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(54) **NECK CLOSURE SYSTEM FOR A WETSUIT**

(52) **U.S. Cl. .... 2/2.16**

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(57) **ABSTRACT**

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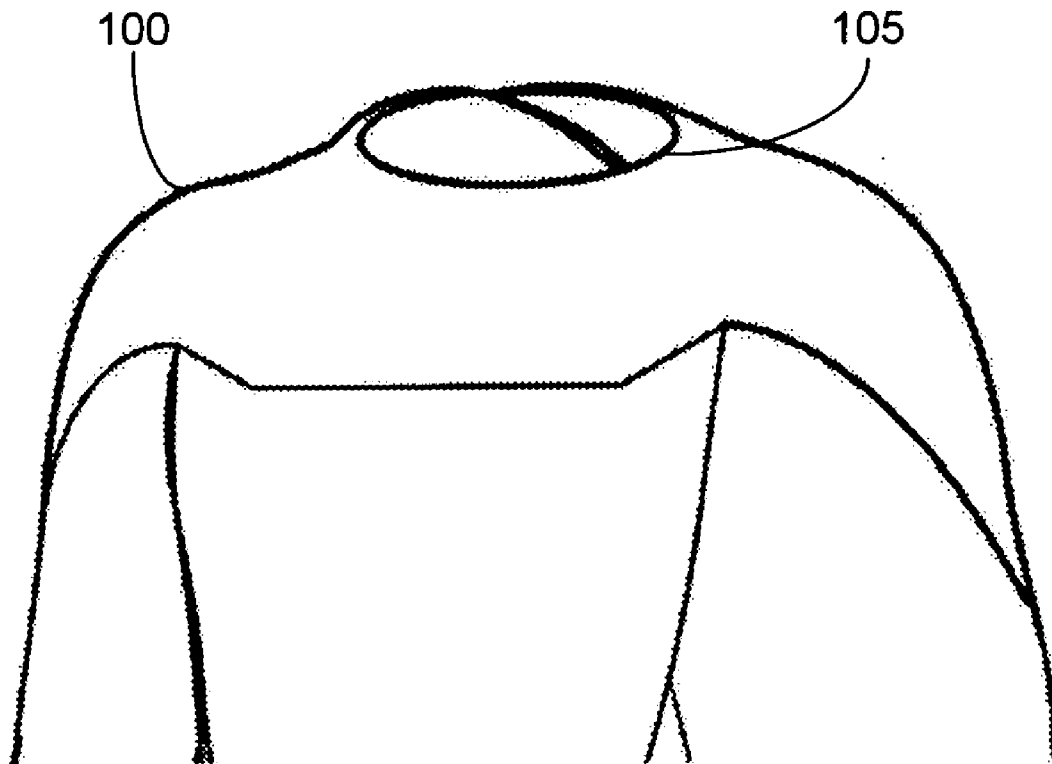
A flexible neck closure that is coupled to specific anchor points on the exterior back and front of a wetsuit by releasable fasteners such that a tensile force is generated in the closure when the wetsuit is worn. The back-to-front tensile forces produce a compressive seal between the flexible neck closure and the wetsuit exterior. The body of the neck closure may have an elongation that is greater or less than the elongation of the fastener. The inner surface of the neck closure and/or the exterior surface of the wetsuit may have one or more rib features for producing a localized seal.

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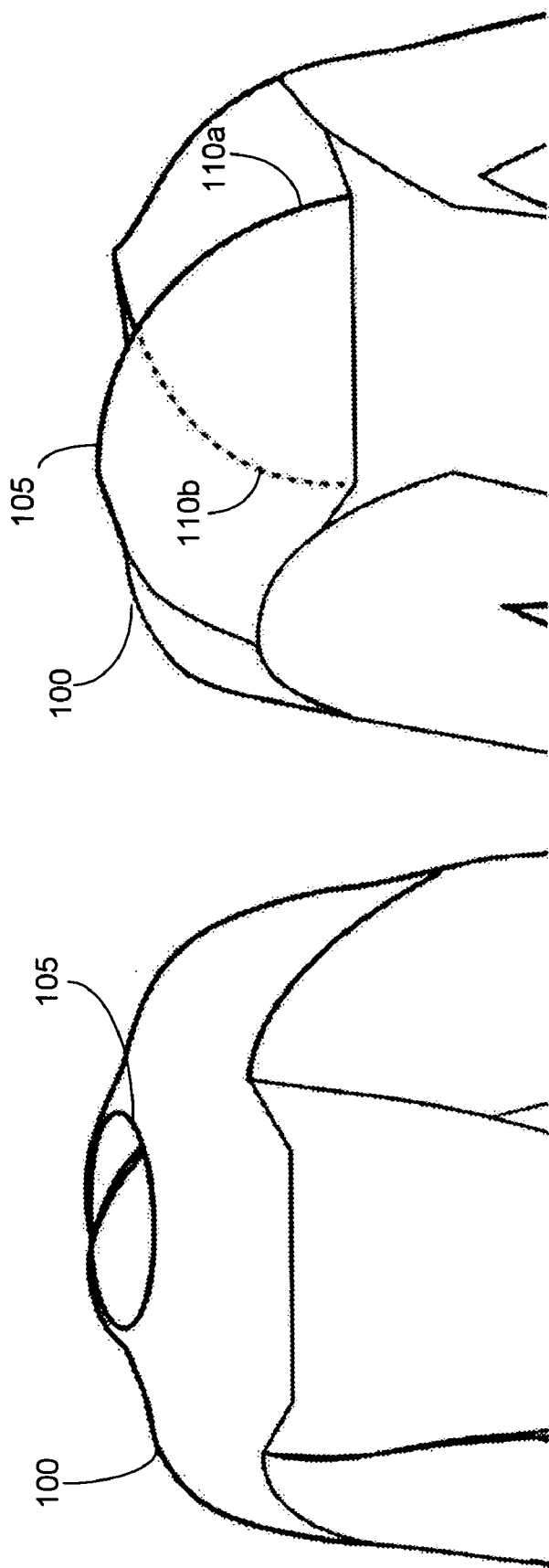


