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(54) **ARMOR FOR BALLISTIC-RESISTANT
HEADGEAR**

(52) **U.S. Cl.** 2/6.6; 89/36.05

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(57) **ABSTRACT**

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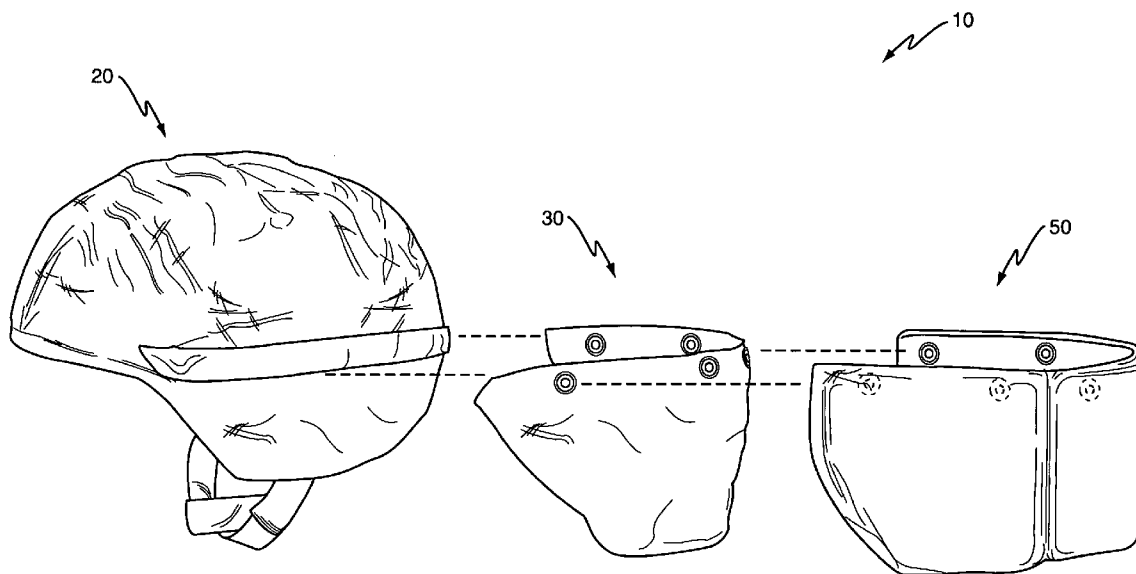
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F41H 1/04 (2006.01)

Armor for a helmet includes a soft-armor attachment and a hard-armor attachment. The soft-armor attachment encases a flexible soft-armor anti-ballistic member within its interior, and detachably mounts to the helmet exterior using one or more fasteners. The hard-armor attachment encases one or more hard-armor members within its interior, and detachably mounts to the soft-armor attachment using one or more fasteners. When both the soft-armor attachment and the hard-armor attachment are in the mounted position, the soft-armor attachment is disposed between the helmet exterior and the hard-armor attachment.



