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(54) **PROTECTIVE HEADGEAR**

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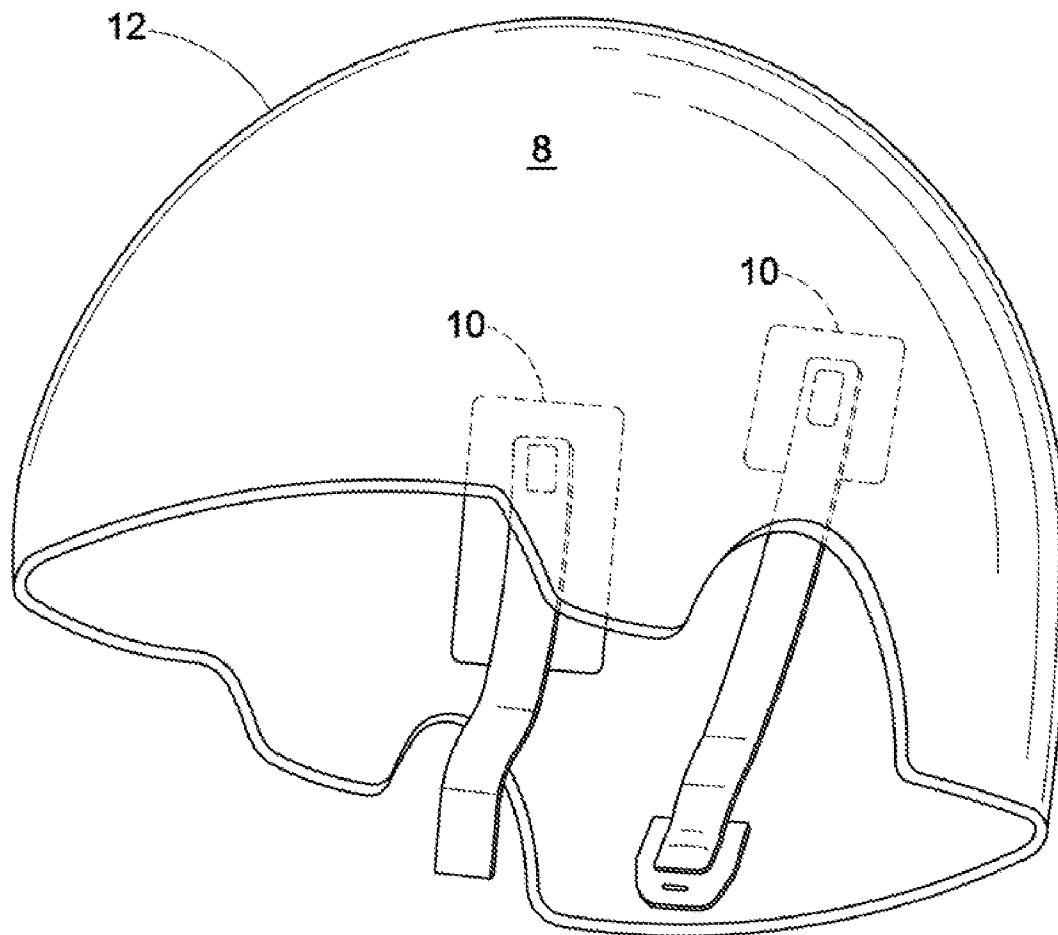
(57) **ABSTRACT**

(22) Filed: **May 9, 2011**

A boltless retention system for a protective headgear includes a pad boltlessly secured within a cavity of the protective headgear. A strap is boltlessly secured within the cavity and between the pad and an inner surface of the headgear. The strap withstands a static pull strength between about 150 pounds and 300 pounds.

**Related U.S. Application Data**

(60) Provisional application No. 61/332,686, filed on May 7, 2010.