FIG. 1B

FIG. 1A

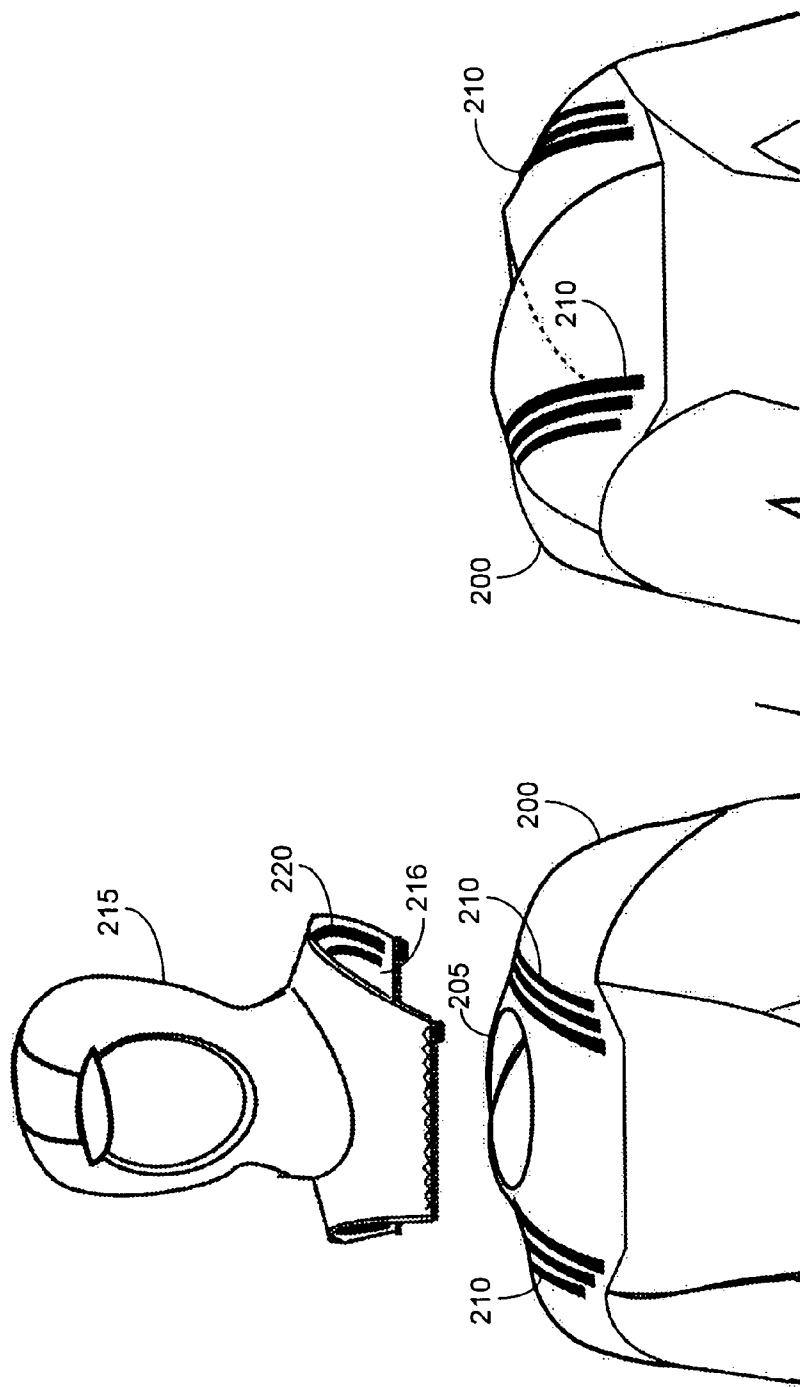


FIG. 2B

FIG. 2A

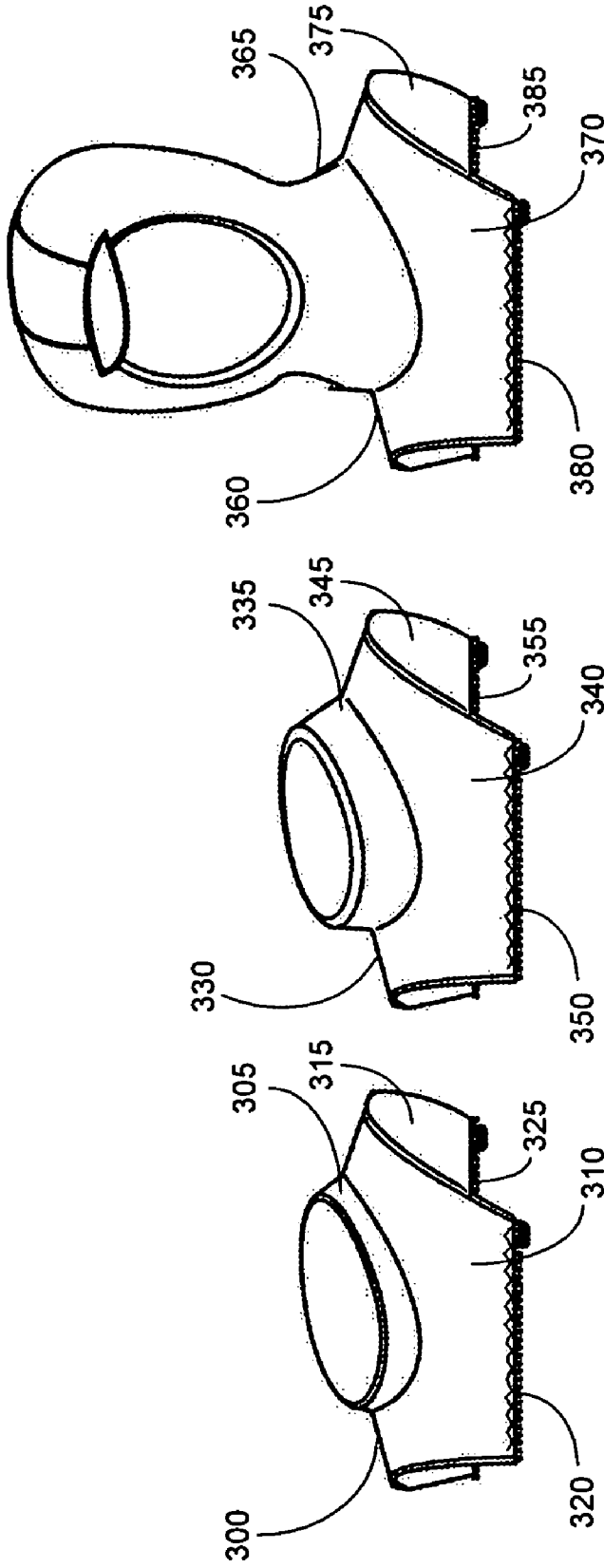


FIG. 3A

FIG. 3B

FIG. 3C

400

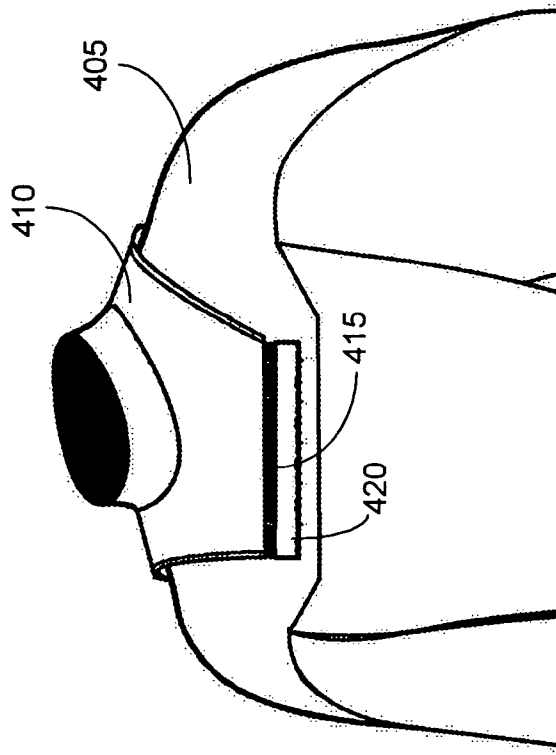


FIG. 4A

401