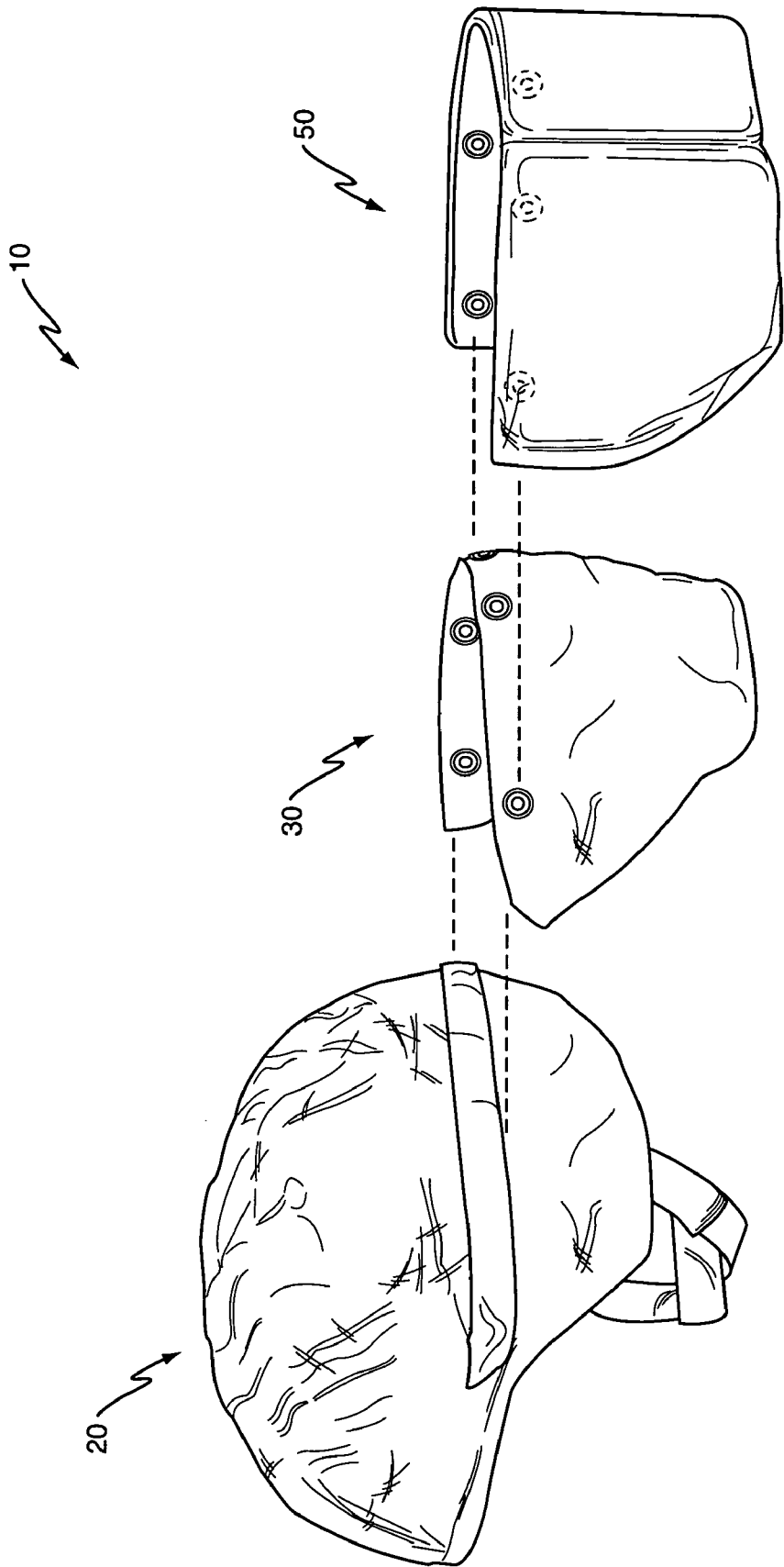


FIG. 1

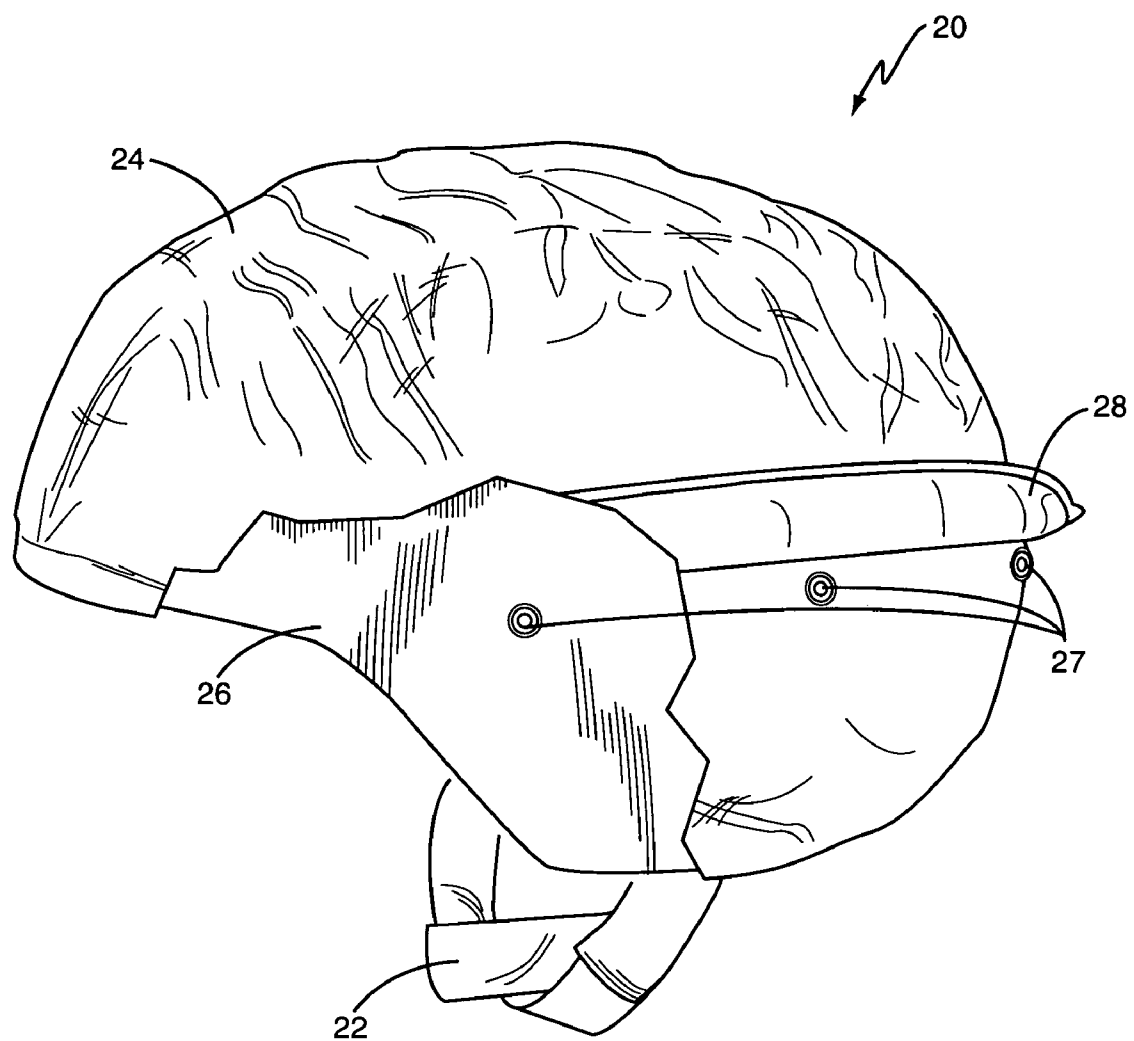


