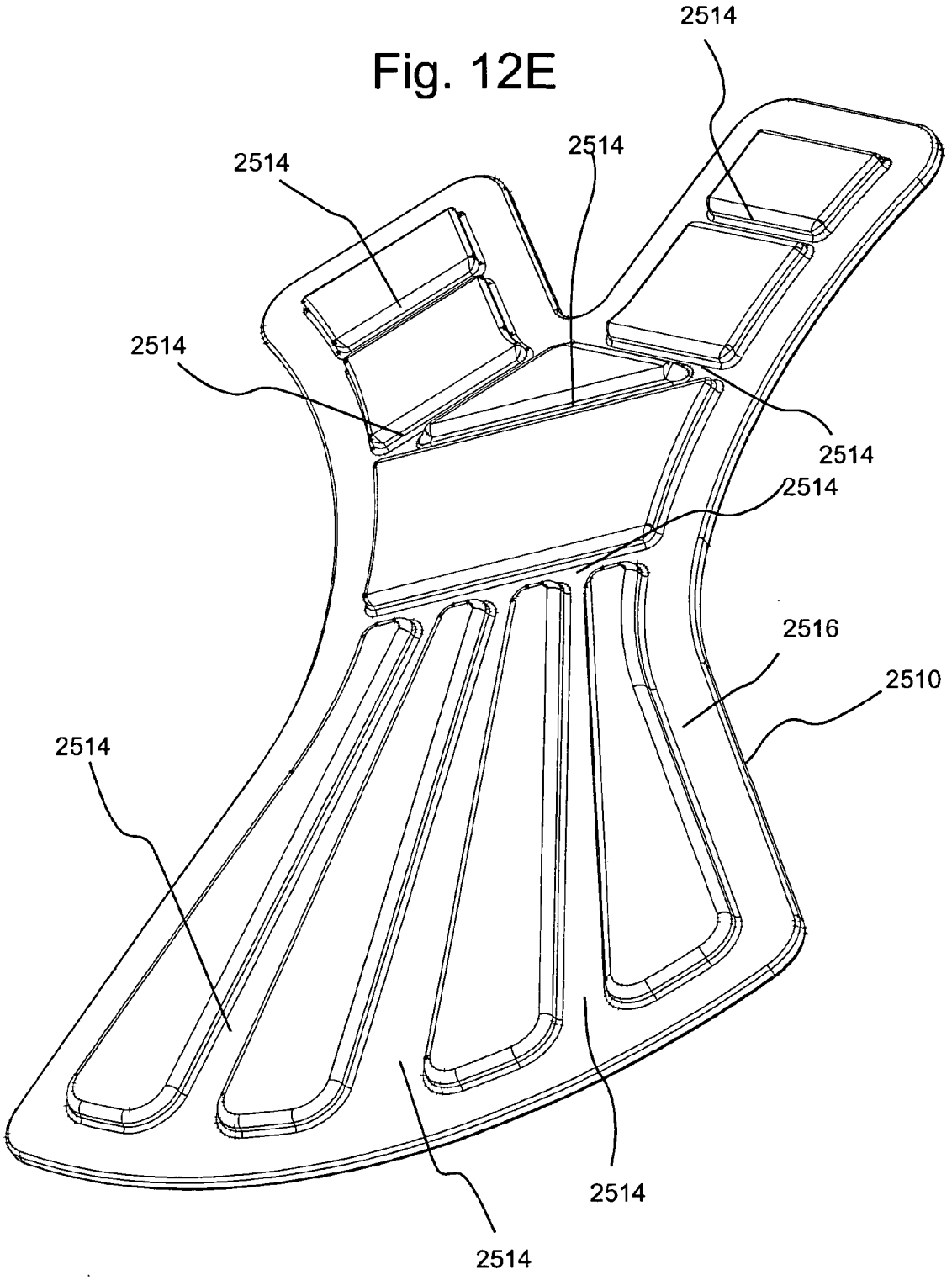
Fig. 12D

Fig. 12E



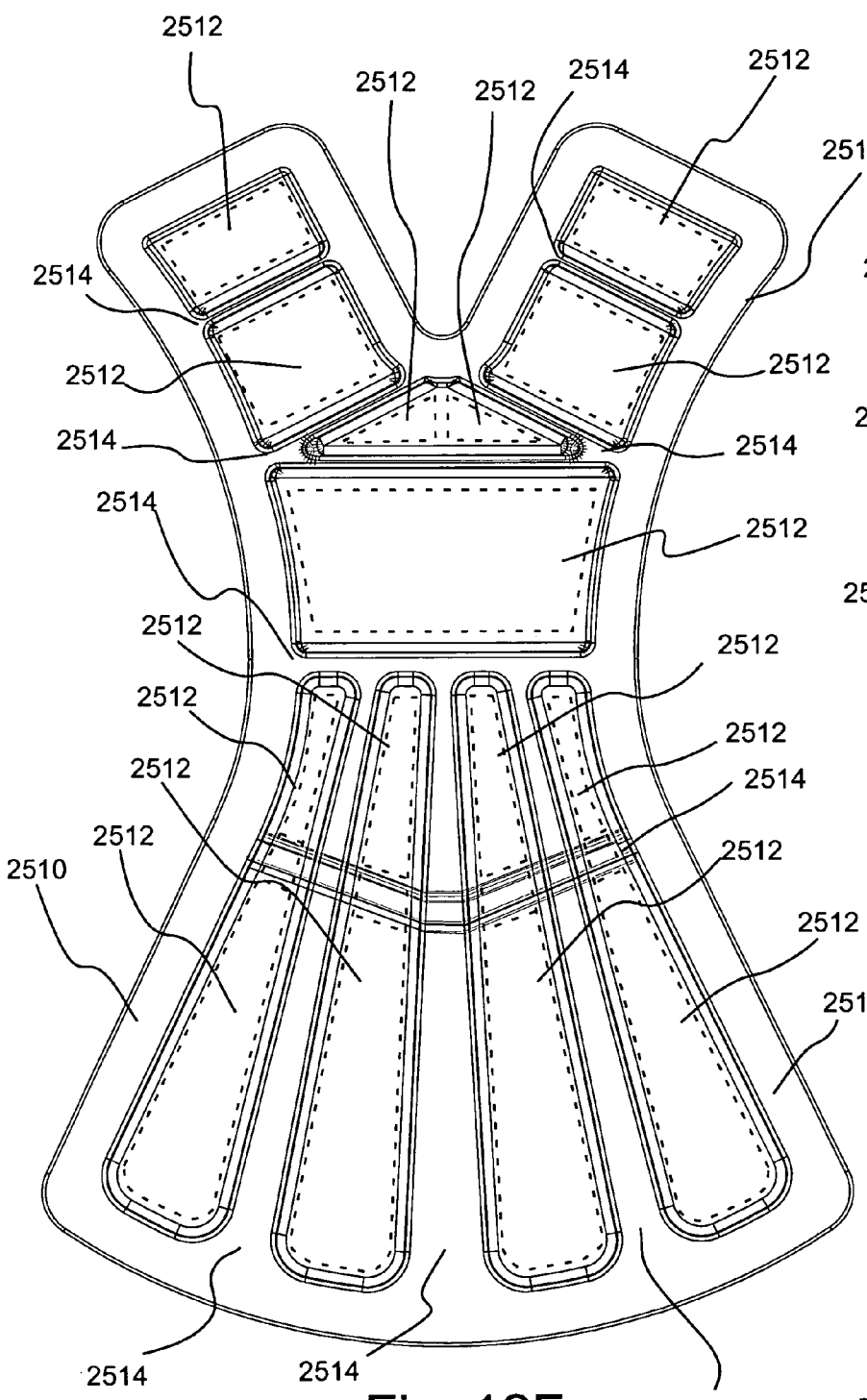


Fig. 12F

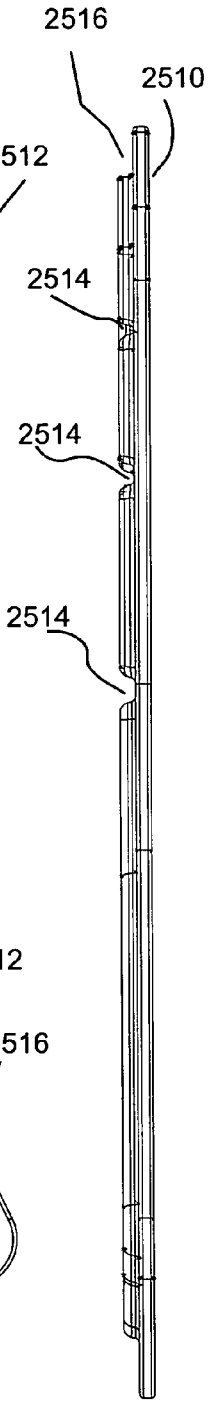


Fig. 12G

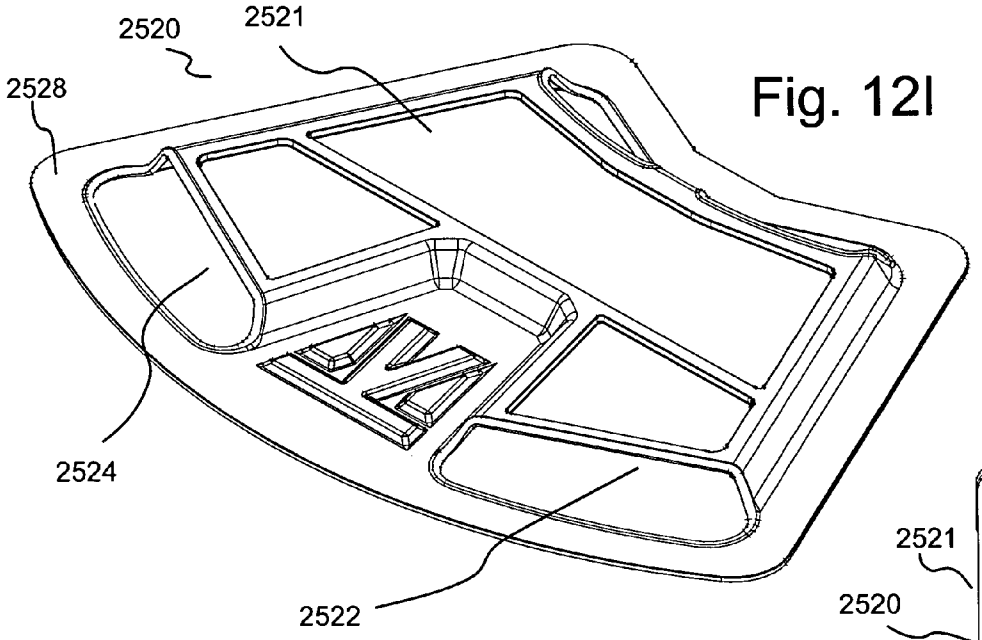


Fig. 12I

Fig. 12J

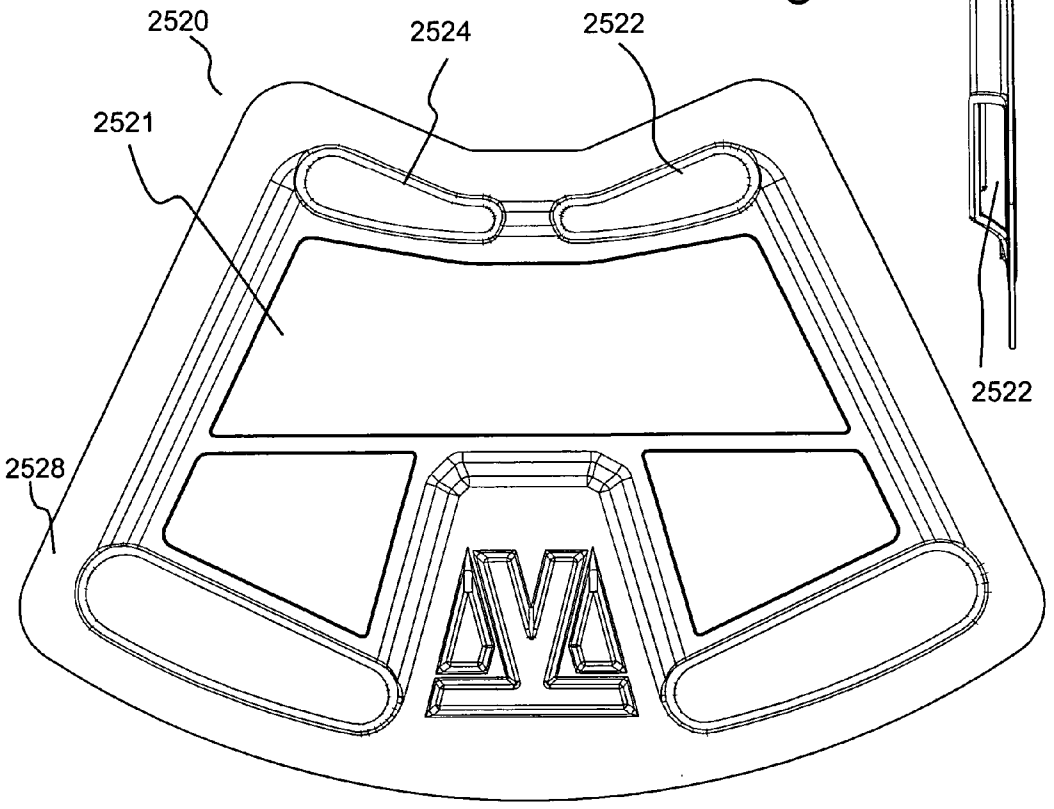
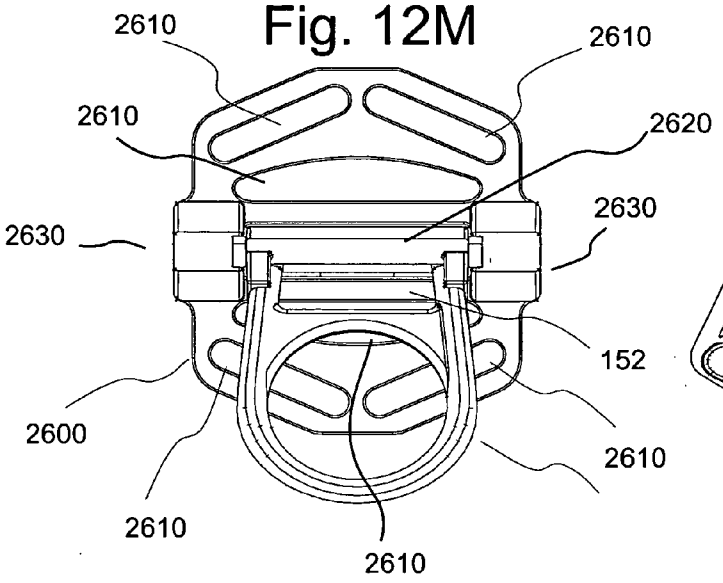