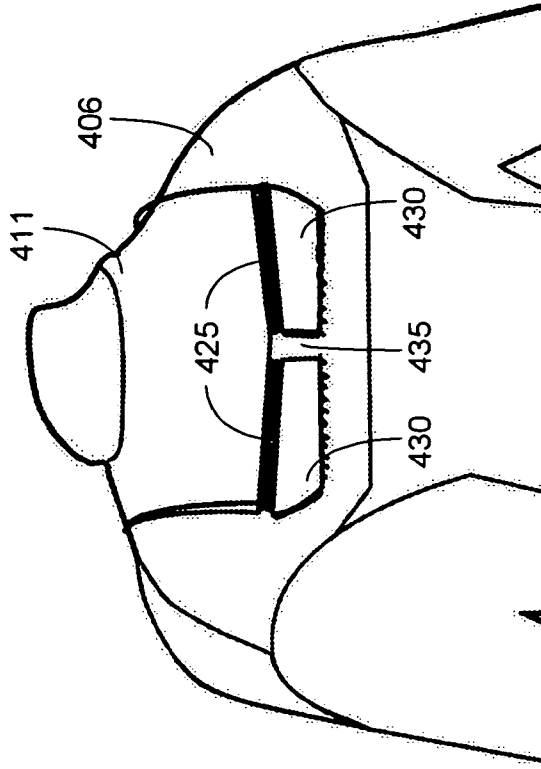


FIG. 4B

500

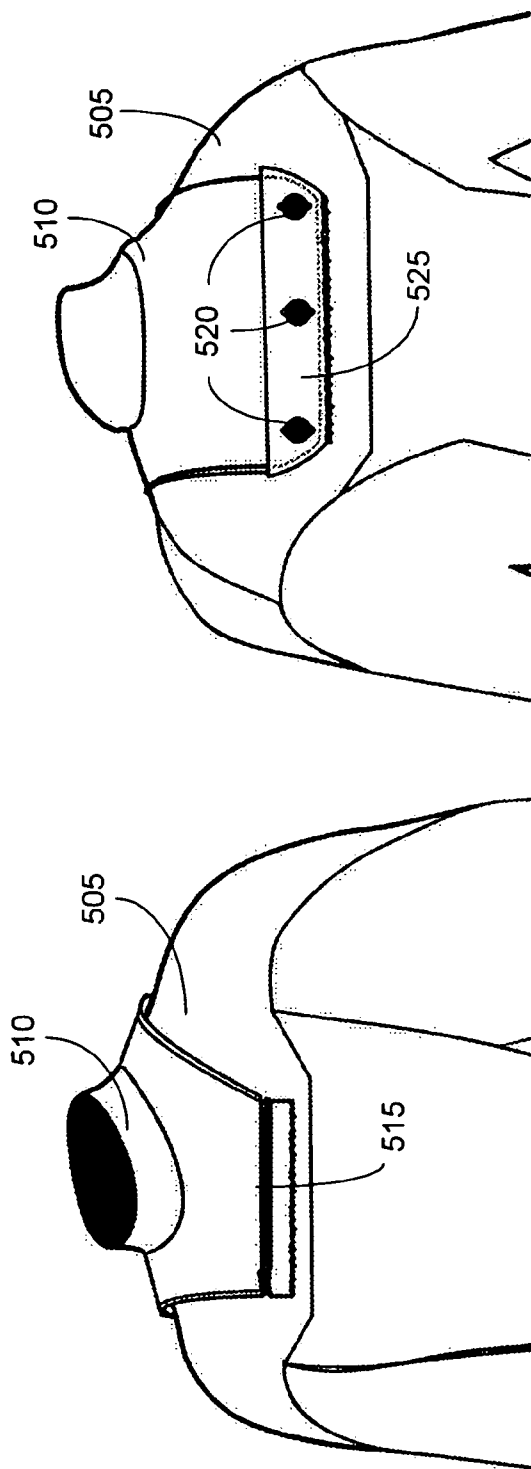


FIG. 5B

FIG. 5A

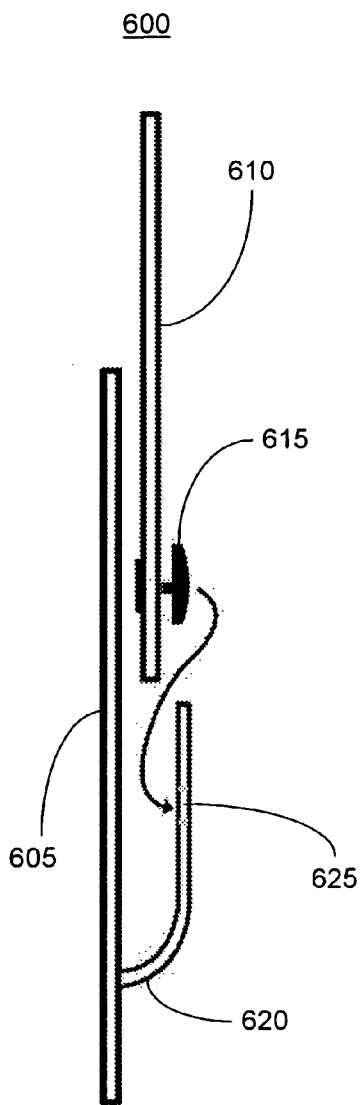


FIG. 6A

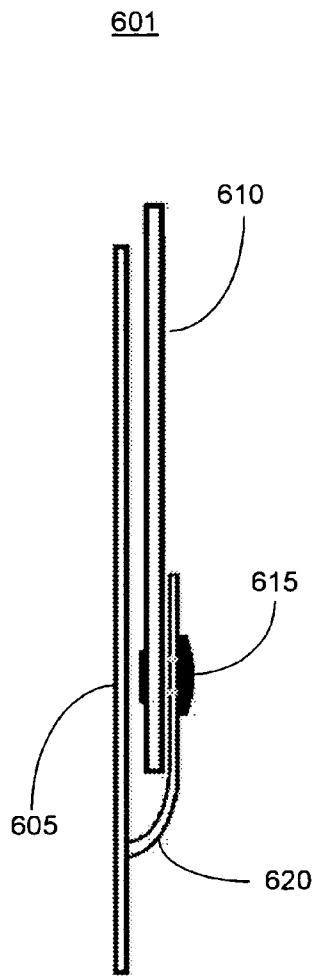


FIG. 6B