FIG. 2

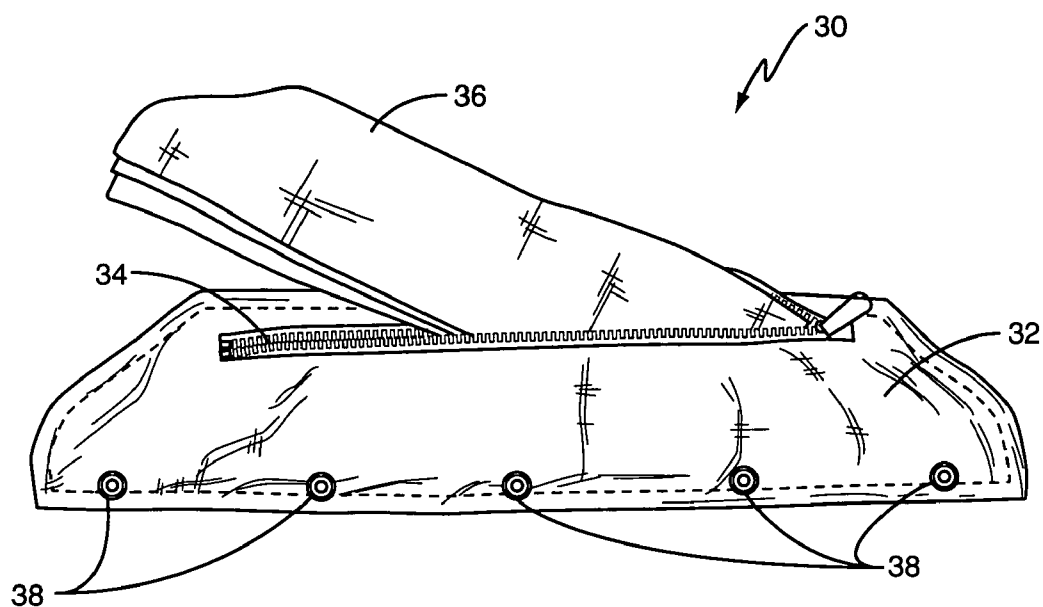


FIG. 3A

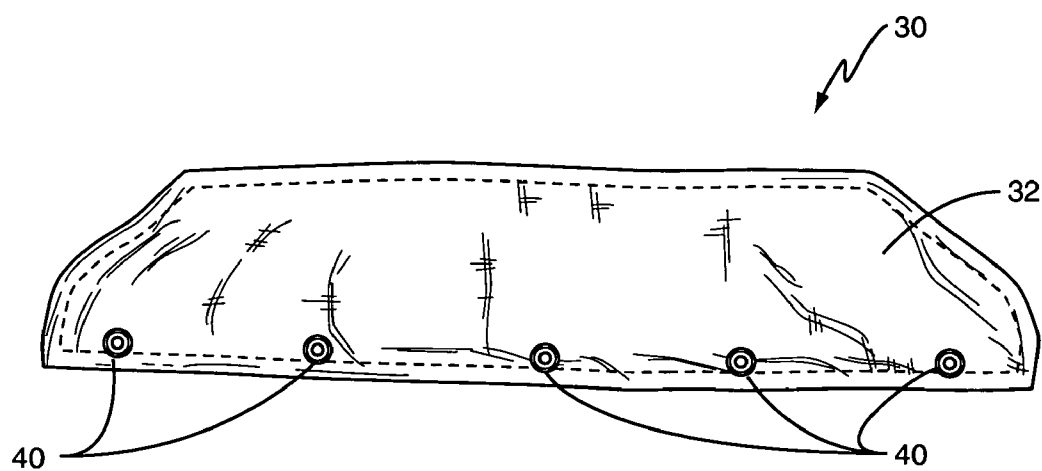