Fig. 12H

Fig. 12M



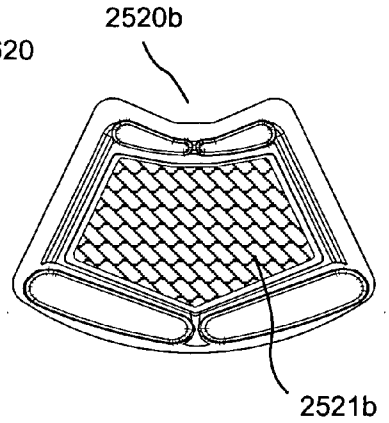


Fig. 12L

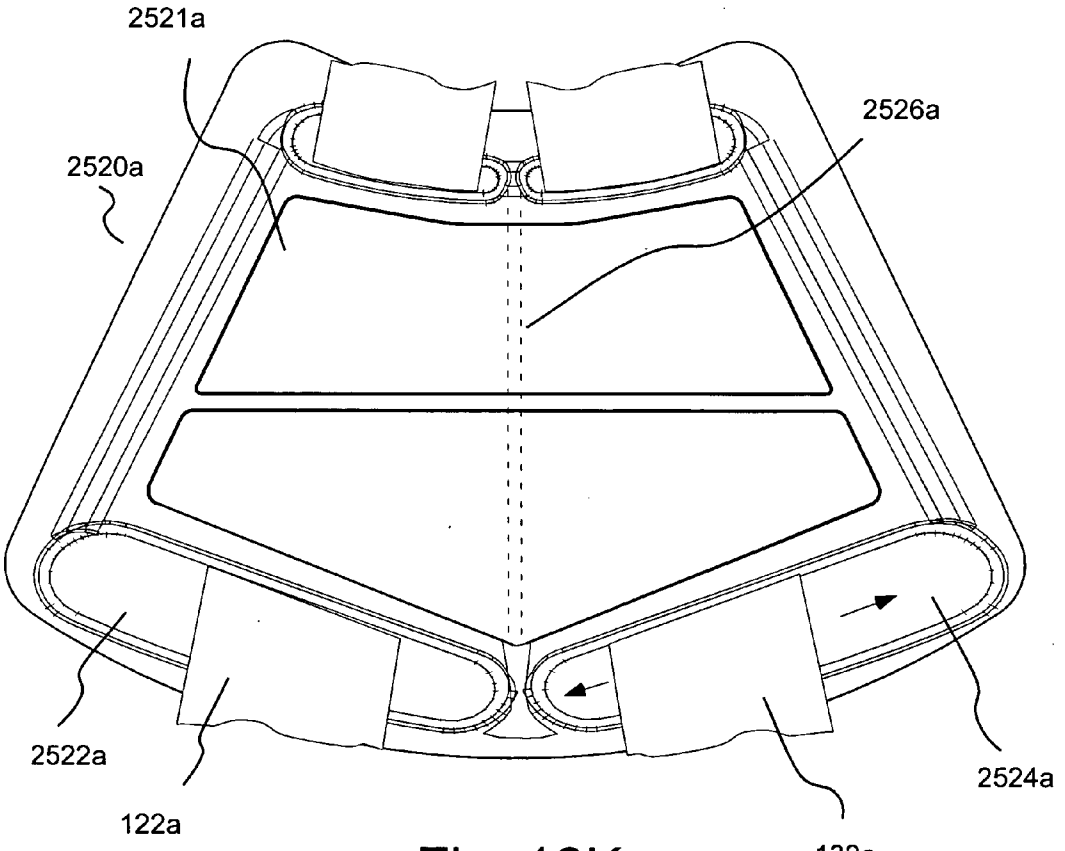


Fig. 12K

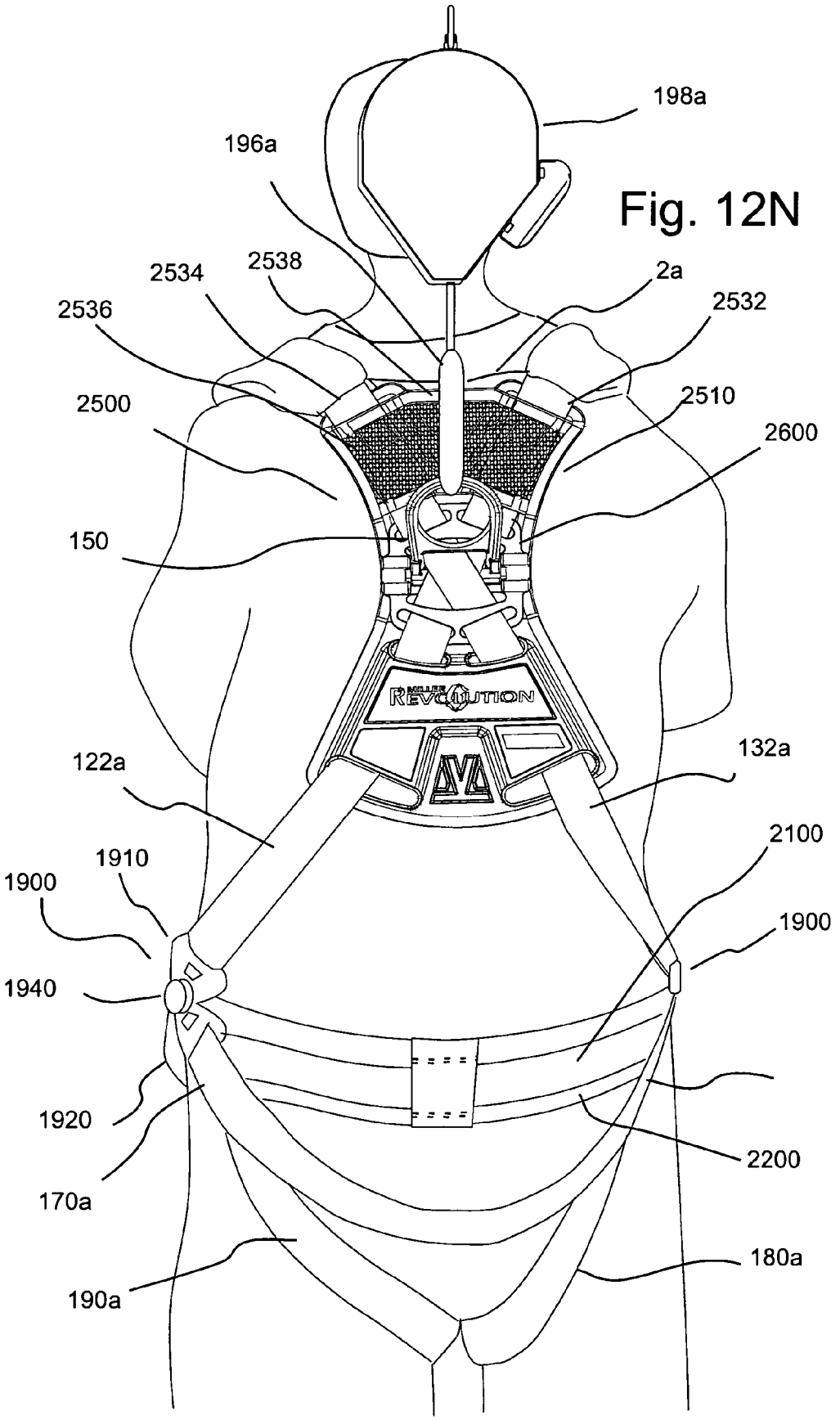

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Fig. 12N

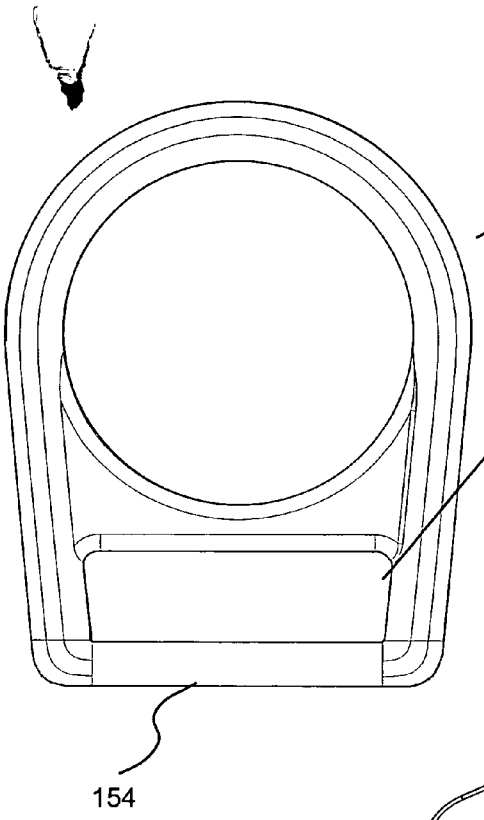


Fig. 12O

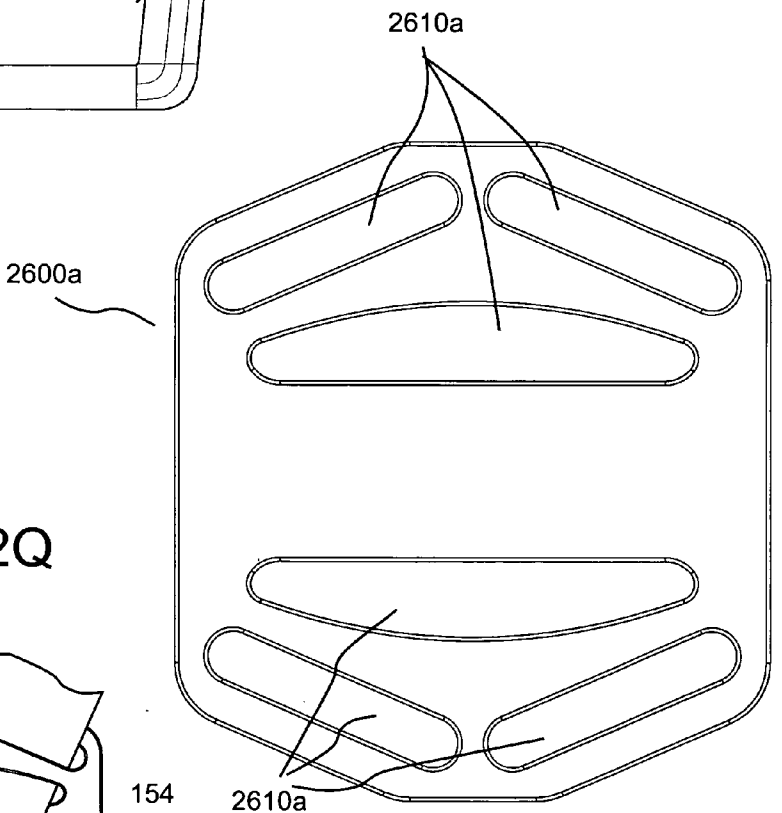
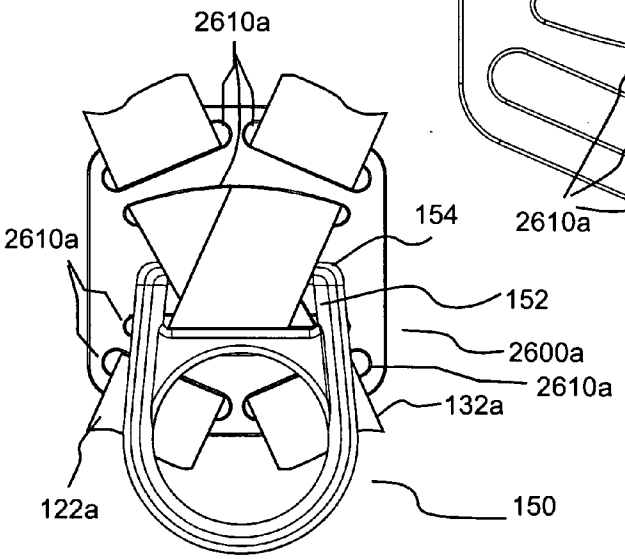


Fig. 12P

Fig. 12Q



SAFETY HARNESSES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present invention is a continuation in part application of U.S. patent application Ser. No. 11/179,228, filed Jul. 12, 2005, which claims benefit of U.S. Provisional Patent Application Ser. No. 60/587,130, filed Jul. 12, 2004, and U.S. Provisional Patent Application Ser. No. 60/611,438, filed Sep. 20, 2004, the disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The present invention relates generally to full body safety harnesses, and particularly to safety harnesses which, for example, provide improved or enhanced range of motion, comfort, ease of donning, ease of adjustment and ease of adding accessory equipment as compared to other safety harnesses.

[0003] References set forth herein may facilitate understanding of the present invention or the background of the present invention. Inclusion of a reference herein, however, is not intended to and does not constitute an admission that the reference is available as prior art with respect to the present invention.

[0004] Safety harnesses are commonly used as part of a fall protection system for persons subjected to the potential of a fall from a height. In the workplace, full-body safety harnesses are required when working at a height of six feet or greater. Such harnesses, which typically include both an upper torso portion (having, for example, shoulder straps) and a lower torso or seat portion (having, for example one or more leg straps and sometimes a seat strap), can be designed in many alternative manners.

[0005] Many currently available full-body safety harnesses are manufactured from relatively inelastic, woven webbing materials such as nylon or polyester. A flexible and elastic harness, as described in U.S. Pat. No. 6,006,700, assigned to the assignee of the present invention, the disclosure of which is incorporated herein by reference, has been introduced that greatly improves the comfort of the user during normal use of the safety harness. A safety harness with blunted edges for further increasing the comfort of the user is disclosed in U.S. Pat. No. 6,739,427, assigned to the assignee of the present invention, the disclosure of which is incorporated herein by reference.

[0006] Although the comfort of safety harnesses during normal use and even during a fall arrest has been greatly improved in the above-described harnesses, the underlying design of currently available safety harnesses still leads to a number of problems including, for example, range of motion problems, comfort problems, donning problems, adjustment problems and webbing wear problems. **FIG. 1** illustrates an embodiment of a conventional, commercially available full-body safety harness **10** Safety harness **10** includes an upper torso portion **12** comprising first and second shoulder straps **20** and **30**, respectively, for extending over the shoulders of the user and a multi-component chest strap **40** for extending over a portion of the chest of the user.

[0007] A first end of each of shoulder straps **20** and **30** extends down over the back of the user to form first and second generally longitudinal back straps **22** and **32**, respectively. Longitudinal back straps **22** and **32** of shoulder straps **20** and **30** cross through and connect to a typical D-ring **50** as known in the art. D-ring **50** includes a harness connection portion **52** and an anchor portion **54**. Harness connection portion **52** enables fastening of D-ring **50** to safety harness **10** via longitudinal back straps **22** and **32**. Anchor portion **54** is adapted to be connected to a nylon rope, a chain, webbing or other connector which may be used to anchor the person wearing safety harness **10**.

[0008] After crossing and passing through D-ring **50**, shoulder straps **20** and **30** are connected via a generally latitudinal back strap **60**. Latitudinal back strap **60** passes generally latitudinally over a portion of the back of the user.

[0009] A second end of each of shoulder straps **20** and **30** extends downward over the front of the user to from generally longitudinal first and second front straps **24** and **34**, respectively. A first chest strap portion **42** is attached to front strap **24** and a second chest strap portion **44** is attached to front strap **34**. Each of first and second chest straps **42** and **44** have cooperating fastening members **46** and **48** on the ends thereof to enable attachment of first and second chest straps **42** and **44** to form chest strap **40**. As known in the art, first and second chest straps **42** and **44**, respectively, are preferably attached via an adjustable mating friction buckle mechanism, including, for example, cooperating fastening members **46** and **48**.

[0010] First and second front straps **24** and **34** of shoulder straps **20** and **30**, respectively, extend further downward and preferably include adjustment members **26** and **36** (for example, adjustable friction buckles) as known in the art for adjustment of the fit of safety harness **10** on the upper torso of the user. Extending still further downward, extensions **24***a* and **34***a* of first and second front straps **24** and **34** converge and, in connection with several other components of safety harness **10** as described below, form a lower torso, seat or subpelvic portion **70**. First and second front extension straps **24***a* and **34***a* connect at section **98**, passing to the rear and under the seat of the user.

[0011] Attached to and extending from seat portion **70** are a first and a second leg strap **80** and **90**, respectively. Each of first and second leg straps **80** and **90** pass around the upper leg of the user to be attached to the distal end of first and second longitudinal back straps **22** and **32**, respectively. The distal ends of each of first and second leg straps **80** and **90** and the distal ends of each of longitudinal back straps **22** and **32** thus preferably comprise cooperating fastening members (**82** and **92** and **28** and **38**, respectively) such as adjusting buckle members as known in the art.