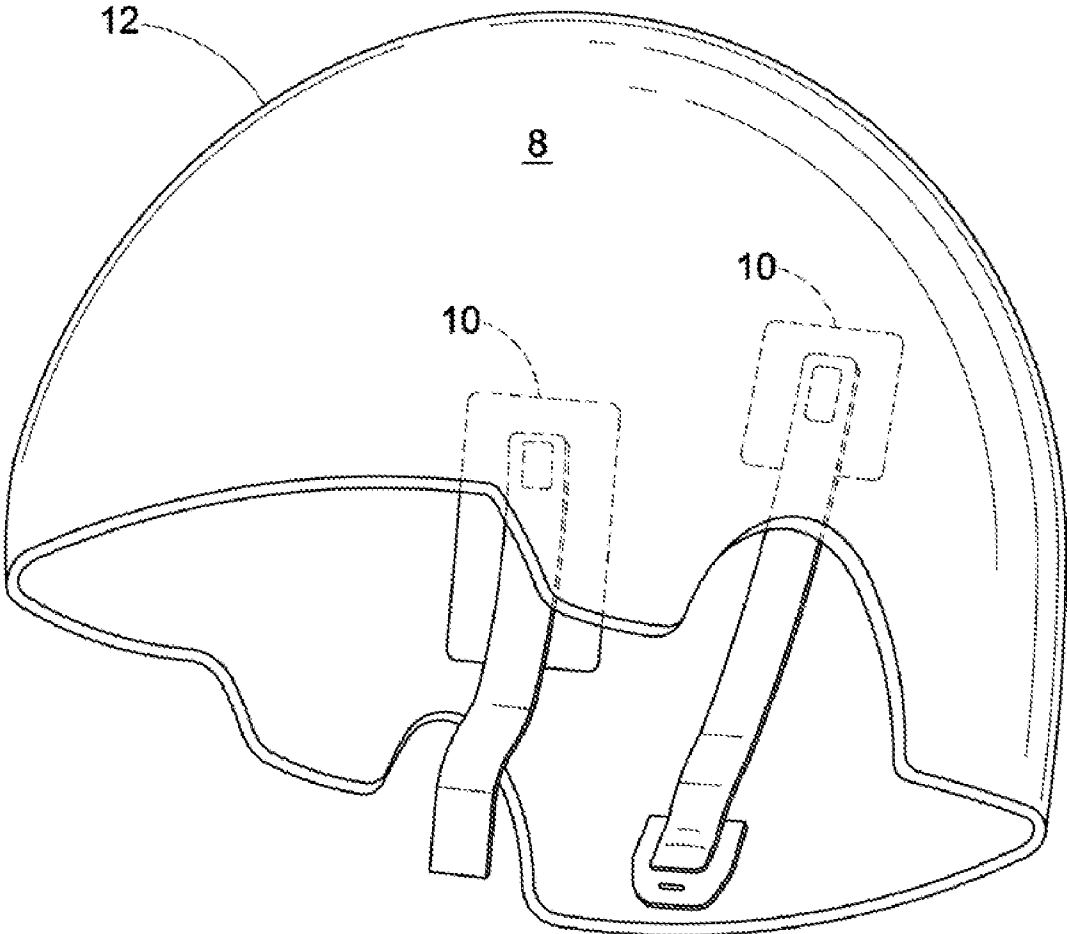


FIG. 1

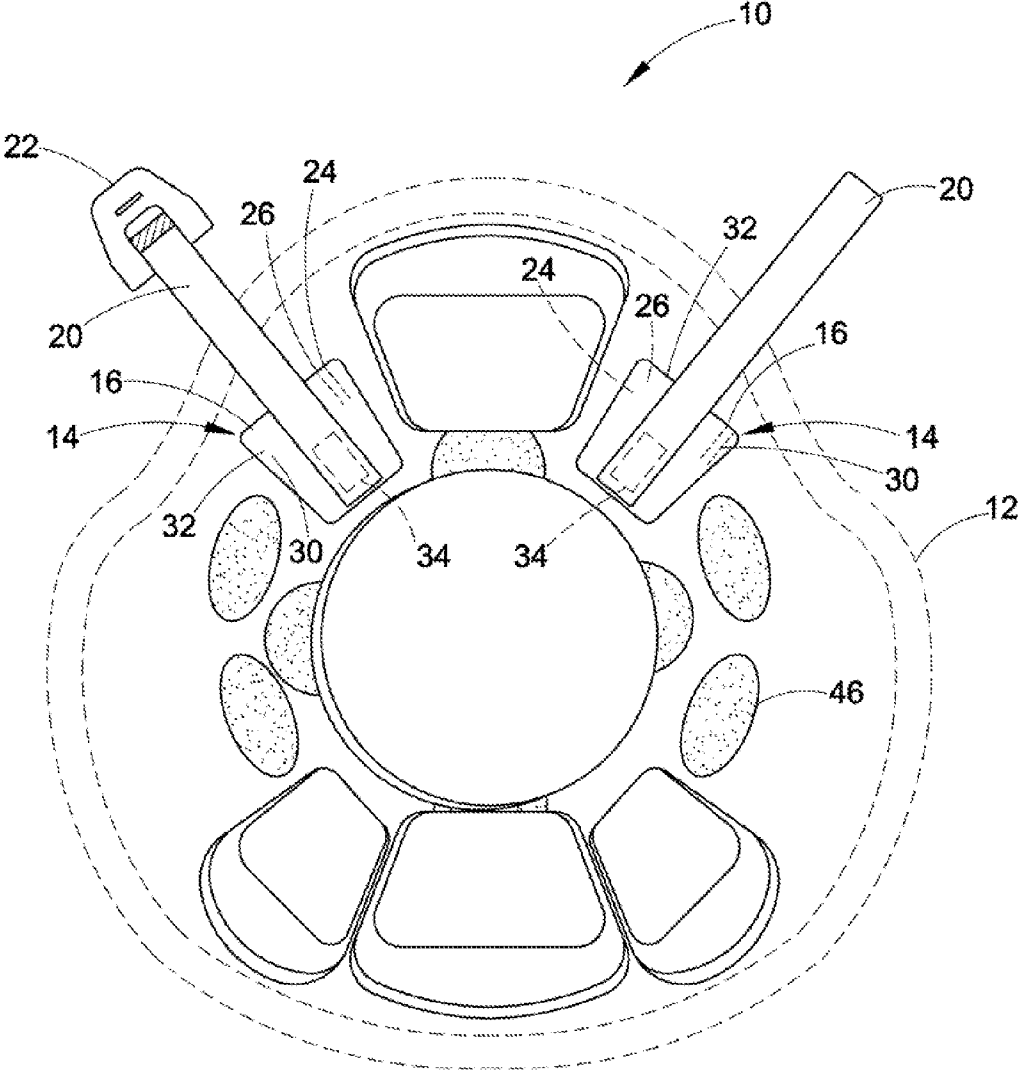


FIG. 2