FIG. 3B

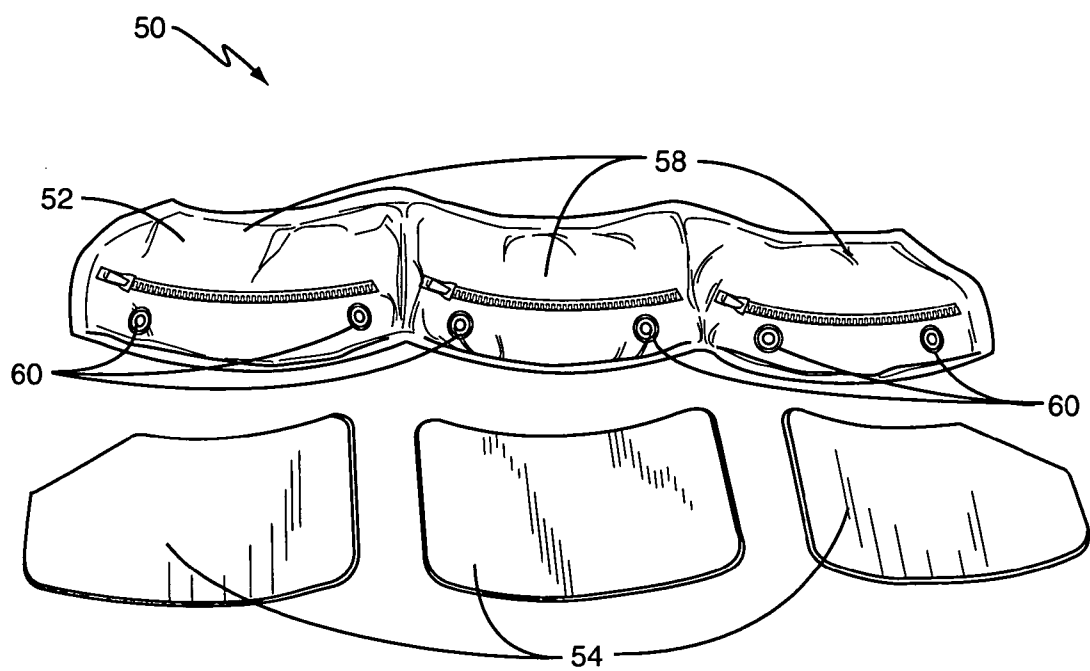


FIG. 4A