[0012] A number of previous safety harnesses included connections in the area of the hips of the wearer between an upper portion of the harness and a lower portion of the harness. For example, U.S. Pat. No. 5,957,091 discloses another design of a body harness including a pair of shoulder straps, a pair of leg straps and a pair of rigid, one-piece hip plates. The shoulder straps are connected at both ends to the hip plates and pass through a back pad and through a shoulder strap retainer (preferably a front or a chest strap). Each leg strap is connected at one end to one of the same rigid hip plates to which the shoulder straps are connected and can be connected at the other end to one of the same rigid hip plates to which the shoulder straps are connected.

Adjustment of the fit of the shoulder straps of the body harness of U.S. Pat. No. 5,957,091 is accomplished through the use of a set of three adjacent parallel slots in the rigid hip plates. Adjustment of the leg straps of the body harness of U.S. Pat. No. 5,957,091 is accomplished through the use of a quick fit buckle.

[0013] A pair of rigid hip connections to which harness strapping was connected were also incorporated in the sides of, for example, the 1983 safety harness that was available from CAN—Miller Safety, LTD of Canada. Semi-rigid hip plates or members to which harness strapping is connected are likewise found on the 750 and 751 safety harnesses currently available from Bacou-Dalloz Fall Protection, Inc. of Franklin, Pa.

[0014] In general, it is difficult, for example, to bend forward or rearward in a harness such as harness **10** and other harnesses because of the resistance of the interconnected strapping material forming the harness. In that regard, a continuous strap or a series of interconnected strap sections from part of the upper torso portion as well as the lower seat section. Use of an elastic strapping material as disclosed in U.S. Pat. No. 6,006,700 facilitates such bending, but resistance is still present. In that regard, bending forward and/or rearward causes significant pulling (that is, tension in the strapping) on the lower torso or seat portion of the harness. Moreover, the interconnected, crossing nature of currently available harnesses such as harness **10** causes adjustment of the fit of one portion of harness **10** to affect the fit/tension in other portions of the harness. For example, adjustment of buckle **26** to adjust the length of shoulder strap **20** affect the fit/tension of one or both of leg straps **80** and **90**. In harnesses that include rigid or semi-rigid connectors in the area of the hips of the wearer to interconnect straps of the harness, tension is passed through the hip plate or member between the upper and lower portions of the harness and substantial resistance to bending is experienced.

[0015] Full body safety harnesses are sometimes provided with a rear pad or back pad that can function, at least in part, to guide the rear strap portions of the shoulder straps in a crossing fashion over the back of the user. See, for example, U.S. Pat. Nos. 6,804,830 and 6,253,874 and U.S. Design Patent No. D454,986.

[0016] U.S. Pat. No. 6,804,830 discloses a generally Y-shaped or a generally X-shaped, spreading back pad wherein the upper arms of the X-shaped back pad are longer than the lower arms to spread the shoulder straps of the harness away from the neck area of the body. See, for example, col. 3, lines 3-15. The crossing shoulder straps are connected to slots in the back pads of U.S. Pat. No. 6,804,830.

[0017] U.S. Pat. No. 6,253,874 discloses a back pad or connector including a generally rigid connector including a plurality of slots to which crossing shoulder straps are connected. The connector is generally triangular in shape and functions to maintain the crossed straps at a desired spaced distance.

[0018] A number of problems exist with current back pad designs. For example, the crossing shoulder straps are maintained by the back pad at a generally defined spacing before and/or after crossing. Maintenance of such predetermined spacing(s) can prevent the harness from fitting properly on widely varying body types. Moreover, current back pad designs provide little if any protection to the safety harness or the user of the safety harness from, for example, impact from sharp and/or heavy equipment such as snap hooks and/or self-retracting lifelines which are typically connected to rear D-rings positioned at the crossing point of the shoulder straps. Such impacts can damage the straps of the safety harness and injure the wearer. Further, current back pads do not adequately provide for the comfort of the user.

[0019] In addition to the above-identified problems, users of currently available safety harnesses find it very difficult to adjust the fit of the safety harness and other fall protection safety gear using friction buckles and other types of adjustment mechanisms found on such safety harnesses. Moreover, this difficulty can often be increased with the use of harness webbing material designed to increase the comfort of the user. Furthermore, it is often difficult to don currently available safety harnesses. Although efforts have been made to simplify the donning of a safety harness by, for example, fabricating the harness material so that the harness maintains its form when not worn as described in U.S. Pat. No. 6,739,427 or by providing a back connector assembly sufficiently rigid to give an undonned harness some shape (see, for example, U.S. Pat. No. 6,253,874), problems in donning persist. For example, it is often difficult of the user of the harness to determine which side of the harness material is the outer or inner side, leading to donning of the harness in and inside-out conformation. Moreover, webbing material used in currently available safety harnesses and other fall protection safety gear is susceptible to fraying, particularly at the end thereof.

[0020] It is very desirable to develop improved safety harnesses that reduce or eliminate the above and other problems with currently available harnesses.

SUMMARY OF THE INVENTION

[0021] In one aspect, the present invention provides a full body safety harness to be worn by a person including an upper torso portion and a lower seat portion. The upper torso portion is operatively connected to the lower seat portion by a first connector on a first lateral side and a second connector on a second lateral side thereof. The first connector and the second connector enable forward and rearward rotation of the upper torso portion relative to the lower seat portion (as in the case of forward and rearward bending by a user of the harness) without causing a significant increase in tension in the lower seat portion. The less tension increases in the lower torso portion during bending, the better. Such tension increases in the lower torso portion of the harnesses of the present invention upon bending can, for example, be reduced to less than 10% or even substantially eliminated.

[0022] In one embodiment, at least one of the first connector and the second connector includes a rotating joint. Both of the first connector and the second connector can include a rotating joint. In another embodiment, at least one of the first connector and the second connector includes a ring member about which at least one strap of the upper torso portion or the lower seat portion is slidably attached. For example, the first connector can include an upper ring member and a lower ring member, wherein at least one end of a shoulder strap of the upper torso portion is slidably

attached to the upper ring member, and at least one strap of leg strap of the lower seat portion is slidably attached to the lower ring member.

[0023] The upper torso portion can, for example, include a first shoulder strap adapted to pass over a first shoulder of the person, wherein a first end of the first shoulder strap is adapted to extend over the front of the person to connect to the first connector and a second end of the first shoulder strap is adapted to extend over the back of the person to connect to the second connector. The upper torso portion can further include a second shoulder strap adapted to pass over a second shoulder of the person, wherein a first end of the second shoulder strap is adapted to extend over the front of the person to connect to the second connector and a second end of the second shoulder strap is adapted to extend over the back of the person to connect to the first connector. The safety harness can further include a first leg strap connected to the first connector and a second leg strap connected to the second connector. In one embodiment at least one of the first shoulder strap and the second shoulder strap includes an adjustment mechanism to adjust the length thereof and at least one of the first leg strap and the second leg strap includes an adjustment mechanism to adjust the length thereof. The first shoulder strap can include a first shoulder strap adjustment mechanism to adjust the length of the first shoulder strap, and the second shoulder strap can include a second adjustment mechanism to adjust the length of the second shoulder strap. The first leg strap can include a first leg strap adjustment mechanism to adjust the length of the first leg strap, and the second leg strap can include a second leg strap adjustment mechanism to adjust the length of the second leg strap.

[0024] In another aspect, the present invention provides a full body safety harness to be worn by a person including an upper torso portion and a lower seat portion, wherein the upper torso portion is operatively connected to the lower seat by a first rotating connector on a first lateral side and a second rotating connector on a second side thereof. The first rotating connector and the second rotating connector enable rotation of the upper torso portion relative to the lower seat portion (as occurs, for example, upon forward and rearward bending by the person).

[0025] The first rotating connector can be positioned to rotate about a point in the vicinity of the axis of rotation of the hips of the person when worn by the person. Likewise, the second rotating connector can be positioned to rotate about a point in the vicinity of the axis of rotation of the hips of the person when worn by the person. In one embodiment, the first rotating connector (and/or the second rotating connector) includes an upper connective member and a lower connective member. The upper connective member is rotatably connected to the lower connective member. The upper connective member can, for example, be connected to the lower connective member by a shaft about which the upper connective member can rotate relative to the lower connective member. The upper connective member can include at least one attachment adapted to connect to harness strapping, and the lower connective member can include at least one attachment adapted to connect to harness strapping. In one embodiment, the upper connective member includes at least two slots formed therein for attachment of harness strapping, and the lower connective member includes at least two slots formed therein of attachment of harness strapping.

[0026] The rotating connectors of the present invention can further include an accessory connector attached to an outer surface thereof which is adapted to connect accessories to the full body safety harness. Likewise, the rotating connectors of the present invention can include a belt connector attached to an inner surface thereof which is adapted to connect the full body safety harness to a belt (for example, a safety positioning belt comprising an anchor attachment or a tool belt).

[0027] The upper torso portion of the full body safety harness can include a first shoulder strap adapted to pass over a first shoulder of the person, wherein a first end of the first shoulder strap is adapted to extend over the front of the person to connect to the first rotating connector, and a second end of the first shoulder strap is adapted to extend over the back of the person to connect to the second rotating connector. The upper torso portion can further include a second shoulder strap adapted to pass over a second shoulder of the person, wherein a first end of the second shoulder strap is adapted to extend over the front of the person to connect to the second rotating connector, and a second end of the second shoulder strap is adapted to extend over the back of the person to connect to the first rotating connector. In this embodiment, the first shoulder strap and the second shoulder strap cross over each other in the back of the full body safety harness. The lower torso portion can include a first leg strap connected to the first rotating connector and a second leg strap connected to the second rotating connector. At least one of the first shoulder strap and the second shoulder strap can include an adjustment mechanism to adjust the length thereof and at least one of the first leg strap and the second leg strap can include an adjustment mechanism to adjust the length thereof. In one embodiment, the first shoulder strap includes a first shoulder strap adjustment mechanism to adjust the length of the first shoulder strap; the second shoulder strap includes a second adjustment mechanism to adjust the length of the second shoulder strap; the first leg strap include a first leg strap adjustment mechanism to adjust the length of the first leg strap; and the second leg strap includes a second leg strap adjustment mechanism to adjust the length of the second leg strap.

[0028] In one embodiment, the full body safety harness of further includes a cam buckle in operative connection with at least one of strap section of the upper torso portion or the lower torso portion to adjust a fit of the strap section. The cam buckle can include a base and a locking member in moveable, operative connection with the base. The locking member can include an abutment surface moveable into and out of contact with the strap. In one embodiment, the locking member is rotatably attached to the base, and the abutment surface is biased in connection with the strap.

[0029] The base can include a strap support over which a strap of the safety harness passes. The abutment surface of the locking member can be biased in connection with a first surface of the strap over a section of the strap wherein a second, opposing surface of the strap contacts the support member. The locking member can include a lever arm to which force is applied to move the locking member into a release position in which the abutment surface is out of

contact with the strap. The cam buckle can also include an activating mechanism that must be activated to enable the locking member to be moved to a release position.

[0030] In another embodiment, the safety harness includes a connector attached to at least one strap section of the upper torso portion or the lower torso portion. The connector includes a first attachment mechanism to attach the connector to the strap and a second attachment mechanism to attach an item to the connector. The connector can, for example, include a base, and the first attachment mechanism can includes a pair of slots formed in the base. The connector can further include a closure in operative connection with the base. In one embodiment, the base and the enclosure at least partially enclose at least one label (including, for example, printed information about or relative to the harness) when the closure in a closed state. In one embodiment, the closure includes a hinge about which the closure is rotatable to the closed state and to an open state. For example, the at least one label can be accessible when the closure is in an open state. The closure can further include a releasable locking mechanism to releasably cooperate with the base to hold the closure in a closed state.

[0031] In another embodiment, the safety harness further includes at least one strap section having an interior surface that is adjacent a wearer when the safety harness is worn and an exterior surface generally opposite the interior surface. The interior surface is perceptibly different from the exterior surface so that a wearer can distinguish the interior surface from the exterior surface. The interior surface can, for example, have a different color from the exterior surface. The interior surface can, for example, have a different texture from the exterior surface. The interior surface can, for example, be softer than the exterior surface. The exterior surface can, for example, have a greater abrasion resistance than the interior surface. In one embodiment, the interior surface and the exterior surface are formed about a generally tubular outer shell. In this embodiment, he strap section can further include a flexible inner material.

[0032] In a further embodiment, the safety harness further includes at least one strap section having a first end. The first end includes an end member in operative connection therewith. The end member includes a retaining member to connect the end member to the at least one strap or to another strap of the harness. The retaining member can, for example, include an extending arm to extend around the another strap. In one embodiment, the extending member is biased against the another strap when extending around the another strap.

[0033] In another aspect, the present invention provides a full body safety harness to be worn by a person including an upper torso portion and a lower seat portion. The upper torso portion is operatively connected to the lower seat by at least one connector adapted to enable rotation of the upper torso portion over a range of positions forward and rearward relative to the lower seat portion without causing significant tension in the lower seat portion.

[0034] In a further aspect, the present invention provides a full body safety harness to be worn by a person including an upper torso portion and a lower seat portion. The upper torso portion is removably connected to the lower torso or seat portion via a first connector on a first lateral side of the harness and a second connector on a second lateral side of the harness.

[0035] In one embodiment, the first connector includes an first upper connecting member to which at least one strap of the upper torso portion is connected and a first lower connecting member to which at least one strap of the lower torso portion is connected. The first upper connecting member and the first lower connecting member are adapted to be placed in operative connection. The second connector includes a second upper connecting member to which at least one strap of the upper torso portion is connected and a second lower connecting member to which at least one strap of the lower torso portion is connected. The second upper connecting member and the second lower connecting member are adapted to be placed in operative connection.

[0036] The first upper connecting member and the first lower connecting member in one embodiment are adapted to be placed in operative connection such that the first upper connecting member is rotatable about an axis relative to the first lower connecting member. The second upper connecting member and the second lower connecting member can also be adapted to be placed in operative connection such that the second upper connecting member is rotatable about an axis relative to the second lower connecting member.

[0037] In still a further aspect, the present invention provides a method of fabricating a full body safety harness, including: forming an upper torso portion of the full body safety harness; forming separately from the upper torso portion a lower seat portion; and connecting the upper torso portion to the lower seat portion via a first connector on a first lateral side of the full body safety harness and a second connector on a second side of the fill body safety harness. In one embodiment, the first connector includes an first upper connecting member to which at least one strap of the upper torso portion is connected and a first lower connecting member to which at least one strap of the lower seat portion is connected. The first upper connecting member and the first lower connecting member are adapted to be placed in operative connection. The second connector can also includes a second upper connecting member to which at least one strap of the upper torso portion is connected and a second lower connecting member to which at least one strap of the lower seat portion is connected. The second upper connecting member and the second lower connecting member are adapted to be placed in operative connection.

[0038] The method can further include: forming a plurality of upper torso portions, each have a unique configuration; and selecting one of the plurality of upper torso portions to be connected to the lower seat portion. Likewise, the method can further include: forming a plurality of lower seat portions, each have a unique configuration; and selecting one of the plurality of lower seat portions to be connected to the upper torso portion.

[0039] In another aspect, the present invention provides a safety harness to be worn by a person which includes at least one strap section. The strap section includes a cam buckle in operative connection therewith to adjust a fit of the strap section. The can buckle can, for example, include a base and a locking member in moveable, operative connection with the base. The locking member includes an abutment surface moveable into and out of contact with the strap. The locking member can be rotatably attached to the base. The abutment surface can be biased in connection with the strap.