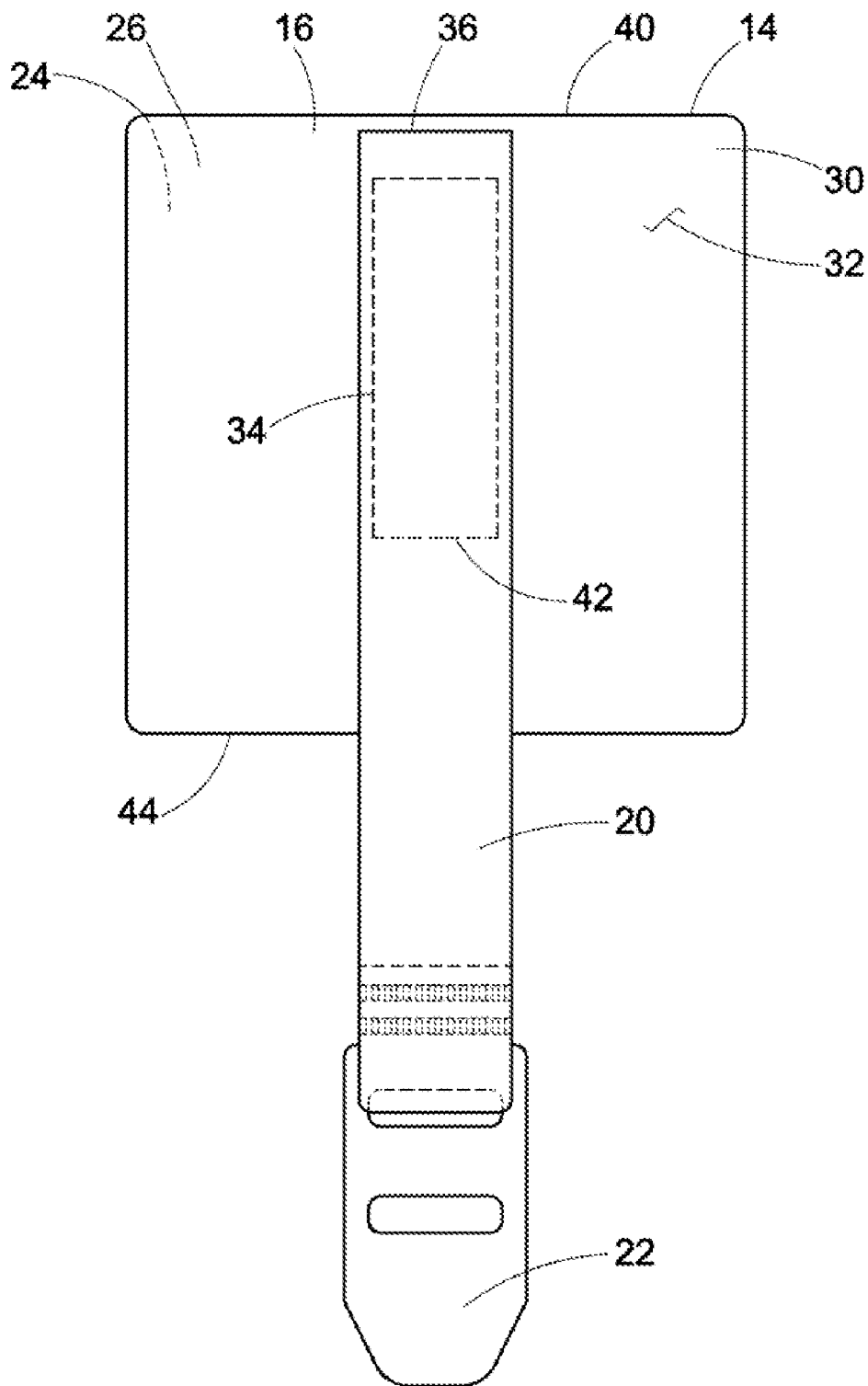


FIG. 3

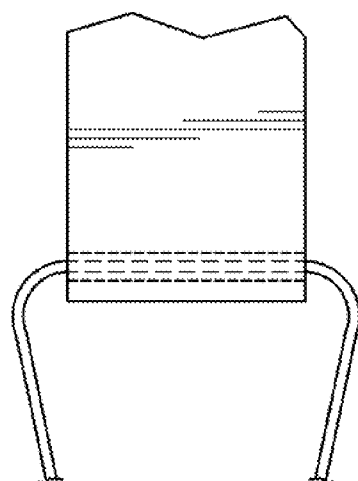
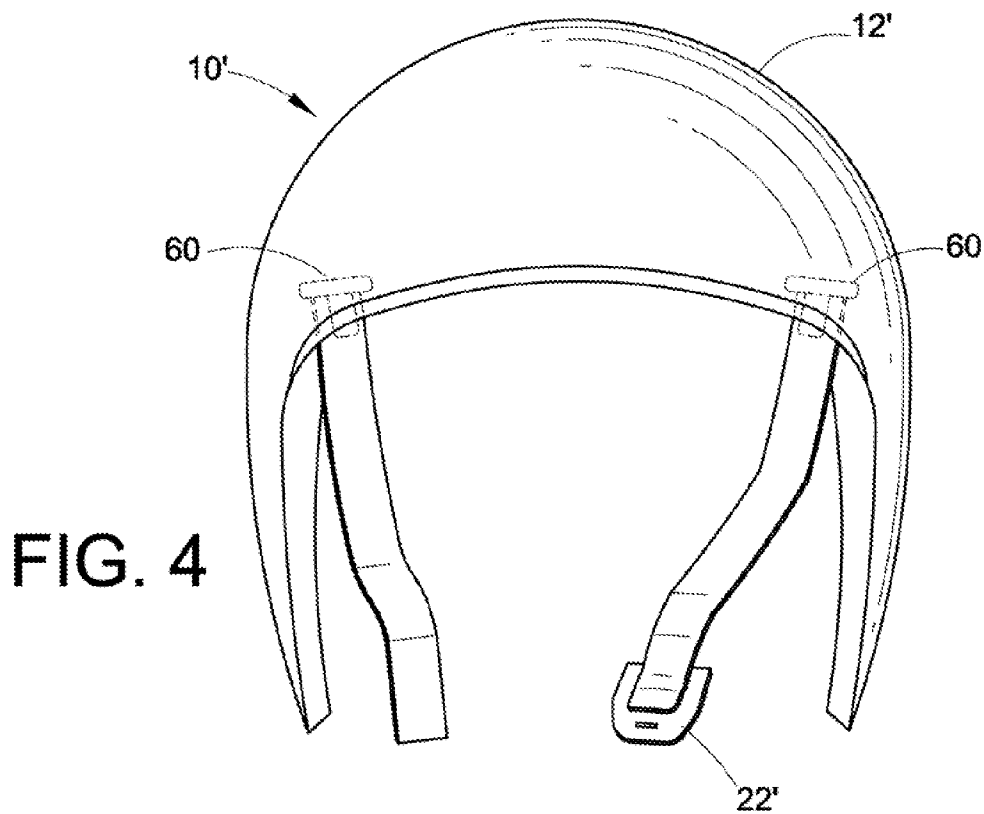