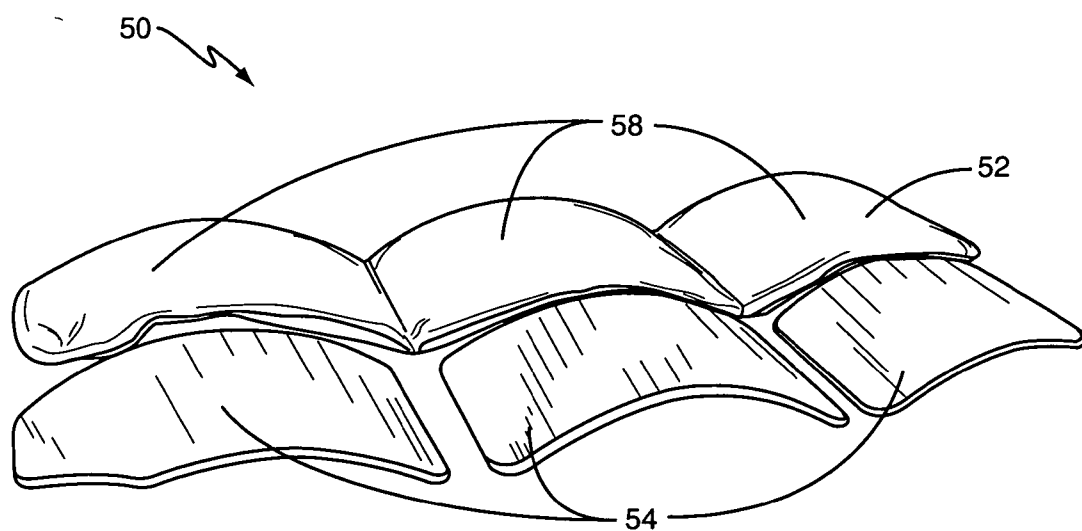


FIG. 4B

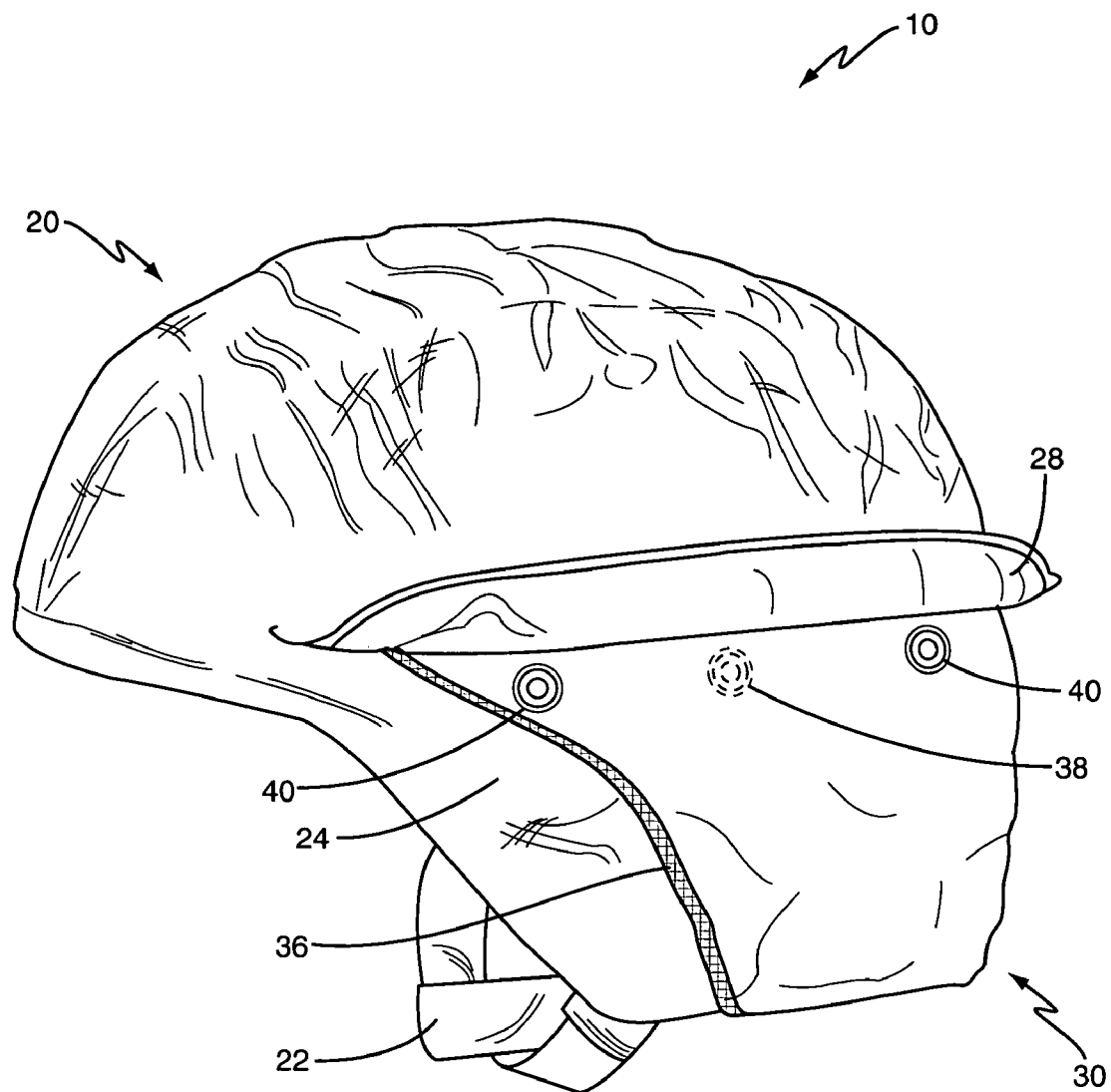