[0040] The base can include a strap support over which the strap passes. The abutment surface of the locking member

can be biased in connection with a first surface of the strap over a section of the strap wherein a second, opposing surface of the strap contacts the support member. In one embodiment, the locking member includes a lever arm to which force is applied to move the locking member into a release position in which the abutment surface is out of contact with the strap. The cam buckle can also an activating or actuating mechanism that must be activated to enable the locking member to be moved to a release position. Requiring such a dual action to cause a release of the strap section can help prevent accidental release.

[0041] In another aspect, the present invention provides a connector for use in connection with a strap of a safety harness. The connector includes a first attachment mechanism to attach the connector to the strap and a second attachment mechanism to attach an item to the connector. In one embodiment, the connector includes a base, and the first attachment mechanism includes a pair of slots formed in the base. In one embodiment, the connector includes a closure in operative connection with the base, and the base and the enclosure at least partially enclose at least one label when the closure in a closed state.

[0042] In a further aspect, the present invention provides a label pack system for use in connection with a safety harness. The label pack system includes a base having an attachment mechanism to attach the base to the strap of the safety harness and a closure in operative connection with the base. The base and the enclosure at least partially enclose at least one label (and more typically a plurality of labels) when the closure in a closed state. The labels include, for example, textual and/or graphical information about the safety harness.

[0043] The closure can include a hinge about which the closure is rotatable to the closed state and to an open state. The label(s) are accessible when the closure is in an open state. The closure can, for example, include a releasable locking mechanism to releasably cooperate with the base to hold the closure in a closed state.

[0044] In another aspect, the present invention provides a safety harness including at least one strap section having a first end; wherein the first end has an end member in operative connection therewith. The end member includes a housing having a seating therein. The end member further includes a clip member having a first extending arm and a second extending arm in between which the first end of the strap is held. The clip is seated within the seating of the housing so that the first extending arm and the second extending arm are forced into contact with first end of the strap. In one embodiment, each of the first extending arm and the second extending arm include teeth that contact the first end of the strap. The clip member can further include a locking member that cooperates with the housing to hold the clip member in operative connection with the seating of the housing. The first extending arm and the second extending arm of the clip can, for example, be formed form an integral or monolithic piece of resilient (for example, polymeric) material. In one embodiment, the housing includes a retaining arm to connect the end member to the strap or to another strap of the harness.

[0045] In still a further aspect, the present invention provides a safety harness including a strap section having an interior surface that is adjacent a wearer when the safety harness is worn and an exterior surface generally opposite the interior surface. The interior surface is perceptibly different from the exterior surface so that a wearer can distinguish the interior surface from the exterior surface. In one embodiment, the interior surface has a color different from a color of the exterior surface. The interior surface can also or alternatively have a texture different from a texture of the exterior surface. The interior surface can, for example, be softer than the exterior surface to provide comfort to the wearer. The exterior surface can be of a more durable or rugged material (for example, having greater abrasion resistance than the interior surface).

[0046] In one embodiment, the interior surface and the exterior surface can form or be formed about on a generally tubular outer shell. In this embodiment, the strap section can further include a flexible inner material. A wear indicator material can be placed between the outer shell and the inner material such that any opening in the outer shell causes the wear indicator material to be visible.

[0047] In another aspect, the present invention provides a safety harness including at least one strap section have a first end. The first end includes an end member in operative connection therewith. The end member includes a retaining member to connect the end member to the strap or to another strap of the harness. The retaining member can, for example, include an extending arm adapted to extend around strap or another strap. In one embodiment, the extending member is adapted to be biased against the strap or against the another strap when extending around the strap or the another strap. The end member can, for example, be fabricated from an integral or monolithic piece of resilient (for example, polymeric) material.

[0048] In another aspect, the present invention provides a back pad for use in connection with a safety harness including at least two spaced back straps. The back pad includes a shield covering at least a portion of each of the back straps of the safety harness. The shield extends between the back straps to cover a portion of a user's back when the safety harness is worn.

[0049] The shield can, for example, be fabricated from a flexible material to allow bending of the back pad in the vicinity of the shield. In one embodiment, the flexible material of the shield has a hardness of at least 30 Shore durometer. In another embodiment, the flexible material of the shield has a hardness of in the range of approximately 80 to 100 Shore durometer.

[0050] The shield can include a first channel and a second channel through which a first strap section and a second strap section, respectively, pass. In one embodiment, the first channel is wider than the first strap section so that the first strap section can move laterally within the first channel, and the second channel is wider than the second strap section so that the second strap section can move laterally within the second channel. The first channel and the second channel can be positioned below a point wherein the first strap section and second strap section cross. A wide variety of body types can thereby be readily accommodated by the strap sections of the harness.

[0051] The back pad can further include a reference point thereon adapted to be aligned with a reference point on a wearer of the harness to position a D-ring in operative connection with the back pad on the wearer.

[0052] In another aspect, the present invention provides a back pad for use in connection with a safety harness comprising back strap sections that cross in the vicinity of the back pad. The back pad includes at least one channel through which at least one of the back strap sections passes. The channel is wider than the back strap section so that the back strap section can move laterally within the channel. In one embodiment, the channel is at least 20% wider than the back strap section. In another embodiment, the channel is at least 50% wider than the back strap section. The channel can be positioned below a point wherein the back strap sections cross.

[0053] In another aspect, the present invention provides a back pad for use in connection with a safety harness. The back pad includes a reference point thereon adapted to be aligned with a reference point on a wearer of the harness to position a D-ring in operative connection with the back pad on the wearer.

[0054] In a further aspect, the present invention provides a full body safety harness to be worn by a person, including an upper torso portion and a lower seat portion. The upper torso portion is operatively connected to the lower seat portion by a first connector on a first lateral side and a second connector on a second lateral side thereof. The first connector and the second connector can, for example, enable forward and rearward rotation of the upper torso portion relative to the lower seat portion (for example, without causing a significant increase in tension in the upper torso portion or the lower seat portion). At least one of the first connector and the second connector includes a shaft. The upper torso portion includes at least one connecting member having a passage formed therein. The lower seat portion includes at least one connecting member have a passage formed therein. The shaft passes through the passage of the at least one connecting member of the upper torso portion and through the passage of the at least one connecting member of the lower torso portion.

[0055] In one embodiment, the connecting member of the upper torso portion is a strap section of the upper torso portion and the connecting member of the lower seat portion is a strap section of the lower seat portion. The strap section of the upper torso portion can, for example, include a grommet through which the shaft passes, and the strap section of the lower seat portion can, for example, include a grommet through which the shaft passes.

[0056] In another embodiment, the (upper) connecting member of the upper torso portion includes a first frame element and a second frame element held in spaced connection by an intermediate element. In this embodiment, the (lower) connecting member of the lower seat portion also includes a first frame element and a second frame element held in spaced connection by an intermediate element. The upper connecting member and the lower connecting member can, for example, be fabricated to be identical. The upper connecting member and the lower connecting member can be rotatably connected about the shaft so that the first and second frame elements are interconnected or intermeshed. The intermediated elements of the upper connecting member and the intermediate element of the lower connecting member can abut during relative rotation of the upper connecting member and the lower connecting member to limit the amount of relative rotation of the connecting members.

[0057] In another aspect, the present invention provides a full body safety harness to be worn by a person including an upper torso portion and a lower seat portion. The upper torso portion is operatively connected to the lower seat portion by a first connector on a first lateral side and a second connector on a second lateral side thereof. The first connector and the second connector can, for example, enable forward and rearward rotation of the upper torso portion relative to the lower seat portion (without, for example, causing a significant increase in tension in the upper torso portion or the lower seat portion). The upper torso portion includes at least one strap, and the lower seat portion includes at least one strap. At least one of the first connector and the second connector includes a loop formed on an end of the strap of the upper torso portion and a loop formed on an end of the strap of the lower seat portion. The loop of the strap of the upper torso portion being interconnected with the loop of the strap of the lower torso portion.

[0058] In another aspect, the present invention provides a safety harness to be worn by a person including at least a first strap and a second strap. The first strap and the second strap are connected by a cam buckle in operative connection therewith to adjust a fit of the safety harness. The can buckle includes a base and a cam shaped locking member in moveable, operative connection with the base. The locking member includes an abutment surface moveable into and out of contact with the first strap. The base includes a first strap support around which the first strap passes and a second strap support around which the second straps passes. The abutment surface of the locking member is biased in connection with a first surface of the first strap over a section of the strap wherein a second, opposing surface of the first strap contacts the support member. The base is formed from a polymeric material. The base further includes a support member of a material having a higher ultimate tensile load than the polymeric material. The support member has an opening therein through which the first strap passes and through which the second strap passes.

[0059] In a further aspect, the present invention provides a full body safety harness to be worn by a person including an upper torso portion and a lower seat portion. The upper torso portion is operatively connected to the lower seat portion by a first connector on a first lateral side and a second connector on a second lateral side thereof. The first connector and the second connector enable forward and rearward rotation of the upper torso portion relative to the lower seat portion. The first connector includes at least one shaft and the second connector includes at least one shaft. At least one of the upper torso portion and the lower seat portion is rotatably connected to or about the shaft of the first connector and at least one of the upper torso portion and the lower torso portion is rotatably connected to or about the shaft of the second connector.

[0060] In another aspect, the present invention provides an accessory attachment system for use in connection with worn articles including a strap or a belt. The accessory attachment system includes a connector having a channel therein through which the strap or belt can pass and an attachment member attached to the connector.

[0061] In still a further aspect, the present invention provides a full body safety harness system including an accessory attachment system for use in connection with a strap of

the safety harness system or a belt worn in connection with the safety harness system. The accessory attachment system includes a connector having a channel therein through which the strap or the belt can pass and an attachment member attached to the connector.

BRIEF DESCRIPTION OF THE DRAWINGS

[0062] **FIG. 1** illustrates a commercially available full body safety harness.

[0063] **FIG. 2A** illustrates a front perspective view of a person wearing an embodiment of a full body safety harness of the present invention, wherein the person is standing erect.

[0064] **FIG. 2B** illustrates a rear perspective view of a person wearing the full body safety harness of **FIG. 2A**, wherein the person is standing erect.

[0065] **FIG. 2C** illustrates a side view of a person wearing the full body safety harness of **FIG. 2A**, wherein the person is standing erect.

[0066] **FIG. 2D** illustrates a side view of a person wearing the full body safety harness of **FIG. 2A**, wherein the person is bending forward in a crouched position.

[0067] **FIG. 2E** illustrates an enlarged, prospective view of an embodiment of a rotating connector of the full body safety harness of **FIG. 2A**.

[0068] **FIG. 2F** is an exploded, perspective view of connector of **FIG. 2E**.

[0069] **FIG. 2G** is a side, cross-sectional view of the connector of **FIG. 2E**

[0070] **FIG. 3A** illustrates a side view of another embodiment of a rotating connector of the present invention.

[0071] **FIG. 3B** illustrates a side view of the rotating connector of **FIG. 3A**.

[0072] **FIG. 3C** illustrates a side, cross-sectional view of the rotating connector of **FIG. 3A**.

[0073] **FIG. 3D** illustrates a perspective, exploded view of the rotating connector of **FIG. 3A**.

[0074] **FIG. 4A** illustrates another embodiment of a connector of the present invention.

[0075] **FIG. 4B** illustrates another embodiment of a connector of the present invention.

[0076] **FIG. 4C** illustrates another embodiment of a connector of the present invention.

[0077] **FIG. 5A** illustrates the attachment of an accessory to the rotating connector of **FIG. 2A**.

[0078] **FIG. 5B** illustrates a front view of another embodiment of a connector of the present invention.

[0079] **FIG. 5C** illustrates an exploded or disconnected view of one of the connecting members of the connector of **FIG. 5B**.

[0080] **FIG. 5D** illustrates a side view of the connector of **FIG. 5B**.

[0081] **FIG. 5E** illustrates another side view of the connector of **FIG. 5B** wherein the lower connecting member is rotated relative to the upper connecting member.

[0082] **FIG. 5F** illustrates the connector of **FIG. 5B** with harness straps attached thereto.

[0083] **FIG. 5G** illustrates a side view of an embodiment of an accessory attachment member of the present invention.

[0084] **FIG. 5H** illustrates a front view of the accessory attachment member of **FIG. 5G**.

[0085] **FIG. 51** illustrates a side view of a cooperating connector adapted to attach an accessory component to the accessory attachment member of **FIG. 5G**.

[0086] **FIG. 5J** illustrates a front view of the cooperating connector of **FIG. 51**.

[0087] **FIG. 5K** illustrates another embodiment of an accessory attachment member of the present invention.

[0088] **FIG. 5L** illustrates an embodiment of a full body safety harness of the present invention including the connector of **FIG. 5B** and several of the accessory attachment members of **FIG. 5G** or 5K.

[0089] **FIG. 6A** illustrates one embodiment of a full body safety harness of the present invention including a first upper torso module and a first lower seat module.

[0090] **FIG. 6B** illustrates another embodiment of a full body safety harness of the present invention including the first upper torso module illustrated in **FIG. 6A** and a second lower seat module, different in configuration from the first lower seat module.

[0091] **FIG. 6C** illustrates the use of the first upper torso module of **FIG. 6A** with a tool belt and without a lower seat module.

[0092] **FIG. 7A** illustrates another embodiment of a rotating connector of the present invention adapted to enable ready disconnection of the upper torso portion or module of the harness from the lower seat portion or module of the harness.

[0093] **FIG. 7B** illustrates a side view of another embodiment of a connector of the present invention.

[0094] **FIG. 7C** illustrates a harness strap for use with the connector of **FIG. 7B**.

[0095] **FIG. 7D** illustrates a front view of the connector of **FIG. 7D**.

[0096] **FIG. 7E** illustrates a side view of another embodiment of a connector of the present invention.

[0097] **FIG. 7F** illustrates a connecting member of the connector of **FIG. 7G**.

[0098] **FIG. 7G** illustrates another embodiment of a connector of the present invention.

[0099] **FIG. 7H** illustrates a harness strap for use in the connector of **FIG. 7E**.

[0100] **FIG. 8A** illustrates a top plan view of an embodiment of a buckle of the present invention.

[0101] **FIG. 8B** illustrates a rear view of the buckle of **FIG. 8A**.

[0102] **FIG. 8C** illustrates a side, cross-sectional view of the buckle of **FIG. 8A**.

[0103] **FIG. 8D** illustrates a side view of the buckle of **FIG. 8A**.

[0104] **FIG. 8E** illustrates a perspective exploded or disconnected view of the buckle of **FIG. 8A**.

[0105] **FIG. 8F** illustrates a side, cross-sectional view of the buckle of **FIG. 8A** in operative connection with a harness strap in which the locking member in a release state.

[0106] **FIG. 8G** illustrates a side, cross-sectional view of the buckle of **FIG. 8A** in operative connection with a harness strap in which the locking member in a locking state.

[0107] **FIG. 8H** illustrates a perspective view of another embodiment of a cam buckle of the present invention.

[0108] **FIG. 8I** illustrates another perspective view of the buckle of **FIG. 8H**.

[0109] **FIG. 8J** illustrates a top plan view of the buckle of **FIG. 8H**.

[0110] **FIG. 8K** illustrates a side view of the buckle of **FIG. 8H**.

[0111] **FIG. 8L** illustrates a front view of the buckle of **FIG. 8H**.

[0112] **FIG. 8M** illustrates an exploded, perspective view of the buckle of **FIG. 8H**.

[0113] **FIG. 8N** illustrates a perspective view of the base of the buckle of **FIG. 8H**.

[0114] **FIG. 8O** illustrates another perspective view of the base of the buckle of **FIG. 8H**.

[0115] **FIG. 8P** illustrates a side view of the cam-shaped locking member of the buckle of **FIG. 8H**.