FIG. 5

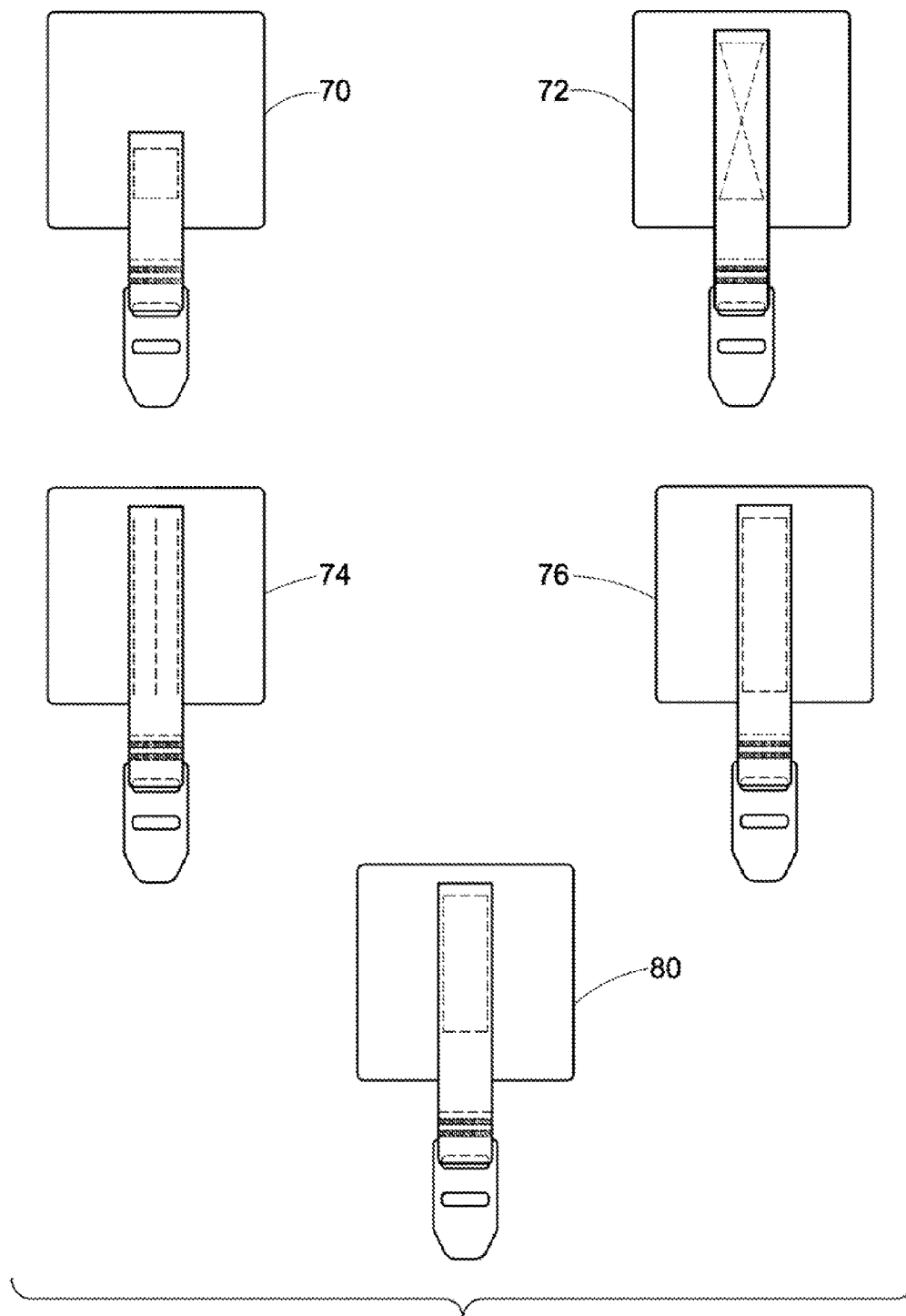


FIG. 6

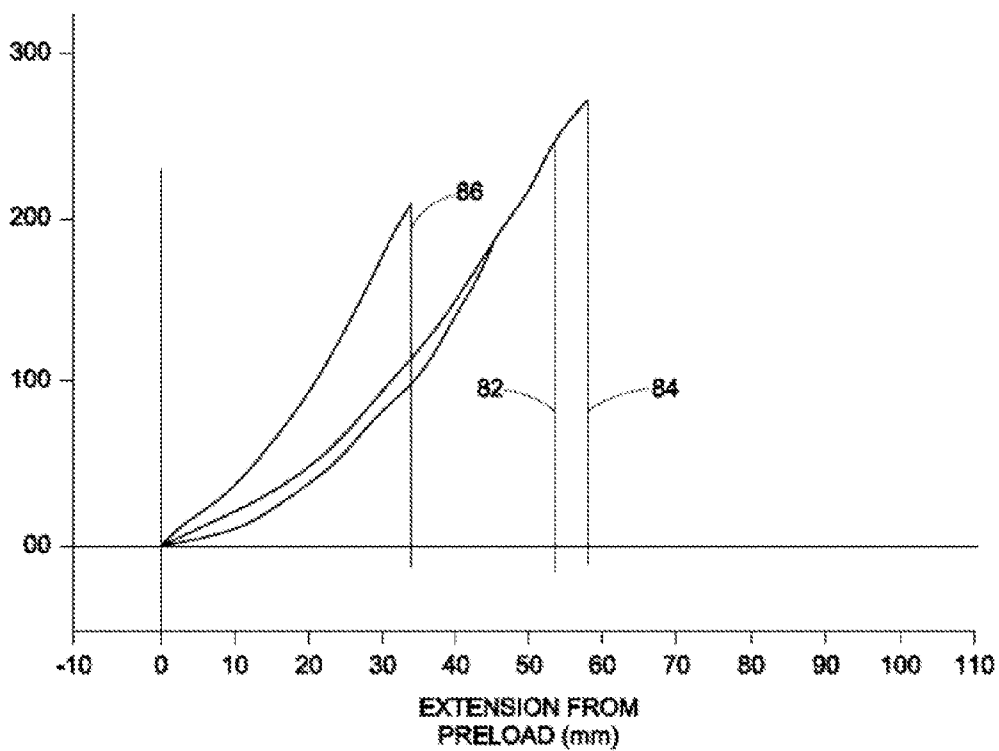


FIG. 7

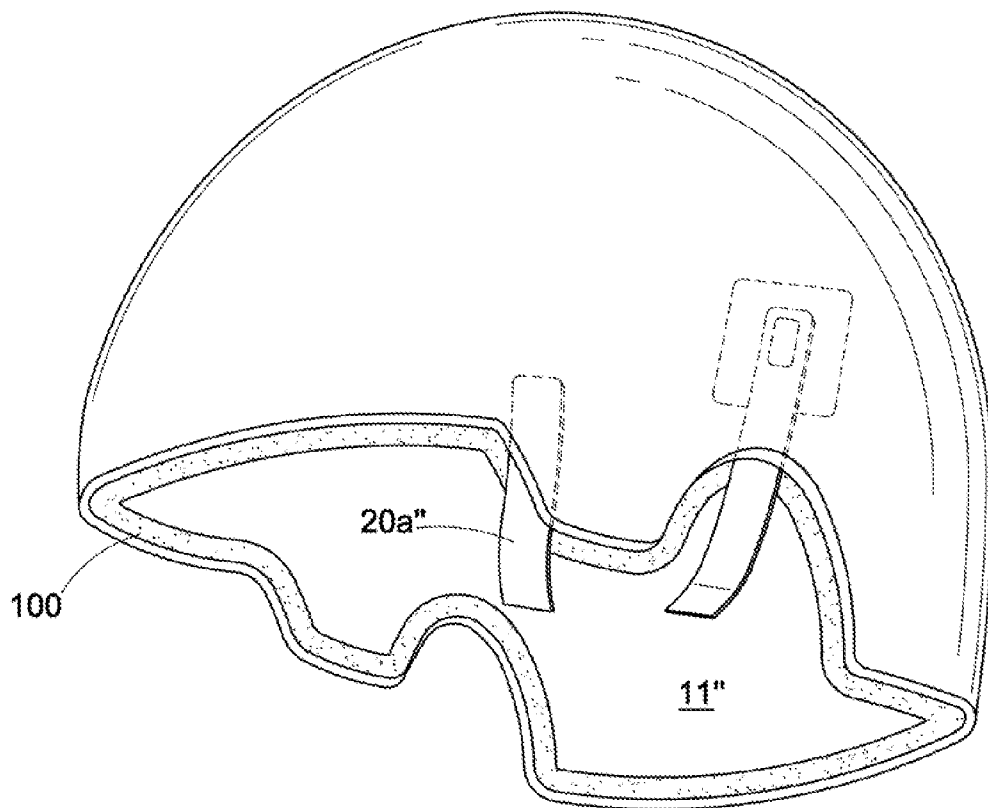


FIG. 8



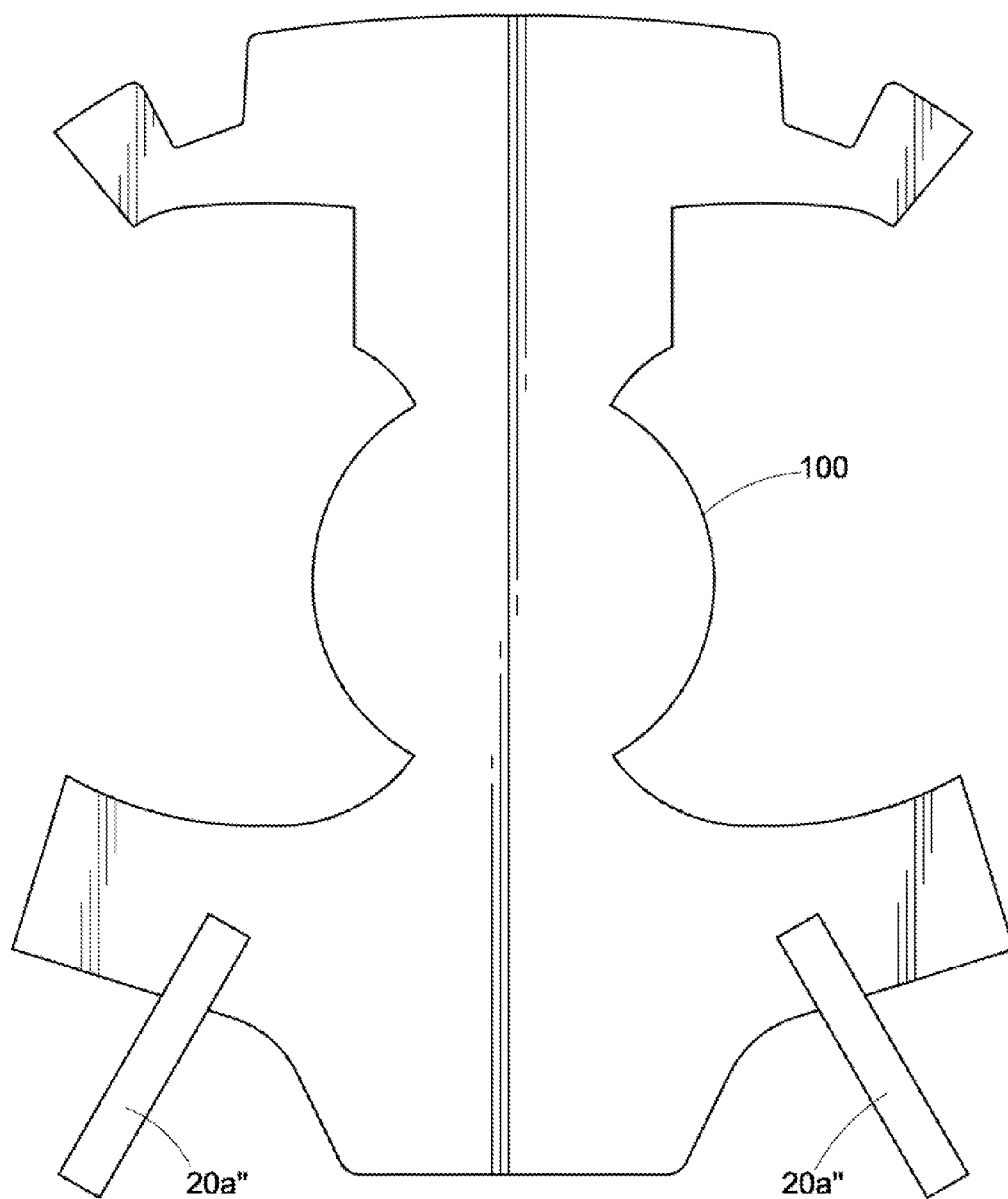


FIG. 9

## PROTECTIVE HEADGEAR

[0001] This application claims the benefit of U.S. Provisional Application No. 61/332,686, filed May 7, 2010, which is hereby incorporated by reference.

### BACKGROUND

[0002] The present invention relates to a retention system. It finds particular application in conjunction with a protective headgear retention system and will be described with particular reference thereto. It will be appreciated, however, that the invention is also amenable to other applications.