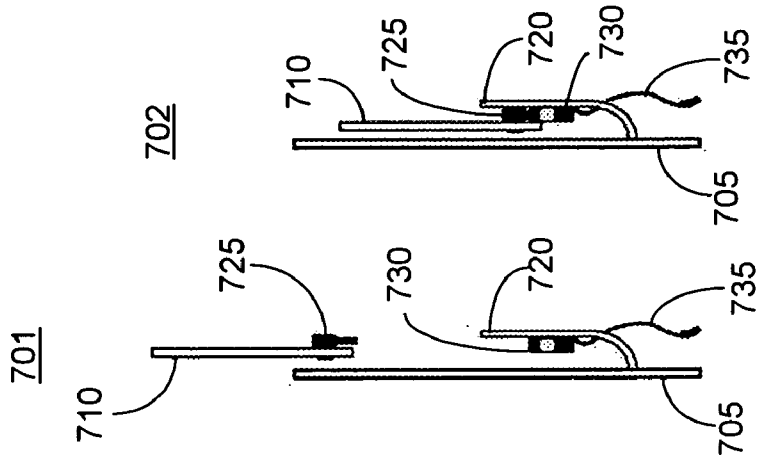


FIG. 7B FIG. 7C

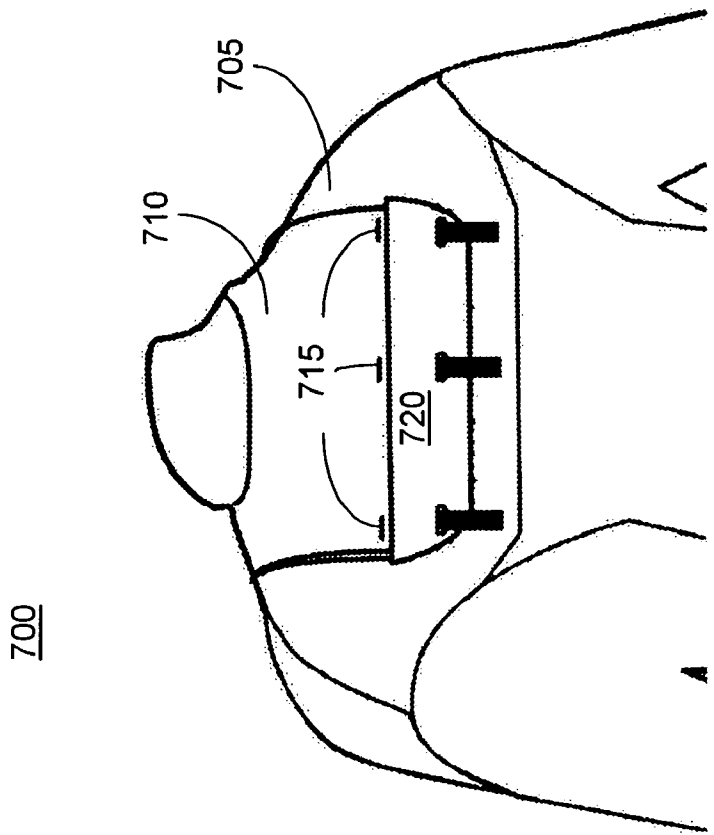


FIG. 7A



800

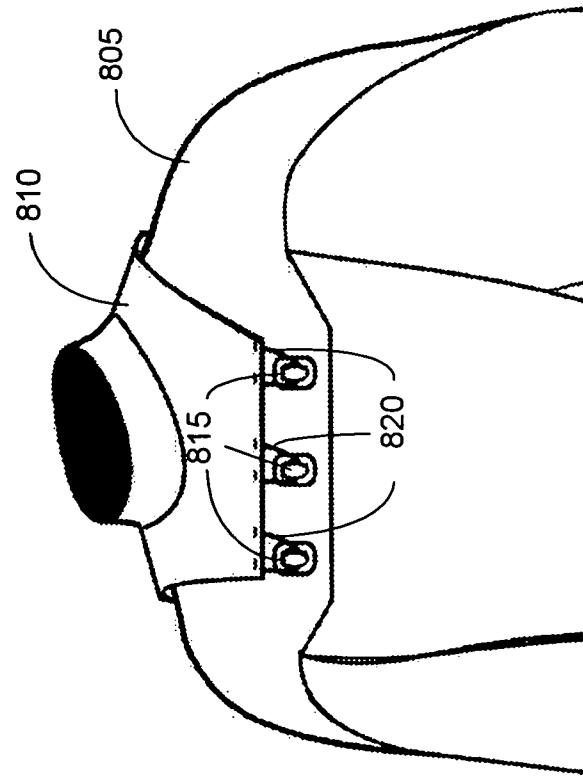


FIG. 8A

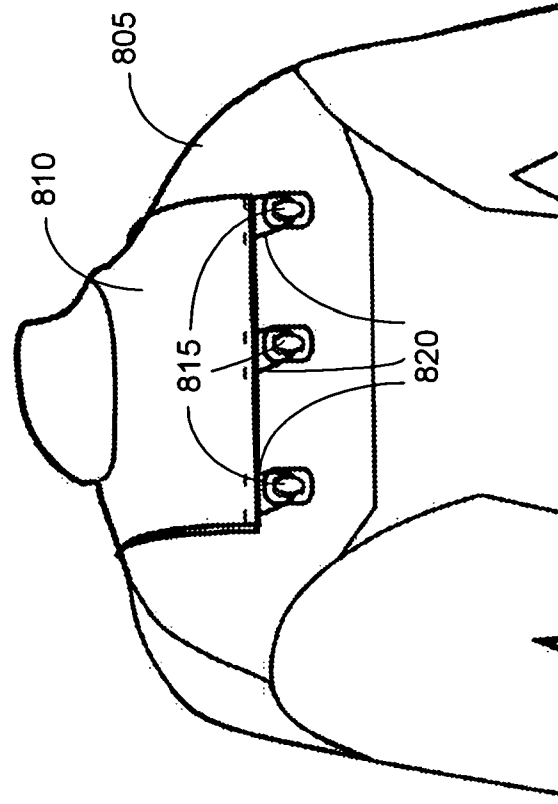


FIG. 8B

## NECK CLOSURE SYSTEM FOR A WETSUIT

### BACKGROUND OF THE INVENTION

#### [0001] 1. Field of the Invention

[0002] The present invention relates to systems for restricting the entry of water through the neck opening of a wetsuit.