FIG. 5A

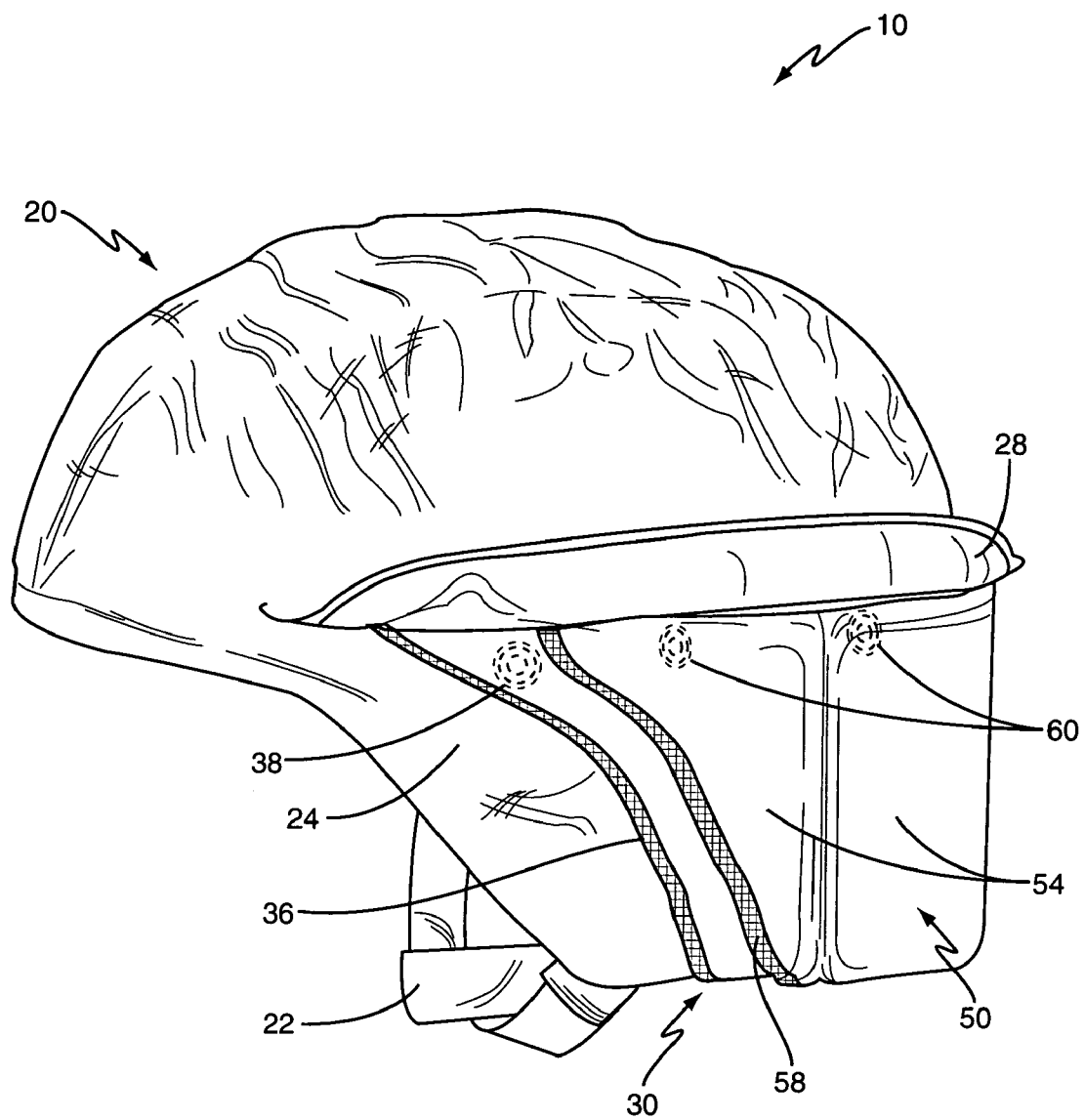


FIG. 5B

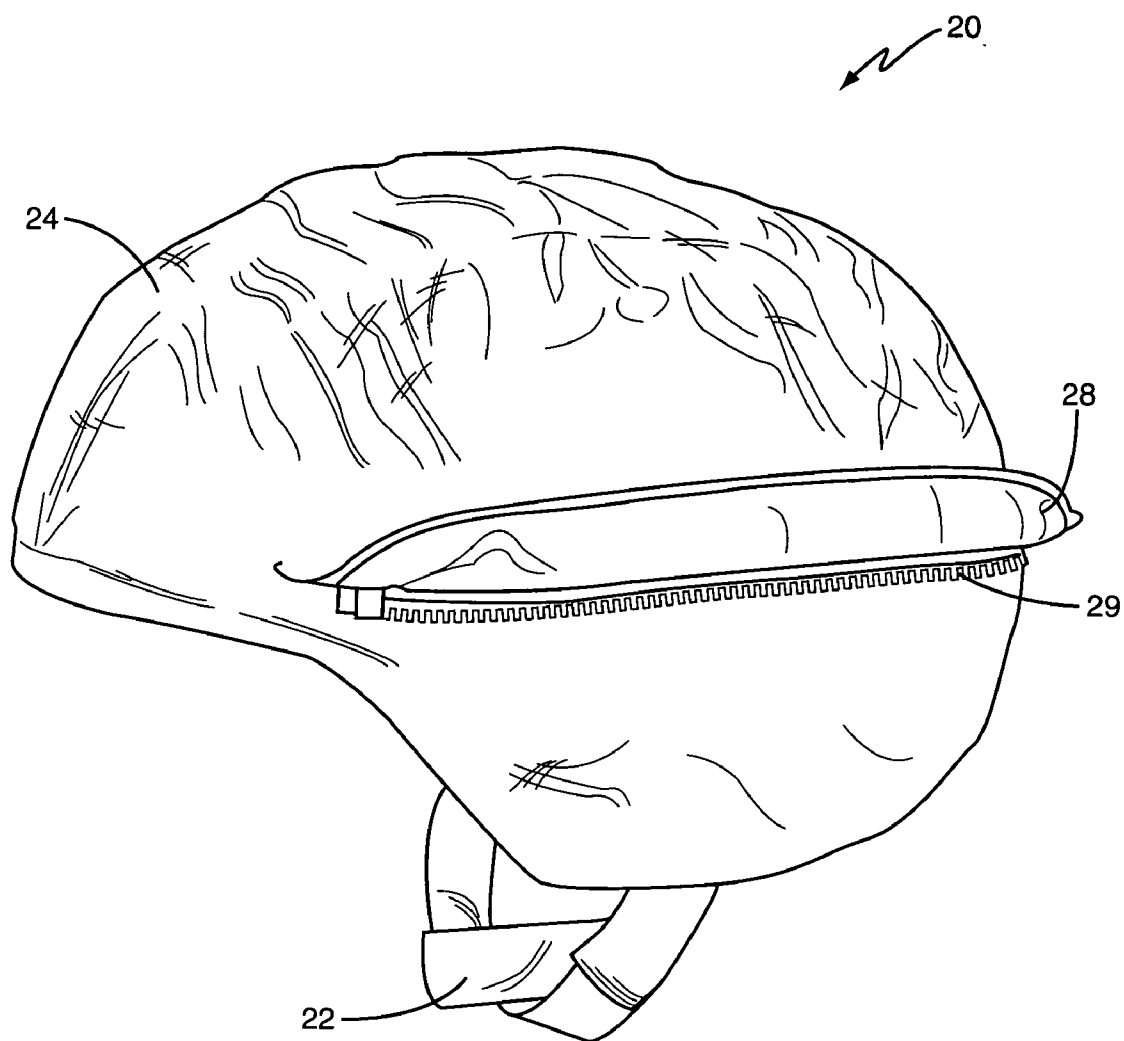