[0003] Current protective headgear retention systems typically use standard metallic fasteners (e.g., bolts) to secure a retention system to a protective headgear (e.g., helmet). To use such standard fasteners, manufacturers create holes through the protective headgear by, for example, drilling. The fasteners are then secured in the respective holes. Respective straps are then secured to the fasteners. The straps are releasably secured together under a user's chin by, for example, a buckle.

[0004] Ballistic resistant protective headgear, such as ballistic helmets for law enforcement and military applications, are primarily comprised of high-performance fiber reinforced composite materials that are not amenable to fabrication processes that could provide an attachment point for the retention system. In addition, creating the holes in the protective helmet requires additional steps during the manufacturing process. Another consideration is the weight added to the protective helmet by the metallic fasteners.

[0005] The present invention provides a new and improved apparatus for boltlessly securing a retention system to a protective headgear.

### SUMMARY

[0006] In one embodiment, a boltless retention system for a protective headgear includes a pad boltlessly secured within a cavity of the protective headgear. A strap is boltlessly secured within the cavity and between the pad and an inner surface of the headgear. The strap withstands a static pull strength between about 150 pounds and 300 pounds.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0007] In the accompanying drawings which are incorporated in and constitute a part of the specification, embodiments of the invention are illustrated, which, together with a general description of the invention given above, and the detailed description given below, serve to exemplify the embodiments of this invention.

[0008] FIG. 1 illustrates a perspective view of a protective headgear in accordance with one embodiment of an apparatus illustrating principles of the present invention;

[0009] FIG. 2 illustrates an inside view of the protective headgear helmet of FIG. 1 showing a schematic representation of a boltless retention system in accordance with one embodiment of an apparatus illustrating principles of the present invention;

[0010] FIG. 3 illustrates a schematic representation of a boltless retention component of FIG. 2;

[0011] FIG. 4 illustrates a protective headgear helmet showing a schematic representation of a boltless retention

system in accordance with a second embodiment of an apparatus illustrating principles of the present invention;

[0012] FIG. 5 illustrates a cross-sectional view of the protective headgear helmet and boltless retention system of FIG. 4;

[0013] FIG. 6 illustrates various schematic representations of different boltless retention component designs;

[0014] FIG. 7 illustrates a graph of load vs. extension from preload for three (3) of the designs of FIG. 6;

[0015] FIG. 8 illustrates a perspective view of a protective headgear helmet showing a schematic representation of a boltless retention system in accordance with a third embodiment of an apparatus illustrating principles of the present invention; and

[0016] FIG. 9 illustrates a top view of a pad of FIG. 8, which has been substantially flattened.

### DETAILED DESCRIPTION OF ILLUSTRATED EMBODIMENT

[0017] With reference to FIG. 1, a perspective view of a helmet portion 8 of a protective headgear 12 including an exemplary boltless retention system 10 is illustrated in accordance with a first embodiment of the present invention. With reference to FIG. 2, a view inside a cavity 11 of the helmet portion 8 is illustrated in accordance with the first embodiment of the present invention. In the illustrated first embodiment, the boltless retention system 10 includes the protective headgear 12, the helmet portion 8, and a retention component 14. The protective headgear 12 is of a known material (e.g., phenolic-polyvinyl butryl (PVB) coated woven aramid fabric), which provides ballistic and impact protection to a user wearing the headgear 12.

[0018] With reference to FIGS. 1-3, the retention component 14 includes a substrate (e.g., a platform) 16, a strap 20, and a buckle 22. In one embodiment, the substrate 16 is a piece of material including a first securing means 24 on a first face 26 (e.g., the back face) (see FIG. 3). The first securing means 24 in this embodiment is contemplated to be an adhesive such as polyurethane, epoxy, polyacrylate, styrene-butadiene-styrene, cyanoacrylate, glue, thermally activated glue, or other suitable adhesive. The substrate 16 also includes a second securing means 30 on a second face 32 (e.g., the front face) (see FIGS. 1-3). The second securing means 30 in this embodiment is contemplated to be one portion of a hook-and-loop fastener (e.g., either a hook portion or a loop portion of a hook-and-loop fastener such as a VELCRO® hook-and-loop fastener).

[0019] The strap 20 is secured to the substrate 16. In the illustrated embodiment, the strap 20 is secured to the second (front) face 32 of the substrate 16. A third securing means 34 secures the strap 20 to the substrate 16. The third securing means 34 includes a stitching (e.g., a box stitching) that passes through the strap 20 and the substrate 16. In one embodiment, the stitching includes 8-10 stitchings per inch using a T-45 bonded Anafil Nylon® twisted filament thread, or some other relatively strong thread that resists deterioration. Including less than 8-10 stitchings per inch may cause the strap 20 to "pucker" and may (or may not) reduce the strength of the connection of the strap 20 to the substrate 16 (depending on how many fewer stitchings than 8-10 stitchings per inch are used). On the other hand, including more than 8-10 stitchings per inch may cause the connection between the strap 20 and the substrate 16 to weaken by, for example, weakening the substrate 16 and/or the strap 20.

[0020] In order to provide adequate strength, the substrate 16 is greater than or equal to about 2 inches<sup>2</sup>. In one embodiment, the substrate 16 is at least 3"×3". The strap 20 is contemplated to be about ¾" wide and 5 ¼" long. As illustrated, the strap 20 is positioned across the substrate 16 with one of the shorter edges 36 of the strap 20 proximate to an edge 40 of the substrate 16. The strap 20 is also substantially centered on the substrate 16 so that approximately equal portions of the substrate 16 are on either side along the length of the strap 20.

[0021] In the illustrated embodiment, the stitching 34 is about 1 ¾" long and about ⅝" wide. One edge 42 of the stitching 34 is between about ⅞" and about 1" from an edge 44 of the substrate 16 beyond which the strap 20 extends (i.e., an edge of the substrate 16 that is proximate to the edge of the strap 20). The about ⅞" or about 1" between the edge 44 of the substrate 16 and the edge 42 of the stitching 34 provides flexibility to the strap (for added comfort to the user) while maintaining a secure connection between the strap 20 and the substrate 16.