[0116] **FIG. 8Q** illustrates a perspective view of the cam-shaped locking member of the buckle of **FIG. 8H**.

[0117] **FIG. 8R** illustrates a front view of the support member of the buckle of **FIG. 8H**.

[0118] **FIG. 8S** illustrates a perspective view of the support member of the buckle of **FIG. 8H**.

[0119] **FIG. 8T** illustrates a side view of the support member of the buckle of **FIG. 8H**.

[0120] **FIG. 9A** of the present invention illustrates a perspective view of an embodiment of a connector of the present invention and a label pack system in operative connection therewith in which a closure of the label pack system is in an open state.

[0121] **FIG. 9B** illustrates a perspective view of the connector of **FIG. 9A** in which the closure is in a closed state.

[0122] **FIG. 9C** illustrates a perspective view of the base of the connector of **FIG. 9A**.

[0123] **FIG. 10A** illustrates a perspective view of a strap end member in an exploded or disconnected state.

[0124] **FIG. 10B** illustrates a perspective view of the strap end member of **FIG. 10A** in a connected or assembled state.

[0125] **FIG. 10C** illustrates a perspective view of another embodiment of a strap end member in an exploded or disconnected state.

[0126] **FIG. 11** illustrates a perspective view of an embodiment of a strap section of the present invention having an interior surface and an exterior surface that are perceptibly different.

[0127] **FIG. 12A** illustrates a perspective view of another embodiment of a full body safety harness of the present invention.

[0128] **FIG. 12B** illustrates a perspective view of a back pad of the safety harness of **FIG. 12A**.

[0129] **FIG. 12C** illustrates a rear view of the back pad of **FIG. 12B**.

[0130] **FIG. 12D** illustrates another perspective view of the back pad of **FIG. 12B**.

[0131] **FIG. 12E** illustrates a perspective view of a base section of the back pad of **FIG. 12B**.

[0132] **FIG. 12F** is a front view of the base section of the back pad of **FIG. 12B**.

[0133] **FIG. 12G** is a side view of the base section of the back pad of **FIG. 12B**.

[0134] **FIG. 12H** is a rear view of an embodiment of a shield of the back pad of **FIG. 12B**.

[0135] **FIG. 12I** is a perspective view or the shield of **FIG. 12H**.

[0136] **FIG. 12J** is a side view or the shield of **FIG. 12H**.

[0137] **FIG. 12K** is a rear view of another embodiment of a shield of the present invention.

[0138] **FIG. 12L** is a rear view of another embodiment of a shield of the present invention.

[0139] **FIG. 12M** is a rear view of a D-ring pad and D-ring for use in connection with the back pad of **FIG. 12B**.

[0140] **FIG. 12N** illustrates a rear view of the safety harness of **FIG. 12A** as worn by the user wherein a self-retracting lanyard is attached to the D-ring thereof via a snap hook.

[0141] **FIG. 12O** illustrates an embodiment of a D-ring for use in connection with the back pads of the present invention.

[0142] **FIG. 12P** illustrates another embodiment of a D-ring pad for use in connection with the back pads of the present invention.

[0143] **FIG. 12Q** illustrates the D-ring pad and D-ring in connection with straps of a safety harness.

DETAILED DESCRIPTION OF THE INVENTION

[0144] **FIGS. 2A through 2G** illustrate one embodiment of a full body safety harness **100** of the present invention. Safety harness **100** includes an upper torso section, portion or module **110** and a lower torso (seat) section, portion or module **112**. Upper torso portion **110** includes a first shoulder strap **120** and a second shoulder strap **130** extending over the shoulders of the user and a multi-component chest strap

140 extending between first shoulder strap **120** and second shoulder strap **130**. First ends of each of shoulder straps **120** and **130** extend down over the back of the user to form first and second generally longitudinal back straps **122** and **132**, respectively. Back straps **122** and **132** cross through and connect to a D-ring **150** in a manner similar to that described above in connection with D-ring **50**. After crossing and passing through D-ring **150**, back strap sections **122** and **132** of shoulder straps **120** and **130** are connected via a generally latitudinal back strap **160**, which passes generally latitudinally over a portion of the back of the user. In the illustrated embodiment, back straps **122** and **132** also cross through a back pad **166** in the region of D-ring **150** which, among, other functions can assist in maintaining a desired distance from neck of the user to D-ring **150**. Back straps **122** and **132** are attached at their respective ends to connectors **200***b* and **200***a*, respectively, that operate to connect upper torso portion or module **110** to lower seat portion or module **112**. In that regard back straps **122** and **132** can, for example, be looped around slots **212***b* and **212***a* formed in upper connecting members **210***b* and **210***a* of connectors **200***b* and **200***a*, respectively, (see, for example, **FIGS. 2C through 2E**) and stitched.

[0145] A second end of each of shoulder straps **120** and **130** extends downward over the front of the user to form generally longitudinal first and second front straps **124** and **134**, respectively. Chest strap **140** is attached between front strap **124** and front strap **134** of shoulder straps **120** and **130**, respectively. At least one fastening member **146** can be provide to enable opening/disconnection of chest strap **140**. One or more adjustment mechanisms **148** (for example, adjustable cam buckle mechanisms as discussed further below) can be provided to adjust the length of chest strap **140**. In an alternative embodiment, as known in the art, first and second front straps **124** and **134** can cross through a front pad, as known in the art, and chest strap **140** can be eliminated.

[0146] First and second front straps **124** and **134** extend further downward from chest strap **140** and can include adjustment members **126** and **136** (for example, adjustable cam buckles as discussed further below) for adjustment of the fit of safety harness **100** on the upper torso of the user. Front straps **124** and **134** are connected at the ends thereof to connectors **200***a* and **200***b*, respectively. In that regard front straps **124** and **134** can, for example, be looped through slots **214***a* and **214***b* formed in upper connecting members **210***a* and **210***b* of connectors **200***a* and **200***b* (see, for example, **FIGS. 2C through 2E**) and stitched.

[0147] Lower torso or seat portion **112** of safety harness **100** can, for example, include leg straps **180** and **190**. Leg strap **180** is attached to connector **200***a* at a first or front end thereof via slot **222***a* formed in a lower connecting member **220***a* of connector **200***a* (see, for example, **FIGS. 2C through 2E**). A second or rearward end of leg strap **180** is attached to lower connecting member **220***a* via slot **224***a*. Similarly, leg strap **190** is attached to connector **200***b* at a first or front end thereof via slot **222***b* formed in a lower connecting member **220***b* of connector **200***b*. A second or rearward end of leg strap **190** is attached to lower connecting member **220***b* via slot **224***b*. As illustrated, for example in **FIG. 2A**, leg straps **180** and **190** can include adjustment members or mechanisms **182** and **192**, respectively, (for example, adjustable cam buckles as discussed further below) for adjustment of the fit of leg straps **180** and **190**. A seat **170** can be attached to and extend between leg straps **180** and **190**. Seat **170** can, for example, be fabricated from a mesh material or from a strapping material.

[0148] In the embodiment of **FIGS. 2A through 2G**, connectors **200***a* and **200***b* are identical in design and operation. The design and operation of connectors **200***a* and **200***b* is discussed herein with reference to connector **200***a*. In that regard, upper connecting member **210***a* and lower connecting member **220***a* (which can each, for example, be formed separately from an integral or monolithic piece of metal such as aluminum) are rotatably or pivotably connected via a shaft **230***a* (see, for example, **FIGS. 2F and 2G**), which is maintained in operative connection with connecting members **210***a* and **220***a* via a locking pin **240***a* which seats in a seating or groove **232***a* formed in shaft **230***a*. As clear to one skilled in the art, connectors **200***a* and **200***b* are preferably fabricated from materials (which can, for example, include one or more metals, high-strength polymeric materials, high-strength composite materials or combinations thereof) of sufficient strength and are preferably connected in such a manner such that connectors **200***a* and **200***b* can withstand the loads experienced in a fall. Like the strapping of safety harness **100**, the materials and construction of connectors **200***a* and **200***b* can, for example, provide an ultimate tensile load of at least 4000 pounds or at least 5000 pounds (as discussed, for example, for harness components generally in U.S. Pat. Nos. 6,006,700 and 6,739,427).

[0149] As illustrated in a comparison of **FIGS. 2C and 2D**, rearward or forward bending of the user results in a rotation of upper connecting member **210***a* relative to lower connecting member **220***a*. Unlike the case of harness **10**, the relative rotation of upper connecting member **210***a* and lower connecting member **220***a* of connector **200***a* (and the relative rotation of upper connecting member **210***b* and lower connecting member **220***b* of connector **200***b*) substantially prevents tension in upper torso portion **110** and lower seat portion **112** during such bending. In that regard, connectors **200***a* and **200***b* effectively "decouple" the strains experienced in the straps of upper torso portion **110** from the strains experienced in the straps of lower seat portion **112** during forward and rearward bending of the user. The range and freedom of movement of a user of safety harness **100** is thereby substantially enhanced as compared to other safety harnesses. Moreover, connectors **200***a* and **200***b* also prevent gapping of the straps away from the body in upper torso portion **110**, which is often experienced in currently available harnesses upon forward or rearward bending. Such gapping in other safety harnesses can present a safety concern as gapped strapping can catch on objects when the safety harness is in use. Still further, connectors **200***a* and **200***b* enable the adjustment of strap length, tension and/or fit in upper torso portion **110** without substantially affecting the strap length, tension and/or fit in lower seat portion **112**, thereby enhancing the comfort of the fit of safety harness **100** as compared to other safety harnesses. Indeed, such connectors enable independent adjustment of straps in upper torso portion **110** and lower seat portion **120** using adjustment mechanisms or members in each of upper torso portion **100** and lower seat portion **120**. In that regard, tightening of shoulder strap **120** via adjustment mechanism **126** may cause some increased tension in leg strap **180** by pulling

upward on connector **200***a*. However, the fit of leg strap **180** can be adjusted via adjustment mechanism **182**.

[**0150**] In general, the benefits afforded by connectors **200***a* and **200***b* are realized regardless of the material chosen for the straps. In that regard, relatively inelastic, woven webbing materials such as nylon or polyester commonly used in many currently available safety harnesses are well suited for use in the present invention. Moreover, the material described in U.S. Pat. No. 6,006,700 and/or U.S. Pat. No. 6,739,427 can also be used. Such materials are, for example, currently used in the DURAFLEX® and the DURAFLEX PYTHON® harnesses currently available from Bacou-Dalloz Fall Protection of Franklin, Pa.

[**0151**] **FIGS. 3A through 3D** illustrate another embodiment of a connector **300** for use in the present invention to operatively connect an upper torso portion of a safety harness to a lower torso or seat portion of the safety harness. Connector **300** operates similarly in many respects to connectors **200***a* and **200***b* as described above. In that regard, connector **300** includes an upper connecting member **310** and a lower connecting member **320** which are rotatably connected via a shaft **330** which projects from upper connecting member **310**. Lower connecting member **320** includes a generally circular passage **316** through which shaft **330** projects. Upper connecting member **310** and lower connecting member **320** are maintained in rotatable connection (about shaft **330**) via a locking ring **340** which seats within a seating or groove **332** formed in shaft **330**. As illustrated in the embodiment of **FIGS. 3A through 3D**, lower connecting member **320** can include abutment members **328** and **328'** which abut upper connecting member **310** to limit the range of relative rotation between upper connecting member **310** and lower connecting member **320** to, for example, prevent upper connecting member **310** from contacting the leg straps of the lower torso portion and causing excessive wear therein. The range of motion of upper connecting member **310** relative to lower connecting member **320** can, for example, be limited to approximately 30° to approximately 40° to prevent such wear while still providing an ample range of motion for bending of the user without causing significant tension in the straps of the lower seat portion.

[**0152**] Connector **300** further includes an inward attachment or connector **350** which includes a flange **352** on an inward projecting end of a shaft **354** thereof to which, for example, a belt such as a positioning safety belt or a tool belt can be attached to connector **300**. As clear to one skilled in the art, other attachment mechanisms as known in the art are suitable for use in attaching belts to the connectors of the present invention. As known in the art, safety positioning belts can, for example, include an anchor attachment such as a D-ring as known in the art to connect a lifeline or lanyard thereto. Attachment **350** is maintained in operative connection with upper connecting member **310** by a locking ring **360** which seats in a seating or groove **356** formed in shaft **354**. Locking ring **360** abuts a radially inward projecting, annular flange **334** formed on an inner wall of shaft **330** (see **FIG. 3C**).

[**0153**] A forward end of shaft **330** can include an attachment or connector through which any of a number of accessories can be attached to connector **300**. In the embodiment of **FIGS. 3A through 3D**, connector **300** includes a seating or groove **338** formed on an outward end thereof through which such accessories can be attached to connector **300**. As clear to one skilled in the art, other attachment mechanisms as known in the art are suitable for use in attaching accessories to the connectors of the present invention. In the embodiment of **FIGS. 3A through 3E**, a cap member **370** is attached to connector **300** via a radially inward projecting, annular flange **372** which forms a snap fit with seating **338**. Seating **338** (or other connection mechanism such as a flange similar to flange **352**) can also be used in attaching accessories as discussed in connection with connector **350**.

[**0154**] **FIG. 4A** illustrates another embodiment of a connector **400** of the present invention. Connector **400** includes a lower connecting member **320** which is generally identical to that of connector **300**. However, rather than an upper connecting member as included in connector **300**, connector **400** includes a preferably curved connecting member such as ring or loop member **410** to which rear strap **132** and front strap **124** are slidably attached. Ring member **410** need not be rotatably attached to lower connecting member **320**. When a user wearing a safety harness of the present invention including connector **400** bends forward as illustrated in **FIGS. 2C and 2D** the strap ends of rear strap **132** and front strap **124** move (that is, slide) around the circumference of ring member **410**, thereby preventing any substantial increase in tension in the straps of lower seat portion **112**. **FIG. 4B** illustrates another embodiment of a connector **400'** in which two ring members **410** and **420** are connected (in a non-rotating connection by a connect **430**. As described above, rear strap **132** and front strap **124** are slidably attached to ring member **410**. In this embodiment, leg strap **180** is slidably attached at its first and second ends to ring member **420**. **FIG. 4C** illustrates another embodiment of a connector **400"** of the present invention including a single ring member **410"** to which rear strap **132**, front strap **124** and the ends of leg strap **180** are slidably attached.

[**0155**] As described above, tension in the straps of a safety harness of the present invention upon forward and rearward bending of a user can thus be reduced or generally eliminated in, for example, two general manners or combinations thereof. In that regard, one can connect in a generally fixed manner (that is, a non-sliding manner) strap ends of the upper torso portion to two upper connecting members. One can also connect in a generally fixed manner (that is, non-sliding manner) strap ends of the lower torso portion to two lower connecting members. The upper connecting member and the lower connecting member are then connected so that the upper connecting member is rotatable relative to the lower connecting member. Alternatively, one or more of the strap ends can be slidably (or movably) attached to a connecting member. In one such embodiment, the connecting member includes an element (which can, for example, be a curved element) about which the a strap end is looped or otherwise connected so that the strap end can slide (or move) along the element. In this embodiment, the connecting member need not be rotatable.

[**0156**] As also described above, various accessories can be attached to the connectors of the present invention. **FIG. 5A** illustrates the attachment of a strap **500**, which can, for example, be formed into a loop and used to attached a tool belt, to connector **200***a*. In that regard, connector **200***a* includes a flange **260***a* attached to the outward end of shaft

230. A high-strength clip **600** (for example, fabricated from a polymeric material) snaps onto flange **260***a* via a slot **610** formed in clip **600**. Strap **500** can, for example, be attached to clip **600** via slots **630***a* and **630***b* formed in clip **600**. In the embodiment of **FIG. 5A**, strap **500** is generally permanently attached to slot **630***b* (for example, via a sewn loop). Strap **500** can be passed through slot **630***a* to form a loop. The free end of strap **600** can, for example, include a hook-and-loop type fastening system **520** such as VELCRO®.