FIG. 6

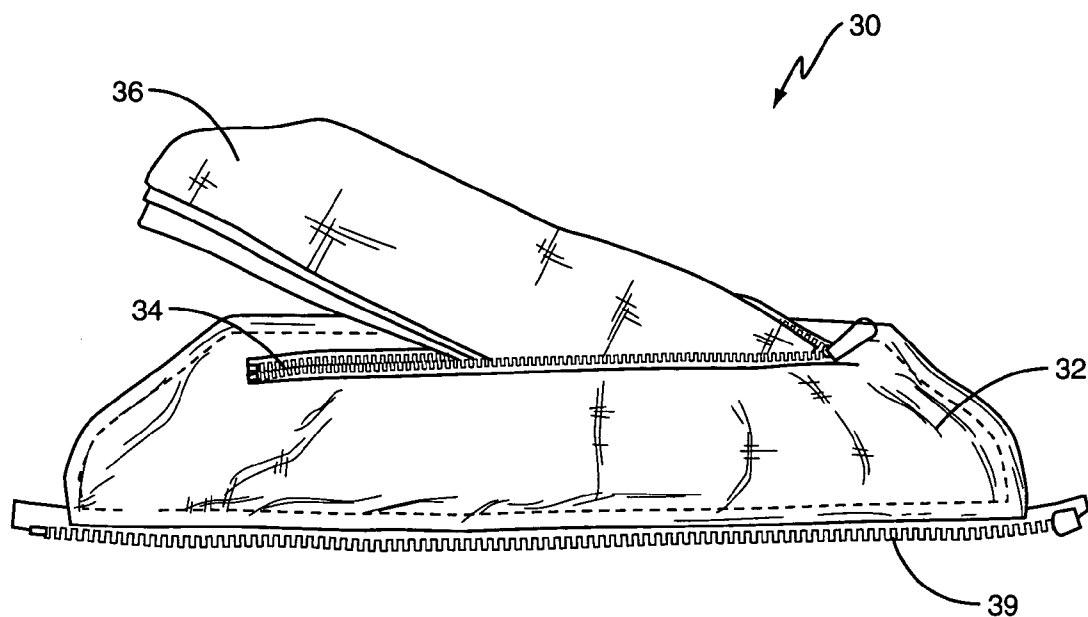


FIG. 7A