[0022] Although the strap 20 is illustrated as secured to the second (front) face 32 of the substrate 16, it is also contemplated that the strap 20 may be secured to the first (back) face 26 of the substrate 16.

[0023] The substrate 16 and the strap 20 are of a fabric material. In one embodiment, the strap 20 is a "webbing" material.

[0024] The buckle 22 is illustrated as a locking bar (e.g., a ladder lock) securing mechanism to secure the straps 20 beneath a user's chin (e.g., at least one of the straps runs under the user's chin). However, other types of buckles are contemplated.

[0025] As discussed above, the second securing means 30 on the front face 32 of the substrate 16 is contemplated to be one portion of a hook-and-loop fastener (e.g., either a hook portion or a loop portion of a hook-and-loop fastener such as a VELCRO® hook-and-loop fastener). The portion of a hook-and-loop fastener on the front face 32 of the substrate 16 provides a means for securing optional one or more pads 46, which are used for providing comfort and achieving a better fit. The pad(s) 46 may be removably secured at various locations on the substrate 16.

[0026] One example of the substrate 16 is a VELCRO® Part #151931, which provides a static pull strength of between about 200 pounds and 300 pounds.

[0027] FIG. 4 illustrates a simplified component diagram of a second embodiment of an exemplary boltless retention system 10'. In the second illustrated embodiment, the boltless retention system 10' includes pass-through openings 60 in the protective headgear 12'. FIG. 5 illustrates a cross-sectional view of the protective headgear 12' with the straps 20' passing through the opening 60.

[0028] With reference to FIG. 6, various schematic representations of different boltless retention component designs are illustrated. A first design 70 includes a small Kevlar fabric backing, a 3"×3" hook tape, and a 1" overlap of lanyard onto substrate. A second design 72 includes no Kevlar fabric backing, a 3"×3" hook tape, a 2.75" overlap of lanyard onto substrate, and an X-stitch. A third design 74 includes no Kevlar fabric backing, a 3"×3" hook tape, a 2.75" overlap of lanyard onto substrate, and three (3) parallel stitches. A fourth design 76 includes no Kevlar fabric backing, a 3"×3" hook tape, a 2.75" overlap of lanyard onto substrate, and a large rectangular stitch to edge of substrate. A fifth design 80 includes no

Kevlar fabric backing, a 3"×3" hook tape, a 2.75" overlap of lanyard onto substrate, and a stitch ⅞" to 1" from the edge of the substrate (see FIG. 3).

[0029] FIG. 7 illustrates a graph of load (pounds) vs. extension from preload (millimeters) for three (3) of the designs (i.e., the second, third, and fifth designs 72, 74, 80, respectively) of FIG. 6. In the illustrated graph, each of the second, third, and fifth designs 72, 74, 80, respectively, failed between 150 lbs. and 300 lbs. The extension from preload axis represents how far the retention component stretched before failing.

[0030] It is typically desirable for the chinstrap assembly to fail at a load greater than the requirement, but below 300 lbs of force (e.g., to withstand a static pull strength of less than 300 lbs.) to ensure the helmet portion 8 can release under extreme duress to reduce/minimize neck and head trauma. From FIGS. 6 and 7, it can be seen that all three of the second, third, and fifth designs 72, 74, 80, respectively, meet the performance requirement of >150 lbs. of force at failure. The second and third designs 72, 74, respectively, (Graphs 82, 84, respectively) meet the minimum load requirement (static pull strength) of >150 lbs, and approach the upper desired (static pull strength) limit of 300 lbs., with failure loads (static pull strengths) of about 245 lbs. and about 265 lbs, respectively. In addition, the fifth design 80 (Graph 86) is relatively easier to manufacture, has relatively improved material interaction (e.g., the), and is relatively more readily removable (because, for example, the X-Stitch assembly in second design 72 and the parallel stitch assembly in third design 74 includes stitching closer to all of the edges relative to the fifth design 80) in the case that the helmet portion's chinstrap assembly requires replacement. The third design 74 typically requires a lifting of the stitch during processing which adds time to the process.

[0031] FIG. 8 illustrates a simplified component diagram of a third embodiment of an exemplary boltless retention system 10". In the third illustrated embodiment, the boltless retention system 10" includes a pad 100 (e.g., a unitary pad) secured within the cavity 11" of the protective headgear 12". The pad 100 is boltlessly secured within the cavity 11". For example, the pad 100 is sized to frictionally fit within the cavity 11". Alternatively, it is also contemplated that the pad 100 is secured to an inner surface of the helmet portion 8" via, for example, a hook-and-loop fastener.

[0032] It is contemplated that the straps 20" are secured between the pad 100 and the inner surface of the helmet portion 8". Two embodiments for securing the straps are illustrated in FIG. 8. In one embodiment, the strap 20a" is secured directly to the pad 100 (and, also, possibly to the inner surface of the helmet portion 8") via, for example, a hook-and-loop fastener. It is also contemplated that the strap 20a" is secured directly to the inner surface of the helmet portion 8" via, for example, a hook-and-loop fastener or an adhesive. In another embodiment, the strap 20b" is boltlessly secured to the pad 100 via, for example, a substrate 16" and a hook-and-loop fastener (as discussed above). Alternatively, the substrate 16" may be secured to the inner surface of the helmet portion 8" using an adhesive. Although both embodiments for securing the strap between the pad 100 and the inner surface of the helmet portion 8" are illustrated in FIG. 8, typically only one or the other embodiment would be used with a particular headgear 12".

[0033] FIG. 9 illustrates one embodiment of a design for the unitary pad 100. In the illustrated embodiment, the pad 100 is flattened and includes various "cut-outs." When the flattened

pad **100** is fit into the cavity **11**, various edges of the cut-outs come into contact with one another to form a single, continuous pad covering most of the inner surface of the helmet portion **8**". FIG. **9** illustrates an embodiment in which the straps **20a**" are secured to a surface of the pad **100** contacting the inner surface of the helmet portion **8**". As discussed above, in this embodiment, the straps are secured to the pad **100** via a hook-and-loop fastener. A similar pad may be used if the straps and/or substrates are secured to the inner surface of the helmet portion **8**" instead.