#### [0003] 2. Description of Related Art

[0004] Wetsuits are close fitting garments that are typically worn for insulation against cold temperatures in aquatic environments. The thermal insulation provided by a wetsuit derives from the close fit and the foam structure. Wetsuits used in aquatic sports are typically fabricated from foamed neoprene rubber with a thickness of about 1 to 6 millimeters.

[0005] The thickness of a wetsuit and the degree of body coverage offered are generally determined by the expected temperature of the aquatic environment in which it is to be used. Wetsuits used in colder environments usually offer a degree of lower body coverage and are donned by stepping into the wetsuit.

[0006] Although wetsuits permit a limited amount of water to enter, it is desirable to avoid a continuous flow of water into and out of the wet suit. The neck and shoulder area of a wetsuit is often the entry point for a wetsuit, and thus is usually a more difficult opening at which to obtain closure.

[0007] In order to provide a closure for the neck region, the prior art has provided combinations of flaps and bibs with collars and hoods that typically form a seal on the interior of a wetsuit such as those disclosed in U.S. Patent Application Publications No. 20020108160 and No. 20050010988.

[0008] The aforementioned prior art closure systems rely on areal contact seals that lack specific features for preventing the entrance of water. Further, these closure systems rely upon the inherent compression of the wetsuit interior, and do not provide forces specific to the seal between the closure and the wetsuit. The efficacy of an areal contact will be affected by the build of the user, the cut of the wet suit, and the movements of the user.

[0009] Thus, a need exists for a neck closure system for a wetsuit that provides specific forces and/or features to provide a localized barrier to water entry that is not dependent upon the compression of the wetsuit interior.

### BRIEF SUMMARY OF THE INVENTION

[0010] The present invention provides a flexible neck closure that is coupled to specific anchor points on the exterior back and front of a wetsuit by releasable fasteners such that a tensile force is generated in the closure when the wetsuit is worn. The back-to-front tensile forces produce a compressive seal between the flexible neck closure and the wetsuit exterior.

[0011] In one embodiment the body of the neck closure has a greater elongation than the fastener of the neck closure. For example, the neck closure body may be constructed of neoprene and the fastener may be a zipper.

[0012] In another embodiment the body of the neck closure has a lesser elongation than the fastener of the neck closure. For example, the neck closure body may be constructed of thick neoprene and the fastener may include an elastic loop and hook.

[0013] In a further embodiment a surface of the neck closure has at least one sealing rib feature for producing a localized seal against the exterior of the wetsuit. For example, a bead having a semi-circular cross-section may extend from back-to-front on the surface of the neck closure.

[0014] In yet another embodiment the exterior surface of the wet suit has at least one sealing rib feature for producing a localized seal against a surface of the neck closure. For example, a bead having a semi-circular cross-section may extend from back-to-front on the exterior surface of the wetsuit.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1A shows a front view of a wetsuit with a non-sealing neck in accordance with an embodiment of the present invention.

[0016] FIG. 1B shows a back view of the wetsuit shown in FIG. 1A in accordance with an embodiment of the present invention.

[0017] FIG. 2A shows a front view of a wetsuit and a hood closure as part of a neck closure system in accordance with an embodiment of the present invention.

[0018] FIG. 2B shows a back view of the wetsuit of FIG. 2A in accordance with an embodiment of the present invention.

[0019] FIG. 3A shows a front view of a neck closure with a low collar in accordance with an embodiment of the present invention.

[0020] FIG. 3B shows a front view of a neck closure with a high collar in accordance with an embodiment of the present invention.

[0021] FIG. 3C shows a front view of a hooded neck closure in accordance with an embodiment of the present invention.

[0022] FIG. 4A shows a front view of a neck closure system fastened with a front zipper in accordance with an embodiment of the present invention.

[0023] FIG. 4B shows a back view of a neck closure system fastened with two back zippers in accordance with an embodiment of the present invention.

[0024] FIG. 5A shows a front view of a neck closure system fastened with a front zipper in accordance with an embodiment of the present invention.

[0025] FIG. 5B shows a back view of the neck closure system of FIG. 5A, with rear button fasteners in accordance with an embodiment of the present invention.

[0026] FIG. 6A shows a detail view of a disengaged button closure in accordance with an embodiment of the present invention.

[0027] FIG. 6B shows a detail view of an engaged button closure in accordance with an embodiment of the present invention.

[0028] FIG. 7A shows a back view of a neck closure system fastened with buckles having adjustable webbing in accordance with an embodiment of the present invention.

[0029] FIG. 7B shows a detail view of a disengaged buckle closure in accordance with an embodiment of the present invention.

[0030] FIG. 7C shows a detail view of an engaged buckle closure in accordance with an embodiment of the present invention.

[0031] FIG. 8A shows a front view of a neck closure system fastened with hooks and elastic loops in accordance with an embodiment of the present invention.