[**0157**] **FIGS. 5B through 5F** illustrate another embodiment of a connector **1900** for use in the present invention to operatively connect an upper torso portion of a safety harness to a lower torso or seat portion of the safety harness. Connector **1900** operates similarly in many respects to connector **200** as described above. In the illustrated embodiment, identical left and right side connectors **1900** each include an upper connecting member **1910** and an identical lower connecting member **1920**, which are rotatably connected via a shaft **1930**.

[**0158**] Before further describing connectors **1900**, an embodiment of a safety harness **100***a* (see, for example, **FIG. 5L**) into which connectors **1900** are incorporated, is described. Safety harness **100***a* is, in many respects, similar in design and operation to safety harness **100** and like components are numbered in a corresponding manner with the addition of the designation "a". Like safety harness **100**, safety harness **100***a* includes an upper torso section, portion or module **110***a* and a lower torso or seat section, portion or module **1112***a*. Upper torso portion **110***a* includes a first shoulder strap **120***a* and a second shoulder strap **130***a* extending over the shoulders of the user and a multi-component chest strap **140***a* (see **FIG. 12A**) extending between first shoulder strap **120***a* and second shoulder strap **130***a*. First ends of each of shoulder straps **120** and **130** extend down over the back of the user to form first and second generally longitudinal back straps **122***a* and **132***a*, respectively. Back straps **122***a* and **132***a* cross through and connect to a D-ring **150***a* in a manner similar to that described above in connection with D-ring **150**. In the area of D-ring, back straps **122***a* and **132***a* also cross through a back pad **2500** in the region of D-ring **150**. Back pad **2500** is described further below. Back straps **122***a* and **132***a* are attached at their respective ends to right side and left side connectors **1900**, that operate to connect upper torso portion or module **110***a* to lower seat portion or module **112***a* in a similar manner as described above in connection with connectors **200**. Back straps **122***a* and **132***a* can, for example, be looped around slots formed in upper connecting members **1910** of connectors **1900** (see, for example, **FIGS. 5B through 5F**) and stitched.

[**0159**] A second end of each of shoulder straps **120***a* and **130***a* extends downward over the front of the user to form generally longitudinal first and second front straps **124***a* and **134***a*, respectively. Chest strap **140***a* is attached between front strap **124***a* and front strap **134***a* of shoulder straps **120***a* and **130***a*, respectively. One or more adjustable adjustment mechanism can be provided to adjust the length of chest strap **140***a*.

[**0160**] First and second front straps **124***a* and **134***a* extend further downward from chest strap **140***a* and terminate at and are attached to a cam buckle adjustment mechanisms **1000***a* (discussed further below) or other adjustment mechanism for adjustment of the fit of safety harness **100***a* on the upper torso of the user. Lengths of connecting strapping strap **124***a*' and **134***a*' are connected at a first end thereof to cam buckes **100***a* and at a second end thereof to connectors **1900** (see, for example, **FIGS. 5F and 5L**). In that regard straps **124***a*' and **134***a*' can, for example, be looped through slots formed in upper connecting members **1910** of connectors **1900** (see, for example, **FIGS. 5B through 5F**) and stitched.

[**0161**] Lower torso or seat portion **112***a* of safety harness **100***a* can, for example, include leg straps **180***a* and **190***a*. Leg strap **180***a* is attached to right side connector **1900** at a first or front end thereof via a slot formed in a lower connecting member **1920** of right side connector **1900** (see, for example, **FIGS. 5F and 5L**). A second or rearward end of leg strap **180** is attached to seat strap **170***a*. Seat strap **170***a* is attached at a first end thereof to right side connector **1900** via a slot formed in lower connecting member **1920** of right side connector **1900** (see, for example, **FIGS. 5F and 5L**). Similarly, leg strap **190***a* is attached to left side connector **1900** at a first or front end thereof via a slot formed in a lower connecting member **1920** of left side connector **1900**. A second or rearward end of leg strap **190** is attached to seat strap **170**. A second end of seat strap **170** is attached to left side connector **1900** via a slot formed in lower connecting member **1920** of left side connector **1900**. Leg straps **180***a* and **190***a* can include adjustment members or mechanisms **182***a* and **192***a*, respectively (seem, for example, **FIGS. 5L and 12A**).

[**0162**] Each of upper and lower connecting members **1910** of connectors **1900** includes two end or frame elements **1910***a*, which are identical (see, for example, **FIG. 5C**). Between frame elements **1910***a* is an intermediate or spacing element **1940**. Intermediate member **1940** maintains frame elements **1910***a* in spaced connection. Frame elements **1910***a* can, for example, include one or more slots **1912***a* or other attachment elements for connecting one or more straps of a harness thereto (see, for example, **FIG. 5F**). Intermediate member **1940** can, for example, includes slots **1942** which align with slots **1912***a* to form attachment slots for harness strapping as discussed above or other connecting members of the harness. To further assist in alignment and connection of frame elements **1910***a* with intermediate element **1940**, frame elements can include alignment holes or passages **1916***a* formed therein. In the embodiment of **FIGS. 5A through 5F**, intermediate member includes flanges **1946** which extend from a surface thereof to mate with holes **1916***a* of frame elements **1910***a*. Likewise, flanges **1948** extend outward from the surface of intermediate element **1940** around the perimeter of slots **1942** to align and mate with slots **1912***a* of frame elements **1910***a*. In the embodiment of **FIGS. 5B through 5F**, flanges **1948** further include abutment members **1949** extending therefrom which form a snap fit with slots **1912***a* of frame elements **1910***a* to retain frame elements **1910***a* in connection with intermediate element **1940**. In one embodiment, intermediate element **1940** was formed from a polymeric material such as polyethylene, while frame elements were formed from a metallic material such as aluminum.

[**0163**] As illustrated, for example, in **FIG. 5B**, when rotatably connected via shaft **1930**, which passes through passages **1919***a* formed in frame elements **1910***a*, one of the

frame elements **1910***a* of lower connecting member **1920** slides between frame elements **1910***a* of upper connecting member **1910**. In the embodiment of **FIGS. 5A** through **5**F, the outer frame element **1910***a* (as defined by being the away from the body of the wearer when harness **100***a* is donned by the wearer) of lower connecting member **1920** slides between frame elements **1910***a* of upper connecting member **1910**. Likewise, one of the frame elements **1910***a* of upper connecting member **1910** slides between frame elements **1910***a* of lower connecting member **1920**. In the embodiment of **FIGS. 5A through 5F**, the inner frame element **1910***a* (as defined by being the toward the body of the wearer when safety harness **100***a* is donned) of upper connecting member **1910** slides between frame elements **1910***a* of lower connecting member **1920**.

[**0164**] This interlocking or intermeshing arrangement of frame elements **1910***a* of upper connecting member **1910** and lower connecting member **1920** assists in preventing disengagement when connector **1900** experiences forces out of the plane of rotation of connecting members **1910** and **1920**. The interlocking arrangement also assists in keeping connector **1900** free from dirt and other debris. In that regard, such debris is typically removed or cleared from connector **1900** by the relative rotation of interlocking connecting members **1910** and **1920**. Debris is forced out through open sides of connectors **1910** and **1920** and/or through one or more openings or passages **1918***a* formed in frame elements **1910***a* in the vicinity of shaft passage **1919***a*. As illustrated in **FIGS. 5B and 5C**, intermediate section **1940** does not extend over the full area of frame elements **1910***a*, resulting in open side areas between frame elements **1910***a* of connecting members **1910** and **1920**.

[**0165**] In addition to maintaining frame elements **1910***a* in spaced connection, intermediate element **1940** also acts as a stop or abutment member to limit the range of relative rotation between upper connecting member **1910** and lower connecting member **1920** to, for example, prevent connecting members **1910** and **1920** from contacting the straps of the safety harness and causing excessive wear therein. The range of motion of upper connecting member **1910** relative to lower connecting member **1920** can, for example, be limited to a value in the range of approximately 30° to approximately 40° as described above to prevent such wear while still providing an ample range of motion for bending of the user without causing significant tension in the straps of the safety harness (see, for example, **FIG. 5E**).

[**0166**] Connector **1900** further includes an outward projecting attachment member **1970**, including, for example, a flange **1972**) to which any number of accessories can be attached. Attachment member **1970** is attached to an outer end of shaft **1930**. As illustrated, for example, in **FIG. 5B**, an inner end of shaft **1930** passes through an opening in belt accessory attachment **2000** and terminates in a retaining flange **1980**. A belt such as a positioning safety belt or a tool belt **2100** as well as a strap **2160** of a waist pad **2150** (see, for example, **FIGS. 5B and 5J**) and can be attached to or passed through accessory attachment **2000**.

[**0167**] **FIGS. 5G through 5J** illustrates an embodiment of an accessory attachment system of the present invention which includes an attachment mechanism **2200** that can be attached to, for example, a harness strap of a belt. Similar to accessory attachment **2000**, attachment mechanism **2200** includes a connector **2205** having a channel or passage **2210** through which a belt, a strap or other component (for example, belt **2100** or a strap of safety harness) can be passed. **FIG. 5J**, for example, illustrates several accessory attachment mechanisms **2200** of the present invention attached to belt **2100**. Attachment mechanism **2200** further includes an outward projecting attachment member **2240** (including, for example, a flange **2242**) to which any number of accessories can be attached. Accessory attachment member **2240** is attached to an outer end of a shaft **2250** which is held in connection with connector **2205** of attachment mechanism **2200** by a retaining member or flange **2260** (see **FIG. 5G**).

[**0168**] **FIG. 5I** illustrates a cooperating connector **2300** adapted to attach to attachment member **2240**. Connector **2300** includes a passage **2310** through which flange **2242** can be passed. A slot **2320** which has a diameter less than flange **2242** is in connection with passage **2310**. Once flange **2242** is passed through passage **2310**, connector **2300** (and attached accessory item **2400**) is move downward (in the orientation of **FIGS. 5H and 5I**) relative to flange **2242** so that flange **2242** passes into slot **2320** and connector **2300** is retained in connection with attachment mechanism **2200**. Accessory item **2400** (shown schematically in **FIG. 5I**) can be suitable to attach numerous items to a belt or safety harness including, but not limited to, tools, communication devices etc. Accessory item **2400** can, for example, be allowed to rotate about flange **2242** (via rotation of connector **2300** about an extending section **2244** (see, for example, **FIG. 5H**) to which flange **2242** is attached) during use of safety harness **100***a* so that items retained therein (for example, tools) do not fall out with movement of the wearer of safety harness **100***a*.

[**0169**] **FIG. 5K** illustrates another embodiment of an accessory attachment system of the present invention which includes a belt or strap attachment mechanism **2200***a* that is similar in design and operation to attachment mechanism **2200**. Like components are numbered similarly to corresponding components of attachment mechanism **2200** with the addition of the designation "a". Attachment mechanism **2200***a* includes a connector **2205***a* having a channel or passage **2210***a* through which a belt or strap (for example, belt **2100** or a strap of safety harness) can pass. In this embodiment, connector **2205***a* comprises a first section **2205***aa* and a second section **2205***ab* that can be connected via, for example, a snap fit. Such an "initially open" or closeable connector **2205***a* can, in certain cases, facilitate addition of attachment mechanism to an assembled harness. Channel **2210***a* can be sized such that attachment mechanism **2000***a* is readily slidable along a harness strap or belt or such that attachment mechanism **2000***a* fits snugly on a harness strap of belt and resists sliding motion.

[**0170**] **FIGS. 6A and 6B** illustrate how several embodiments of connectors of the present invention of the present invention including upper and lower connecting members (such as upper connecting members **210***a* and **210***b* or **1900** and lower connecting member **220***a* and **220***b* or **1900**) can be used to readily fabricate modular full body safety harnesses in which various upper torso portions or modules can be mixed and matched with various lower seat portions or modules to easily and inexpensively fabricate a variety of harness for different uses and for different users. For example, using 10 different upper torso modules and 10

different lower seat modules, 100 different full body safety harnesses can be assembled. **FIG. 6A** illustrates a rear view of a user wearing full body safety harness **100** including upper torso module **110** and lower seat module **112** as described above. In **FIG. 6A**, the user is also wearing a tool belt **700** that is attached to safety harness **100** via looped straps **500** as described above. In **FIG. 6B**, the user is wearing a full body safety harness **100'** including upper torso module **110** and a different lower seat module **112'**. Lower seat module **112'** includes leg straps **180'** and **190'** than encircle the legs of the user as is common in European safety harnesses. As illustrated in **FIG. 6C**, upper torso module **110** can be used without a lower seat module to, for example, act as suspenders to support tool belt **700**. The modularity provided by the connectors of the present invention can substantially reduce the manufacturing costs in manufacturing a wide variety of harness types as compared to current manufacturing methods.

[0171] The connector for connecting upper torso modules and lower seat modules of the present invention can, for example, be fabricated to be disconnectable only by the manufacturer or can be made to be more readily disconnectable so that disconnection can, for example, be made by those in the field (for example, by an authorized safety officer). In that regard, **FIG. 7A** illustrates an embodiment of a connector **800** of the present invention that operates in a number of manners similarly to connector **200***a*. In that regard, connector **800** includes upper connecting member **810** and lower connecting member **820** that are rotatably connected via a shaft **830**. Connector **800** also includes a release **900** operable to release upper connecting member **810** and lower connecting member **820** from connection with shaft **830** and thereby from connection with each other. Release **900** can include any of various release mechanisms known to those skilled in the art. In the embodiment of **FIG. 8**, release **900** includes release buttons **910** and **920** which are moved radially inward to cause disconnection. In one embodiment, each of buttons **910** and **920** must be actuated to cause disconnection to decrease the likelihood of accidental disconnection. A locking mechanism (for example, requiring an actuating key or other instrument) as known in the art can also be provided to ensure that disconnection is effected only by authorized personnel and that accidental disconnection does not occur.

[0172] **FIGS. 7B through 7D** illustrate another embodiment of a connector **2500** of the present invention to operatively and rotatably connect an upper torso portion of a safety harness to a lower torso or seat portion of the safety harness. In this embodiment, connector **2500** includes a shaft **2510** to which straps **132***b*', **124***b*', **170***b* and **180***b* can be rotatably connected. Straps **132***b*, **124***b*, **170***b* and **180***b* correspond in position and operation to straps **132***a*', **124***a*', **170***a* and **180***a* of harness **100***a*. In that regard, each of straps **132***b*', **124***b*', **170***b* and **180***b* includes a connector such as a grommet **2550**. Each grommet **2550** includes a passage **2552** through which connector shaft **2510** passes. Grommets **2550** are maintained in connection with connector shaft **1510** by retaining flanges **2560***a* and **2560***b* on the ends of connector **2510**.

[0173] In the embodiment of **FIGS. 7B through 7D**, each of straps **132***b*', **124***b*,'**170***b* and **180***b* rotate about a common shaft **2510**. As illustrated in **FIGS. 7E and 7F**, straps **132***b*' and **124***b*', can, for example, rotate about a first shaft **2510'** and straps **170***b* and **180***b* can rotate about a second shaft **2510"**. Shafts **2510'** and **2510"** are connected to passages **2512'** and **2512"**, respectively, formed in a connecting member **2514'**. Alternatively, each of straps **132***b*', **124***b*', **170***b* and **180***b* can rotate about a separate shaft, each of which is connected to a common connecting member.