**[0034]** It is to be understood that the various sizes, lengths, and designs of the straps **20**" and/or substrates **16**" in FIGS. **8** and **9** are discussed above with reference to the other embodiments. For example, if a substrate is used, a strap may be boltlessly secured to the substrate using a stitching pattern as discussed above.

**[0035]** While the present invention has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, it is not the intention of the applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the invention, in its broader aspects, is not limited to the specific details, the representative apparatus, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the applicant's general inventive concept.

I/we claim:

1. A protective headgear, comprising:
  - a helmet portion;
  - a substrate secured to the helmet portion;
  - an adhesive on a first face of the substrate for adhering the substrate to the helmet portion; and
  - a strap secured to the substrate, the strap remaining secured to the substrate and the substrate remaining secured to the helmet portion to a static pull strength between about 150 pounds and 300 pounds.
2. The protective headgear as set forth in claim **1**, wherein: the strap is secured to a second face of the substrate.
3. The protective headgear as set forth in claim **1**, wherein: the adhesive is an epoxy.
4. The protective headgear as set forth in claim **2**, further including:
  - a stitching through the strap and the substrate to secure the strap to the substrate.
5. The protective headgear as set forth in claim **4**, wherein: the stitching includes about 8 stitches to about 10 stitches per inch.
6. The protective headgear as set forth in claim **5**, wherein: the substrate is at least 2" by 2"; and the strap is about 5 ¼" long by about ¾" wide.
7. The protective headgear as set forth in claim **6**, wherein: the strap is substantially centered on the substrate and positioned across the substrate with one of the about ¾" wide edges of the strap proximate to one of the edges of the substrate.
8. The protective headgear as set forth in claim **7**, wherein: the stitching is about 1 ¾" long and about ⅝" wide; one of the about ⅝" wide edges of the stitching is proximate the edge of the substrate that is proximate to one of the about ¾" edges of the strap; and

the other of the about ⅝" wide edges of the stitching is between about ⅞" and about 1" from an opposite edge of the substrate that is proximate to one of the about ¾" edges of the strap.

9. The protective headgear as set forth in claim **1**, wherein: the strap extends around a user's chin to secure the user's head in the helmet portion.
10. A boltless retention system for a protective headgear, the boltless retention system comprising:
  - a pad boltlessly secured within a cavity of the protective headgear; and
  - a strap boltlessly secured within the cavity, and between the pad and an inner surface of the headgear, the strap withstanding a static pull strength between about 150 pounds and 300 pounds.
11. The boltless retention system for a protective headgear as set forth in claim **10**, wherein:
  - the pad is sized to frictionally fit within the cavity of the protective headgear; and
  - the strap is secured to the pad with a hook-and-loop fastener.
12. The boltless retention system for a protective headgear as set forth in claim **10**, wherein:
  - the pad is secured to the inner surface of the headgear with a hook-and-loop fastener;
  - the strap is secured to the pad with a hook-and-loop fastener; and
  - the strap is secured to the inner surface of the headgear with a hook-and-loop fastener.
13. The boltless retention system for a protective headgear as set forth in claim **10**, further including:
  - a substrate;
  - wherein the strap is boltlessly secured to the substrate; and
  - wherein the substrate is boltlessly secured to the inner surface of the headgear.
14. The boltless retention system for a protective headgear as set forth in claim **13**, wherein: the strap is stitched to the substrate.
15. The boltless retention system for a protective headgear as set forth in claim **14**, wherein: the substrate is secured to the inner surface of the headgear with a hook-and-loop fastener.
16. The boltless retention system for a protective headgear as set forth in claim **14**, wherein: the substrate is secured to the inner surface of the headgear with an adhesive.
17. The boltless retention system for a protective headgear as set forth in claim **16**, wherein:
  - a first face of the substrate is secured to the inner surface of the protective headgear with the adhesive; and
  - the strap is stitched to a second face of the substrate.
18. The boltless retention system for a protective headgear as set forth in claim **14**, wherein:
  - the substrate is at least about 2 inches<sup>2</sup>; and
  - the strap is about 5 ¼" long and about ¾" wide.
19. The boltless retention system for a protective headgear as set forth in claim **18**, wherein: the strap is stitched to the substrate using a box-stitching design and includes about 8 to about 10 stitchings per inch.
20. The boltless retention system for a protective headgear as set forth in claim **19**, wherein: the box-stitching is about 1 ¾" long and about ⅝" wide.

**21.** The boltless retention system for a protective headgear as set forth in claim **10**, further including:

a substrate;

wherein the strap is boltlessly secured to the substrate via a stitching; and

wherein the substrate is secured to the pad with a hook-and-loop fastener.

**22.** A protective headgear, comprising:

a helmet portion;

a pad sized to frictionally fit within a cavity of the helmet portion;

a first strap boltlessly secured to the pad, the first strap being positioned between the pad and an inner surface of the headgear, and the first strap withstanding a static pull strength between about 150 pounds and 300 pounds; and

a second strap boltlessly secured to the pad, the second strap being positioned between the pad and an inner surface of the headgear, and the second strap withstanding a static pull strength between about 150 pounds and 300 pounds, the first and second straps capable of being secured together so that at least one of the straps runs under a user's chin to secure the user's head in the helmet portion.

**23.** The protective headgear as set forth in claim **22**, wherein:

the first strap is secured to the pad with a hook-and-loop fastener; and

the second strap is secured to the pad with a hook-and-loop fastener.

**24.** The protective headgear as set forth in claim **22**, further including:

a first substrate; and

a second substrate;

wherein the first strap is stitched to the first substrate;

wherein the second strap is stitched to the second substrate;

wherein a surface of the pad includes a first portion of a hook-and-loop fastener;

wherein the first substrate includes a second portion of the hook-and-loop fastener that is secured to the first portion of the hook-and-loop fastener at a first location on the pad; and

wherein the second substrate includes another second portion of the hook-and-loop fastener that is secured to the first portion of the hook-and-loop fastener at a second location on the pad.

**25.** The protective headgear as set forth in claim **24**, wherein:

the first substrate is at least about 2 inches<sup>2</sup>;

the second substrate is at least about 2 inches<sup>2</sup>;

the first strap is about 5 1/4" long and about 3/4" wide; and

the second strap is about 5 1/4" long and about 3/4" wide.

\* \* \* \* \*