[0032] FIG. 8B shows a back view of a neck closure system fastened with hooks and elastic loops in accordance with an embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

[0033] FIG. 1A shows a front view of a wetsuit 100 with a non-sealing neck 105 in accordance with an embodiment of the present invention. The wetsuit 100 may be a wetsuit with coverage of the legs. Alternatively, the wetsuit 100 may be a jacket that may be used with a longjohn. The non-sealing neck 105 lacks a collar or other reinforcement, and thus is susceptible to water entry under turbulent conditions in an aquatic environment.

[0034] FIG. 1B shows a back view of the wetsuit 100 of FIG. 1A. An outer flap 110a overlaps an inner flap 110b. The flaps provide an expandable opening for entry into the wetsuit 100. A back zipper may also be used in place of the overlapping flaps 110a and 110b.

[0035] Although the non-sealing neck 105 lacks the reinforcement or tight fit necessary for a good seal, the non-sealing neck 105 typically provide better elasticity and a larger initial opening for entry than a sealing neck. This allows for the use of a shorter zipper 110.

[0036] FIG. 2A shows a front view of a wetsuit 200 and a matching hood closure 215 as part of a neck closure system in accordance with an embodiment of the present invention. a number of sealing ribs 210 are disposed on the exterior surface of the wetsuit 200. Although a single continuous rib surrounding the neck may be used, the placement of anchor points and releasable fasteners on the front and back of a wetsuit usually provide sufficient local sealing so that a sealing rib traversing the front or back is not essential, although it may be used for enhanced sealing.

[0037] For purposes of this disclosure, a releasable fastener is defined as a fastener having at least two components that may be repeatedly engaged and disengaged from each other. A fastener is considered to be attached to a wetsuit or neck closure if at least one component of the fastener is attached, although the other component may or may not be engaged. For example, a button hole may be considered attached to a button flap that is attached to a wetsuit, and a button may be considered attached to a neck closure.

[0038] FIG. 2B shows a back view of the wetsuit 200 of FIG. 2A in which the sealing ribs 210 can be seen extending across the top of the shoulders to the back of the wetsuit 200. although three ribs are shown on each side of the wet suit

body 200, as few as one rib per side, or more, may be used. The sealing rib 210 provides a localized high point to which a positive contact may be established and maintained against the inner surface 216 of the hood closure 215.

[0039] A series of sealing ribs 220 are shown on the inner surface 216 of the hood closure 215. Sealing ribs may be used on either the hood closure 215, the wetsuit 200, or both. When sealing ribs are present on both the wetsuit 200 and the inner surface 216, they may be oriented so that a continuous contact along all or most of their length is established when the hood closure 215 is drawn to the wetsuit 200. The ribs may be fabricated using resins to specifically enhance tack.

[0040] FIG. 3A shows a front view of a neck closure 300 with low collar 305 in accordance with an embodiment of the present invention. The closure has a front zipper fastener 320 and a back zipper fastener 325. Since the zipper fasteners 320 and 325 do not have inherent elasticity, it is preferable that the closure body 300 be constructed of a material that does have inherent elasticity (e.g., foamed or sheet elastomeric material).

[0041] The low collar 305 is preferably constructed with an elastic material so that the collar 305 will expand when drawn over the head of as user, and subsequently contract to provide a seal against the neck of the user. The neck closure 300 does not provide insulation for the head of the user, and is best suited for use in warmer conditions. In the absence of a requirement for insulation, the neck closure 300 may be fabricated of higher density (e.g., unfoamed) materials.

[0042] FIG. 3B shows a front view of a neck closure 330 with a high collar 335 in accordance with an embodiment of the present invention. Neck closure 330 is similar to neck closure 300 in that it has a front zipper fastener 350 and a back zipper fastener 355; however, the higher collar 335 provides a better neck seal and more insulation than the low collar 305.

[0043] FIG. 3C shows a front view of a hooded neck closure 360 in accordance with an embodiment of the present invention. Neck closure 360 is similar to neck closure 300 in that it has a front zipper fastener 350 and a back zipper fastener 355; however, the hood 365 provides a better neck seal and more insulation than either collar 305 or collar 335. A hood is preferably fabricated from a foamed elastomeric material.

[0044] One or more sealing ribs similar to rib 220 of FIG. 2A may be used on the inner surface 315, 345, and 375, of closures 300, 330, and 360, respectively. Just as the body 310, 340, and 370, of closures 300, 330, and 360, respectively, may or may not be constructed of a foamed material, the sealing ribs may or may not be constructed of a foamed material.

[0045] FIG. 4A shows a front view of a neck closure system 400 fastened with a front zipper 420 in accordance with an embodiment of the present invention. Neck closure 410 is similar to neck closure 330 of FIG. 3B. The zipper 420 is attached to the wetsuit 405 by a zipper flap 425.

[0046] FIG. 4B shows a back view of a neck closure system 401 for a wetsuit fastened with two back zippers 430 in accordance with an embodiment of the present invention. Neck closure 411 is similar to neck closure 330 of FIG. 3B.

The zippers 425 are attached to the wetsuit 406 by zipper flaps 425. The use of two zippers 430 allows for an elastic region 435 to be maintained on the back of the wetsuit 406 so that flexibility of the user is not compromised.

[0047] FIG. 5A shows a front view of a neck closure system 500 fastened with a front zipper 515 in accordance with an embodiment of the present invention. FIG. 5B shows a back view of the neck closure system 500, with rear button fasteners 520. Button fasteners 520 are buttoned to button flap 525, which is attached to the a wetsuit 505. Button flap 525 is preferably constructed of an elastic material in order to maintain flexibility for the user.