[0174] **FIGS. 7G and 7H** illustrate a further embodiment of a connector system of the present invention to operatively and rotatably connect an upper torso portion of a safety harness to a lower torso or seat portion of the safety harness. In this embodiment, each of straps **132***c*', **124***c*', **170***c* and **180***c* (which correspond in position and operation to straps **132***a*', **124***a*', **170***a* and **180***a* of harness **100***a*) includes a connector **133***c*', **125***c*', **171***c* and **181***c*, respectively, formed by looping the strap back on itself and connecting (for example by stitching) the strap to itself. During fabrication of the harness, loop connectors **133***c*', **125***c*', **171***c* and **181***c* are interconnected as illustrated in **FIG. 7G** to allow forward and rearward rotation of the upper torso portion of the safety harness relative to the lower or seat portion of the safety harness without causing a significant increase in tension in the safety harness.

[0175] In several embodiments, the harnesses of the present invention include one or more cam buckles that function as adjustment members such as adjustment members **126** and **136** to adjust the fit of the harnesses. The inventors of the present invention have discovered that such cam buckles provide a significant improvement in the ease of adjustment of the fit of one or more of the straps of the present invention as compared to adjustment mechanisms such as friction buckles previously used in safety harnesses. Moreover, the present inventors have discovered that cam buckles provide suitable locking strength such that the cam buckles do not open under loads experienced under normal conditions of use or under fall conditions.

[0176] **FIGS. 8A through 8G** illustrate one embodiment of a cam buckle **1000** suitable for use in harnesses of the present invention and in other safety harnesses. Buckle **1000** includes a base **1010** including a first strap support **1020** and a second strap support **1030**. **FIGS. 8F and 8G** illustrate strapping sections **1100** and **1200** looped around first support **1010** and second support **1020**, respectively. If desired or required by law, base **1010** can be fabricated from high-strength materials (which, can, for example, include various metals, high-strength polymeric materials, high-strength composite materials or combinations thereof) such that base **1010** provides a relatively high ultimate tensile load (for example, of at least 4000 pounds or at least 5000 pounds).

[0177] Buckle **1000** further includes a cam-shaped locking member **1040** that operates to lock strapping section **1100** in a desired position and to enable release of strapping section **1100** to allow adjustment of the fit of a harness by moving or sliding strapping section **1100** around or over support **1020**. Locking member **1040** includes a passage **1042** through which a rod **1050** (around which locking member **1040** is rotatable) passes. Rod **1050** includes a first end section **1052** of generally reduced radius that passes through a passage or seating **1072** in a first side member **1070** of base **1010** and is held in position therein by bearing **1056**. On the opposite end, rod **1050** includes a second end section **1054** of generally reduced radius that passes through a passage or seating **1082** in a second side member **1080** of base **1010** and

is held in position by bearing **1058**. A biasing element can be used to bias locking member in a locking position in which strap **1100** is prevented from moving or sliding relative to first strap support member **1020**. In the embodiment of **FIGS. 8A through 8G**, the biasing element is a spring **1060** which is positioned within passage **1042**. Second end section **1054** of rod **1050** passes through spring **1060** which closes tightly around second end section **1054** to bias locking member **1040** in a locking position as illustrated, for example, in **FIG. 8G**.

[**0178**] To place locking member **1040** in a release position as illustrated in **FIG. 8F**, a user applies a downward force (in the orientation of **FIGS. 8F and 8G**) to a lever arm **1044** of locking member **1040** to cause rotation of locking member **1040** around rod **1050** in a clockwise direction (once again in the orientation of **FIGS. 8F and 8G**). Rotation of locking member **1040** as illustrated in **FIG. 8F**, causes an abutment surface **1046** on an end of locking member **1040** generally opposite to lever arm **1044** to rotate out of contact with strapping section **1100**, thereby releasing strap **1100** to enable adjustment thereof. Once strapping section **1100** is in adjusted to a desired position or fit, force is removed from lever arm **1044** so that locking member rotates around rod **1050** in a counterclockwise direction (in the orientation of **FIGS. 8F and 8G**) so that abutment surface **1046** rotate back into its biased position of contact with strapping section **1100**. Strapping section **1100** is held or locked in position between abutment surface **1046** of locking member **1040** and an upper abutment surface **1022** of strap support **1020**. As illustrated, for example, in **FIGS. 8F and 8G**, abutment surface **1046** and/or abutment surface **1022** can include knurling or ridges to assist in holding strapping section **1100** in a locked position.

[**0179**] A dual or double action can be required to place locking member **1040** in a release position. As illustrated in **FIGS. 8F and 8G**, for example, a moveable actuating, activating or abutment member **1080** can be placed in operative connection with lever arm **1044** to prevent movement of lever arm **1044** to a release position until abutment member **1080** is first moved to a release position (see **FIG. 8F**). Buckle **1000** can be fabricated in part or in whole from polymeric materials. In on embodiment base **1010** is fabricated from a polymeric material and locking member **1040** is fabricated from aluminum.

[**0180**] **FIGS. 8H through 8T** illustrate another embodiment of a cam buckle **1000***a* suitable for use in harnesses of the present invention and in other safety harnesses. In many respects, buckle **1000***a* is similar in construction and operation to buckle **1000** and like components are numbered in a corresponding manner with the addition of the designation "a" in the case of buckle **1000***a*. Buckle **1000***a* includes a base **1010***a* including a first strap support **1020***a* and a second strap support **1030***a*. Strapping sections loop around first support **1020***a* and second support **1020***a* in a similar manner to that illustrated in **FIGS. 8F and 8G** for buckle **1000**. Unlike buckle **1000**, base **1010***a* of buckle **1000***a* includes a recess or seating **1012***a* therein. Strengthening, reinforcement or support member **1014***a* is seated within recess or seating **1012***a* as, for example, illustrated in **FIG. 8I**. In the embodiment of **FIGS. 8H through 8T**, reinforcement member **1014***a* is generally rectangular in shape and is formed with an opening **1015***a* therein. Seating **1012***a* can, for example, include one or more abutment members **1013***a* which form a snap fit with reinforcement member **1014***a* to retain reinforcement member **1014***a* in connection with base **010***a*.

[**0181**] One strapping section of a safety harness loops around first support **1020***a* and a first side **1014***a*' of reinforcement member **1014***a*, passing through opening **1015***a*. A second strapping section of a safety harness loops around second support **1030***a* and a second side **1014***a*" of reinforcement member **1014***a*, passing through opening **1015***a*. Support member **1014***a* is preferably fabricated from a high-strength material such that base **1010***a* in combination with support member **1014***a* thereof provides a relatively high ultimate tensile load (for example, of at least 4000 pounds or at least 5000 pounds).

[**0182**] Reinforcement member **1014***a* can, for example, be fabricated from a high-strength metallic material. Use or reinforcement member **10104***a* enables fabrication of the remainder of buckle **1000***a* from a relatively low-weight material that need not exhibit as high an ultimate tensile load as reinforcement member **1014***a*. Fabrication of cam buckle **1000***a* from relatively low-weight materials reduces or minimizes the overall weight of cam buckle **1000***a* and the safety harness within which cam buckle **1000***a* is used.

[**0183**] As the strapping sections of the safety harness pass around opposite sides of reinforcement member **1014***a*, tension forces on the strapping sections connected to buckle **1000***a* will be distributed around reinforcement member **1014***a* and buckle **1000***a* will exhibit the ultimate tensile load of reinforcement member **1014***a*. In one embodiment, reinforcement member **1014***a* was fabricated from aluminum, which exhibits a high ultimate tensile load and relatively low weight. The remainder of base **1010***a* was fabricated from a relatively high strength, low weight polymeric material such as VERTON, a polymer composite including relatively long glass fibers, available from LNP Engineering Plastics, of Exton, Pa.

[**0184**] Like buckle **1000**, buckle **1000***a* further includes a cam-shaped locking member **1040***a* that operates to lock strapping section **1100***a* (see **FIGS. 8F and 8G**) in a desired position and to enable release of strapping section **1100** to allow adjustment of the fit of a harness by moving or sliding strapping section **1100** around or over support **1020***a*. Locking member **1040***a* includes a passage **1042***a* through which a rod **1050***a* (around which locking member **1040***a* is rotatable) passes. Rod **1050***a* passes through a passage or seating **1072***a* in a first side member **1070***a* of base **1010***a* and is held in position therein by bearing **1056***a*. On the opposite end, rod **1050***a* passes through a passage or seating **1082***a* in a second side member **1080***a* of base **1010** and is held in position by bearing **1058***a* and an end member **1059***a*. A biasing element can be used to bias locking member in a locking position in which strap **1100** is prevented from moving or sliding relative to first strap support member **1020***a*. In the embodiment of **FIGS. 8H through 8T**, the biasing element is a spring **1060***a* which is positioned within passage **1042***a*. Second end section **1054***a* of rod **1050***a* passes through spring **1060***a*, which closes tightly around rod **1050***a* and biases locking member **1040***a* in a locking position in a similar manner to that of spring **1060** of buckle **1000** (see **FIG. 8G**).

[**0185**] Under current law in the United States and other countries, a number of labels are required to be attached to

safety harnesses. In currently available safety harnesses, label packs are typically sewn to the harness. Such label packs often become loose, damaged or lost. **FIGS. 9A through 9C** illustrate a connector **1300** of the present invention which can be used to attach a label pack **1400** and/or other items to safety harness **100** or to other safety harnesses. Connector **1300** can, for example, include a base **1310** which can, for example, be fabricated from a resilient polymeric material. Base **1310** includes an attachment mechanism for removable or non-removable attachment of base **1310** to harness **100**. In the embodiment illustrated, for example, in **FIGS. 9A through 9C**, base **1310** includes two slots **1320***a* and **1320***b* through which harness strapping or webbing can passed to attach base **1310** to harness **100** or to another harness. As clear to one skilled in the art, many other types of attachments (either removable or non-removable) can be used. As illustrated, for example, in **FIGS. 2A, 9A** and 9B, shoulder strap **120** of harness **100** can be passed through slots **1320***a* and **1320***b*. Chest strap **140** can be looped around shoulder strap **120** in the area of shoulder strap **120** between slot **1320***a* and **1320**, and chest strap **140** can then be sewn to itself as illustrated, for example, in **FIGS. 9A and 9B**.

[**0186**] Base **1310** further includes an attachment mechanism for attaching an item such as a label pack system **1400** and/or other items thereto. In the embodiment of **FIGS. 9A through 9C**, the item attachment mechanism includes a lower slot **1330** (see **FIG. 9B**) and an upper slot **1340**. An item or a portion thereof to be attached to base **1310** via, for example, a snap fit with one or both of slots **1330** and **1340**. As clear to one skilled in the art many other types of attachments can be used. In the embodiment of **FIGS. 9A through 9C**, label pack system **1400** includes various labels **1410** and a lid or closure **1420**. Closure **1420** can, for example, be permanently or removably attached to base **1310** via lower slot **1330** via a snap fit as known in the art. Closure **1420** can alternatively be formed integrally with base **1310** or otherwise permanently or removably attached thereto. Closure **1420** can include a hinge **1430** (for example, a live hinge as known in the art) about which closure **1420** can rotate or hinge to an open position (as illustrated in **FIG. 9A**) and to a closed position (as illustrated in **FIG. 9B**). Closure **1420** can further include a releasable locking or closing mechanism **1440** which cooperates with upper slot **1340** to hold closure **1420** in a closed position. Application of force to closing mechanism **1440** by the user can release closing mechanism **1440**. Closing mechanism, can for example, include a lever arm extending from closure **1420** with an abutment flange **1442** formed on an end thereof to abut an interior surface of upper slot **1340**. Application of, for example, a downward force (in the orientation of **FIG. 9B**) can remove abutment flange **1442** from contact with base **1310** around the perimeter of slot **1340** and enable opening of closure **1420**.

[**0187**] Labels **1410** can, for example, be permanently attached to base **1310** via stitching or via an adhesive. Labels **1410** can alternatively be attached to closure **1420**. Base **1310** and closure **1420** act together to protect labels **1410** and prevent loosening, detachment or damage of labels **1410**.

[**0188**] Connector **1300** can be used to attach other items such as a cell phone holder **1500** (see **FIG. 2A**) to harness **100** and to other harnesses. Cell phone holder **1500** can, for example, be attached to base **1310** using slots **1330** and **1340** or otherwise attached to base **1310**. Connector **1300** can be used to attach many other devices including, but not limited to, a global positioning system devices, transponders, various communication devices, and/or sensors to, among other things, detect a fall.

[**0189**] In the embodiment of **FIGS. 9A through 9C**, connector **1300** further includes a lanyard attachment ring **1360**, which can be used by a wearer of harness **100** to attach a lanyard (not shown) when the lanyard is not in use for fall protection. In that regard, such a lanyard is attached to D-ring **150** at a first end and to an anchor point at a second end when the lanyard is in use for fall protection. However, attachment ring **1360** can be used to attach the second end of the lanyard when the lanyard is not in use for fall protection (for example, when the wearer is walking around on the ground or on another surface) to keep the lanyard from dragging behind the wearer.

[**0190**] **FIGS. 10A and 10B** illustrate an embodiment of a harness strap end member **1600**, which can operate, for example, to prevent fraying of a harness strap end such as an end **142** of chest strap **140**. In one embodiment, end member **1600** includes a cap or housing **1610** and a clip **1650**. Housing **1610** can, for example, be fabricated from a polymeric material. Clip **1650** is in the form of an alligator clip having a first or upper lever arm **1660**, a second or lower lever arm **1670** and an intermediate hinging area **1680**. Clip **1650** can, for example, be fabricated from an integral piece of a resilient polymeric material or an integral piece of a resilient metal (for example, spring steel). Each of lever arms **1660** and **1670** including gripping teeth on an end thereof opposite hinging area **1680**.

[**0191**] Strap end **142** is first placed within clip **1650** so that, for example, strap end **142** abuts hinging area **1680**. Clip **1650**, with strap end **142** therein, is then pushed into an opening **1620** in housing **1610** which leads to a hollow portion or seating portion **1624** within housing **1610**. Opening **1620** and seating **1624** are dimensioned to force lever arms **1660** and **1670** toward each other so that strap end **142** is securely gripped by the toothed ends of lever arms **1660** and **1670**.

[**0192**] At least one of first lever arm **1660** and second lever arm **1670** can, for example, include a retaining mechanism to retain clip **1650** in operative connection with housing **1610**. In the embodiment of **FIGS. 10A and 10B**, first lever arm **1660** includes abutment member **1662** and **1664** in the from of raised, resilient or flexible tabs. Tabs **1662** and **1664** are biased in an upward direction (in the orientation of **FIG. 10A**), but are forced downward as clip **1650** is pushed within seating **1624**. Housing **1610** includes slots **1612** and **1614** into which tabs **1662** and **1664**, respectively, can spring open. Once tabs **1662** and **1664** spring open or upward into slots **1612** and **1614**, tabs **1662** and **1664** cooperate with slots **1612** and **1614** to prevent movement of clip **1650** and strap end **142** out of connection with housing **1610**. Seating **1624** can include a rear abutment member or wall to facilitate positioning of tabs **1662** and **1664** in operative connection with slots **1612** and **1614**. In the embodiment of **FIGS. 10A and 10B**, slots pass entirely through the wall of housing **1610**, but such slots can pass only partially therethrough.

[**0193**] Housing **1610** can further include a retaining arm **1630** that can be slipped over or around a strap to hold end

member **1600** in connection with the strap (see, for example, **FIG. 2A**). Retaining arm **1630** can, for example, be formed of a resilient material and create a gap between retaining arm **1630** and the surface of housing **1610** suitably dimensioned so that a gripping or biasing force is applied to the strap.

[**0194**] In the embodiment of **FIGS. 10A and 10B**, housing **1610** and clip **1650** are illustrated as separate, connectible elements. However, housing **1610** and clip **1650** can be integrated, for example comolded. Moreover, an end member or end housing such as housing **1650** can be attached to strap end **142** in manners other than using a clip such as clip **1650**. For example, such a housing or end member can be sewn to (via a stitching section **1650***a* as illustrated in **FIG. 10C**), riveted to and/or adhered to strap end **142**. Such an end housing or end member can also be attached via ultrasonic welding. Likewise, an end housing can be overmolded upon a strap end such as strap end **142** using overmolding techniques known in the art.

[**0195**] **FIG. 11** illustrates an embodiment of harness webbing or strapping for use in harness **100** and other safety harnesses. Strap **1800** can, for example, include a generally tubular, outer shell **1804** fabricated from a flexible, high-strength material and a flexible inner member **1806** that can be a foam material as described generally in U.S. Pat. No. 6,739,427, assigned to the assignee of the present invention, the disclosure of which is incorporated herein by reference. In the embodiment of **FIG. 11**, outer shell **1804** includes a first or interior surface **1810** (that is, the surface that lays adjacent the wearer's body when the harness is worn) which is perceptibly different (for example, visibly different and/or different to the touch) from a second or outer surface **1820** thereof. Interior surface **1810** and outer surface **1820** can, for example, be of a different color, pattern and/or of a different texture. Inner surface **1810** can, for example, be woven to be of a different color from and softer than outer surface **1820** to increase the comfort of the user. Outer surface **1820** can be woven to be harder and/or more durable than inner surface **1810** to increase the wear life of the harness even in hostile environments such as experienced in welding operations. Additional or alternatively, materials, dyes or other elements can be added to at least one side of a manufactured harness strap to provide perceptibly different inner and outer surfaces of the harness strap.

[**0196**] Providing a harness including strapping sections having interior surfaces and exterior surfaces which are perceptibly different from each other facilitates donning the harness. In that regard, in currently available harnesses, it is quite difficult for a user to determine the interior and exterior surfaces of the harness, thereby making donning of the harness quite difficult. The interior surface and the exterior surface of the entire length of one or more straps (for example, the entire length of shoulder strap **120**, including back strap **122** and front strap **124**, and shoulder strap **130**, including back strap **132** and front strap **134**) can be perceptibly different as described above. Preferably, the interior surface and the exterior surface of a strap over a substantial portion (for example, at least 50%) of the length of the strap is perceptibly different such that donning is facilitated. In one embodiment, the entire length of each shoulder strap **120** and **130** and each leg strap **180** and **190** of safety harness **100** was formed of strapping having interior surfaces and exterior surfaces which were perceptibly different.

[**0197**] In the embodiment, of **FIG. 11**, inner member or material **1806** can, for example, be surrounded by a material **1840** having a highly visibly color that is different from each of inner surface **1810** and outer surface **1820** to act as a wear indicator. In that regard, should one of inner surface **1810** or outer surface **1820** wear through or tear, wear indicator material **1840** becomes visible and the harness can be taken out of service.

[**0198**] Inner surface **1810** and outer surface **1820** can, for example, be formed/woven separately and sewn together on the lateral sides of outer shell **1804** of strap **1800**. Alternatively, inner surface **1810** and outer surface **1820** can be woven integrally using methods known in the weaving arts. In the embodiment of **FIG. 11**, strap **1800** includes spaced stitching sections **1830** that create a quilted effect and that can operate to prevent bunching or movement of inner member **1806** within outer sheath **1804**. Spaced stitching sections **1830** can also create pockets for air flow.

[**0199**] **FIGS. 12A through 12Q** illustrate an embodiment of a back pad **2500** of the present invention. Back pad **2500** includes a base **2510** which contacts the back of the wearer and is fabricated to be flexible to conform to the contour of the user's back. Back pad **2500** includes at least one shield or energy absorbing/distributing member **2520** attached to an outer surface of base **2510** (for example, by being sewn to a perimeter of base **2510**) in a lower section of base **2510** which functions, in part, to protect back straps **122***a* and **132***a* of full body safety harness **100***a* (or other safety harness) and the wearer of safety harness **100***a* against blows from, for example, sharp and heavy items such as a snap hook **196***a* and/or a self-retracting lanyard **198***a* (see **FIG. 12N**) attached to D-ring **150**. In one embodiment, shield **2520** includes a contact surface **2521** that covers straps **122***a* and **132***a* and extends therebetween to cover the portion of the user's back between straps **122***a* and **132***a*. Shield **2520** can, for example, be sufficiently flexible to allow flexing of back pad **2500** in the area of shield **2520** to conform to the back of the user during movement of the wearer of back bad **2500**.

[**0200**] In general, the material(s) for shield **2520**, and particularly contact surface **2521**, are preferably durable and resistant over extended use. In that regard, the materials are preferably chemically resistant (for example, to substances that may be encountered during use). Moreover, the materials preferably retain both flexibility and energy absorption/distribution properties over an extended temperature range (for example, from −20° F. to 100° F. and, more preferably from −50° F. to 140° F.).

[**0201**] In the embodiment illustrated in **FIGS. 12A through 12Q**, shield **2520** is fabricated from a relatively thin, flexible and hard polymeric material. In this embodiment, shield **2520** distributes the force of any blow to shield **2520** over the area of shield **2520**, protecting straps **122***a* and **132***a* and "softening" the blow experienced by the user. The force of such a blow can, for example, be distributed over an area of 3 to 6 square inches or more. In this embodiment, shield **2520** preferably exhibited a hardness of at least 30 Shore durometer or durometer hardness on the Shore A scale. More preferably, the hardness of the material of shield **2520** was at least 50 durometer hardness. Even more preferably, the hardness of the material of shield **2520** is at least 80 durometer hardness. In several embodiments of the

present invention, shield **2520** exhibited a durometer hardness in the range of approximately 80 to approximately 100. Shield **2510** can, for example, be fabricated from a polymeric material such as a thermoplastic rubber. In one embodiment, shield **2520** was fabricated from SANOPRENE® having a durometer hardness of approximately 90.

[**0202**] In the embodiment illustrated in **FIGS. 12H through 12J**, shield **2520** was formed from an integral piece of polymeric material (for example, a thermoplastic rubber). Shield **2520** included a generally flat flange or perimeter portion **2528** on a forward section thereof which was attached to base **2510** (for example, by stitching). In the illustrated embodiment, forward flange portion **2528** did not extend over the entire forward surface of shield **2520** but only around the perimeter thereof. In that regard, a forward surface of channels **2522** and **2524** was formed, in part, by a rearward surface of base **2510** (see, for example, **FIG. 12D**).

[**0203**] In the illustrated embodiment, shield **2520** is positioned below (in, for example, the orientation of **FIG. 12N**) D-ring **150**, which is the position most likely to receive a blow from snap hooks, self-retracting lanyards or other items. A similar shield or an extension of shield **2520** can also be provided in the vicinity of and/or above D-ring **150**.

[**0204**] In the illustrated embodiment, back shield **2520** also functions to channel crossing webbing straps **122***a* and **132***a* in a manner to fit body types of a wide range of sizes. In that regard, unlike a number of available back pads, straps **122***a* and **132***a* are not connected or fixed in position within channels **2522** and **2524** and are free to move over a range of positions as they pass through channels **2522** and **2524** formed in shield **2500**. In that regard, channels **2522** and **2524** are preferably at least 20% wider than straps **122***a* and **132***a*. More preferably, channels **2522** and **2524** are preferably at least 50% wider than straps **122***a* and **132***a*. As illustrated in **FIG. 12K**, another embodiment of a back shield **2520***a* of the present invention includes a generally central divider **2526***a*, and straps **122***a* and **132***a* are free to move within channels **2522***a* and **2524***a* over a variety of positions, but are preferably prevented from crossing within shield **2520***a* by divider **2526***a*.

[**0205**] In alternative embodiment, as, for example, illustrated in **FIG. 12L**, one or more other materials can be used in shield **2520***b* of the present invention to protect straps **122***a* and **132***a* and the user of the safety harness from forces associated with blows from, for example, sharp and heavy items such as a snap hook **196***a* and/or a self-retracting lanyard **198***a*. For example, contact surface **2521***b*, can include one or more energy absorbent materials such as a resilient polymeric foam or a resilient electrometric material.

[**0206**] As illustrated, for example, in **FIG. 12F**, an inward portion of base **2510** includes a plurality of padding sections **2512** (illustrated in dashed lines in **FIG. 12F**) of various shapes, which can, for example, be fabricated from a foamed polymeric or other cushioning material as known in the art. Separations **2514** between padding sections **2512** create articulated segments in base **2510** that further facilitate bending of back pad **2500** to follow the ergonomic movement of a person at work (see, for example, **FIG. 12A**). Moreover, separations, contours or valleys **2514** between padding sections **2512** facilitate air flow to enhance comfort/coolness. In one embodiment, a knitted membrane **2516** covered padding sections **2512**. Preferably, knitted membrane **2516** does not absorb moisture and further promotes air flow to enhance comfort/coolness. Knitted membrane **2516** was sewed to the perimeter of base **2510**.

[**0207**] Base **2510** of back pad **2500** further includes an upper section over which straps **122***a* and **132***a* pass before crossing through D-ring **150** (see, for example, **FIG. 12N**). In one embodiment, channels **2532** and **2534** for passage of straps **122***a* and **132***a* were created with a section of meshed fabric **2536**. In the illustrated embodiment, a border or perimeter **2538** of elastic material surrounded meshed fabric **2536**. Border **2538** was sewn to base **2510** in a manner to create channels **2532** and **2534**. In one embodiment, a reference point such as the top of border **2538** of meshed section **2536** was positioned relative to D-ring **150** such that when border **2538** is positioned at a reference point on the wearer of harness **100***a* such as the base of the user's neck (generally, at the bottom of a shirt collar **2***a* of the user as illustrated in **FIG. 12N**), back pad **2500** operates to properly position D-ring **150** for people ranging from the 5th to the 95th percentile in size.

[**0208**] D-ring **150** and D-ring pad **2600** are positioned over an intermediate section of base **2510** between meshed section **2536** and shield **2520**. In the illustrated embodiments, D-ring **150** and D-ring pad **2600** were not attached to base **2510**. As known in the art, D-ring pad includes six slots **2610** through which straps **122***a* and **132***a* cross and pass through a channel **152** of D-ring **150** (see, for example, **FIGS. 120 and 12**Q). In one embodiment, D-ring pad **2600** included a rotatable housing section **2620** in which an attachment member **154** at the bottom of channel **152** of D-ring **150** was positioned. Housing section **2620** is rotatably seated within seatings **2630**. A standard D-ring pad **2600***a*, without such a housing, as illustrated in **FIGS. 12P and 12Q** can also be used in connection with back pad **2500** of the present invention.

[**0209**] The foregoing description and accompanying drawings set forth preferred embodiments of the invention at the present time. Various modifications, additions and alternative designs will, of course, become apparent to those skilled in the art in light of the foregoing teachings without departing from the scope of the invention. The scope of the invention is indicated by the following claims rather than by the foregoing description. All changes and variations that fall within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

1. A back pad for use in connection with a safety harness comprising at least two spaced back straps, the back pad comprising a shield covering at least a portion of each of the back straps of the safety harness, the shield extending between the back straps to cover a portion of a user's back when the safety harness is worn.

2. The back pad of claim 1 wherein the shield is flexible and has a hardness of at least 30 Shore durometer.

3. The back pad of claim 1 wherein shield is flexible and has a hardness of in the range of approximately 80 to 100 Shore durometer.

4. The back pad of claim 1 wherein the shield comprises a first channel and a second channel through which a first strap section and a second strap section, respectively, pass.

5. The back pad of claim 4 wherein the first channel is wider than the first strap section so that the first strap section can move laterally within the first channel and the second channel is wider than the second strap section so that the second strap section can move laterally within the second channel.

6. The back pad of claim 1 further comprising a reference point thereon adapted to be aligned with a reference point on a wearer of the harness to position a D-ring in operative connection with the back pad on the wearer.

7. A back pad for use in connection with a safety harness comprising back strap sections that cross in the vicinity of the back pad, the back pad comprising at least one channel through which at least one of the back strap sections passes, the channel being wider than the back strap section so that the back strap section can move laterally within the channel.

8. The back pad of claim 7 wherein the channel is at least 20% wider than the back strap section.

9. The back pad of claim 7 wherein the channel is at least 50% wider than the back strap section.

10. A back pad for use in connection with a safety harness, the back pad comprising a reference point thereon adapted to be aligned with a reference point on a wearer of the harness to position a D-ring in operative connection with the back pad on the wearer.

11. A full body safety harness to be worn by a person, comprising: an upper torso portion and a lower seat portion, the upper torso portion being operatively connected to the lower seat portion by a first connector on a first lateral side and a second connector on a second lateral side thereof, the first connector and the second connector enabling forward and rearward rotation of the upper torso portion relative to the lower seat portion, at least one of the first connector and the second connector comprising a shaft, the upper torso portion comprising at least one connecting member having a passage formed therein, the lower seat portion comprising at least one connecting member have a passage formed therein, the shaft passing through the passage of the at least one connecting member of the upper torso portion and through the passage of the at least one connecting member of the lower torso portion.

12. The full body safety harness of claim 11 wherein the connecting member of the upper torso portion is a strap section of the upper torso portion and the connecting member of the lower seat portion is a strap section of the lower seat portion.

13. The full body safety harness of claim 13 wherein the strap section of the upper torso portion comprises a grommet through which the shaft passes and the strap section of the lower seat portion comprises a grommet through which the shaft passes.

14. A full body safety harness to be worn by a person, comprising: an upper torso portion and a lower seat portion, the upper torso portion being operatively connected to the lower seat portion by a first connector on a first lateral side and a second connector on a second lateral side thereof, the first connector and the second connector enabling forward and rearward rotation of the upper torso portion relative to the lower seat portion, the upper torso portion including at least one strap, the lower seat portion including at least one strap, at least one of the first connector and the second connector comprising a loop formed on an end of the strap of the upper torso portion and a loop formed on an end of the strap of the lower seat portion, the loop of the strap of the upper torso portion being interconnected with the loop of the strap of the lower torso portion.

15. A safety harness to be worn by a person, comprising at least a first strap and a second strap, the first strap and the second strap being connected by a cam buckle in operative connection therewith to adjust a fit of the safety harness, the can buckle comprising a base and a cam shaped locking member in moveable, operative connection with the base, the locking member comprising an abutment surface moveable into and out of contact with the first strap, the base comprises a first strap support around which the first strap passes and a second strap support around which the second straps passes, the abutment surface of the locking member being biased in connection with a first surface of the first strap over a section of the strap wherein a second, opposing surface of the first strap contacts the support member, the base being formed from a polymeric material, the base further comprising a support member of a material having a higher ultimate tensile load than the polymeric material, the support member having an opening therein through which the first strap passes and through which the second strap passes.

16. A full body safety harness to be worn by a person, comprising: an upper torso portion and a lower seat portion, the upper torso portion being operatively connected to the lower seat portion by a first connector on a first lateral side and a second connector on a second lateral side thereof, the first connector and the second connector enabling forward and rearward rotation of the upper torso portion relative to the lower seat portion, the first connector comprising at least one shaft and the second connector comprising at least one shaft, at least one of the upper torso portion and the lower seat portion being rotatably connected to the shaft of the first connector and at least one of the upper torso portion and the lower torso portion being rotatably connected to the shaft of the second connector.

17. An accessory attachment system for use in connection with worn articles comprising a strap or a belt, the accessory attachment system comprising: a connector having a channel therein through which the strap or belt can pass and an attachment member attached to the connector.

18. A full body safety harness system comprising an accessory attachment system for use in connection with a strap of the safety harness system or a belt worn in connection with the safety harness system, the accessory attachment system comprising: a connector having a channel therein through which the strap or the belt can pass and an attachment member attached to the connector.

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