[0048] In general, releasable fasteners may be disposed at anchor points on the front and back of the exterior surface of a wetsuit. The configuration of the neck closure, releasable fasteners, and anchor points is such that when the wetsuit is worn by a user with a close fit and the releasable fasteners are engaged, a tensile force is developed in the neck closure between the anchor points on the front of the wetsuit and the anchor points on the back.

[0049] FIG. 6A shows a detail view of a disengaged button closure 600 similar to that shown in FIG. 5B. A button 615 is attached to a closure body 610. A buttonhole 625 is provided in button flap 620, which is attached to a wetsuit 605. FIG. 6B shows a detail view of an engaged button closure 601.

[0050] FIG. 7A shows a back view of a neck closure system 700 fastened with three buckles 715 in accordance with an embodiment of the present invention. FIG. 7B shows a detail view of a disengaged buckle closure 701. Each buckle includes a buckle insert 725 and a buckle capture 730. The buckle insert 725 is attached to a closure body 710 and the buckle capture 730 is attached to a strap 735. The strap is attached to a buckle flap 720 which is attached to a wetsuit 705.

[0051] FIG. 7C shows a detail view of an engaged buckle closure 702. The buckle insert 725 is inserted in the buckle capture 730. The operation of the strap 735 and buckle 715 is similar to the operation of an automobile seat belt in that the tension may be adjusted by sliding the strap through the buckle. The strap 735 may be a webbing similar to that used in a seat belt. The strap 735 may also be an elastic band.

[0052] FIG. 8A shows a front view of a neck closure system 800 fastened with hooks 815 and elastic loops 820 in accordance with an embodiment of the present invention. The elastic loops 820 are attached to a closure body 810 and the hooks 815 are attached to a wetsuit 805. FIG. 8B shows a back view of the neck closure system 800. Neck closure system 800 is an example of a system wherein most of the elasticity may be provided by the fasteners.

[0053] Common elastomers such as polyurethane, rubbers, and styrenic block copolymers (SBCs) can be formulated with an elongation of several hundred percent. Elastic cord fabricated from these polymers may be used in neck closure systems wherein the neck closure body lacks elasticity.

[0054] While the invention has been described in detail with reference to preferred embodiments thereof, it will be apparent to one skilled in the art that various changes can be made, and equivalents employed, without departing from the

scope of the invention. For example, the type and number of releasable fasteners may be varied, with different types of fasteners being combined in a single closure system. Examples of equivalent releasable fasteners may include, and are not limited to velcro, snaps and toggles.

1. A neck closure system for a wetsuit comprising:
  - a fully detachable flexible neck closure;
  - a plurality of anchor points disposed on an exterior surface of said wetsuit;
  - a plurality of releasable fasteners for coupling said fully detachable flexible neck closure to said plurality of anchor points.
2. The neck closure system of claim 1 wherein said flexible neck closure comprises a collar.
3. The neck closure system of claim 1 wherein said flexible neck closure comprises a hood.
4. The neck closure system of claim 1 wherein said plurality of fasteners comprises at least one zipper.
5. The neck closure system of claim 1 wherein said plurality of fasteners comprises at least one button.
6. The neck closure system of claim 1 wherein said plurality of fasteners comprises at least one hook and at least one elastic loop.
7. The neck closure system of claim 1 wherein said flexible neck closure comprises a foamed elastomer material.
8. The neck closure system of claim 1 further comprising at least one sealing rib disposed on an inner surface of said flexible neck closure.
9. The neck closure system of claim 1 further comprising at least one sealing rib disposed on an exterior surface of said wetsuit.
10. The neck closure system of claim 1 further comprising:
  - at least one first sealing rib disposed on an inner surface of said flexible neck closure;
  - at least one second sealing rib disposed on an exterior surface of said wetsuit;
 wherein contact is established between said first sealing rib and said second sealing rib when said flexible neck closure is drawn to said wetsuit through the engaging of said releasable fasteners.
11. A wetsuit comprising:
  - at least one first releasable fastener for fastening a fully detachable flexible neck closure, wherein said first releasable fastener is attached to an anchor point on a front exterior surface of said wetsuit; and
  - at least one second releasable fastener for fastening a fully detachable flexible neck closure, wherein said first releasable fastener is attached to an anchor point on a back exterior surface of said wetsuit.
12. The wetsuit of claim 11 wherein at least one of said first and second releasable fasteners comprises a zipper.
13. The wetsuit of claim 11 wherein at least one of said first and second releasable fasteners comprises a buttonhole.
14. The wetsuit of claim 11 wherein at least one of said first and second releasable fasteners comprises a hook.
15. The wetsuit of claim 11 wherein at least one of said first and second releasable fasteners comprises a buckle.

**16.** The wetsuit of claim 11 further comprising a flexible neck closure, wherein said flexible neck closure is attached to said first and second releasable fasteners.

**17.** The wetsuit of claim 16 wherein said flexible neck closure comprises a collar.

**18.** The wetsuit of claim 16 wherein said flexible neck closure comprises a hood.

**19.** The wetsuit of claim 16 further comprising at least one sealing rib disposed on an inner surface of said flexible neck closure.

**20.** The wetsuit of claim 16 further comprising at least one sealing rib disposed on an exterior surface of said wetsuit.

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