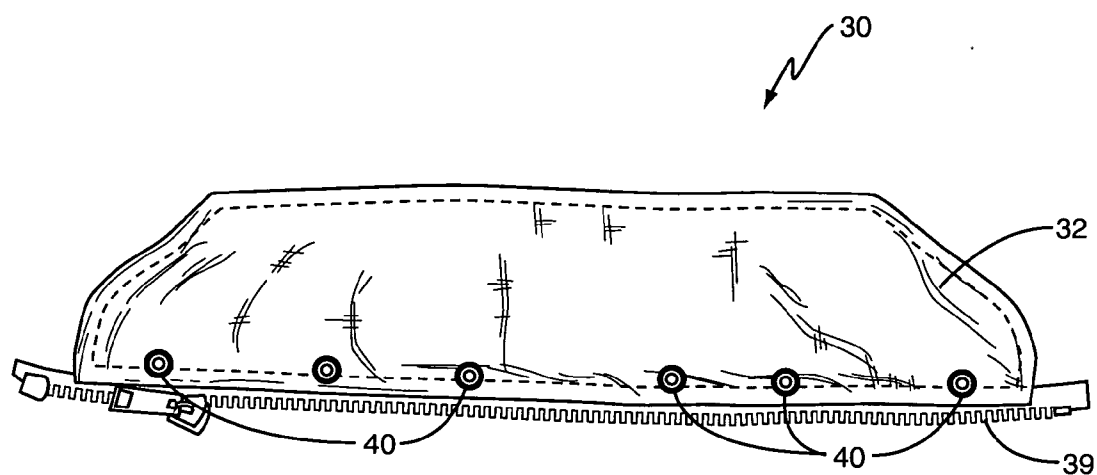


FIG. 7B

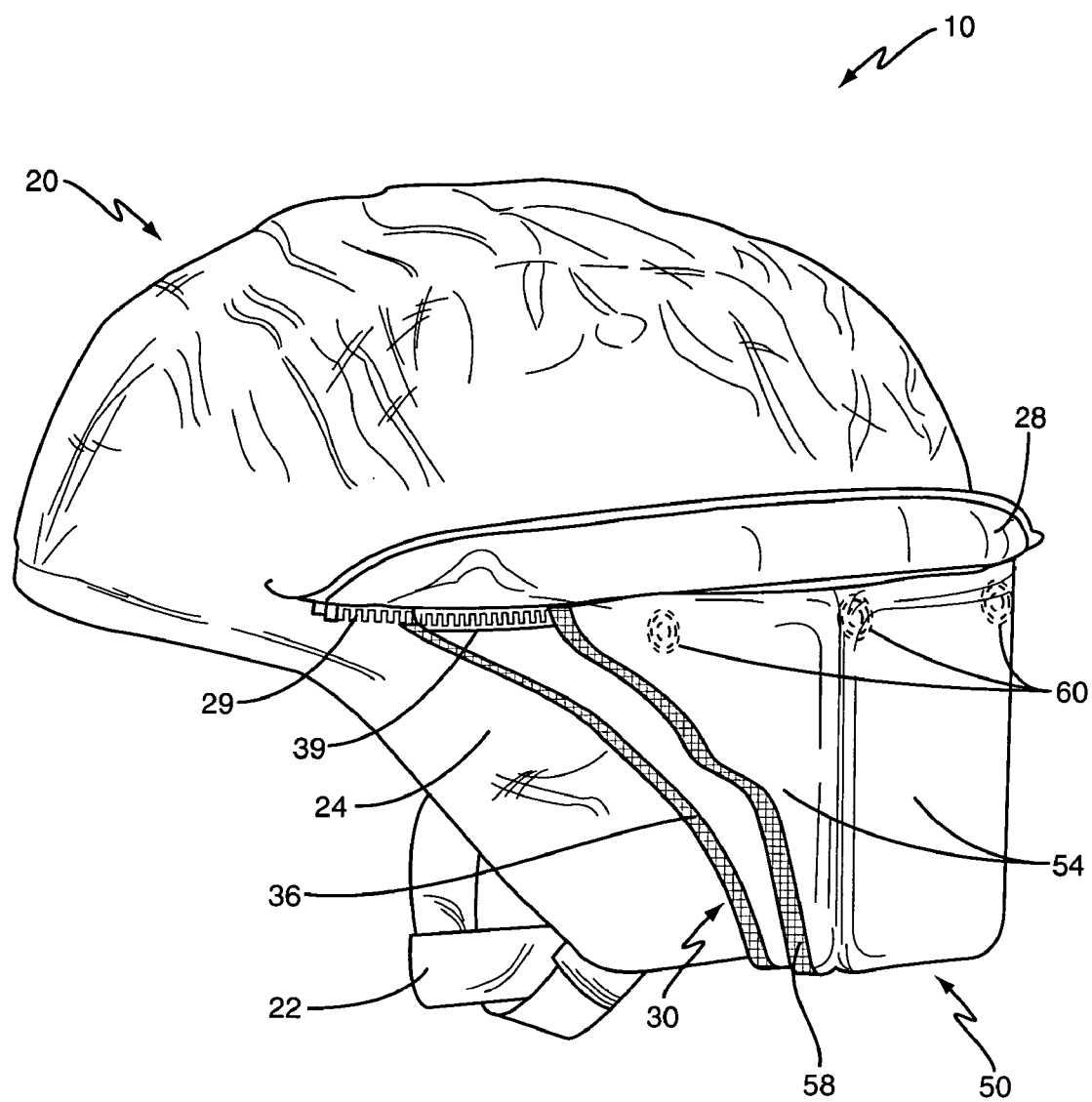


FIG. 8

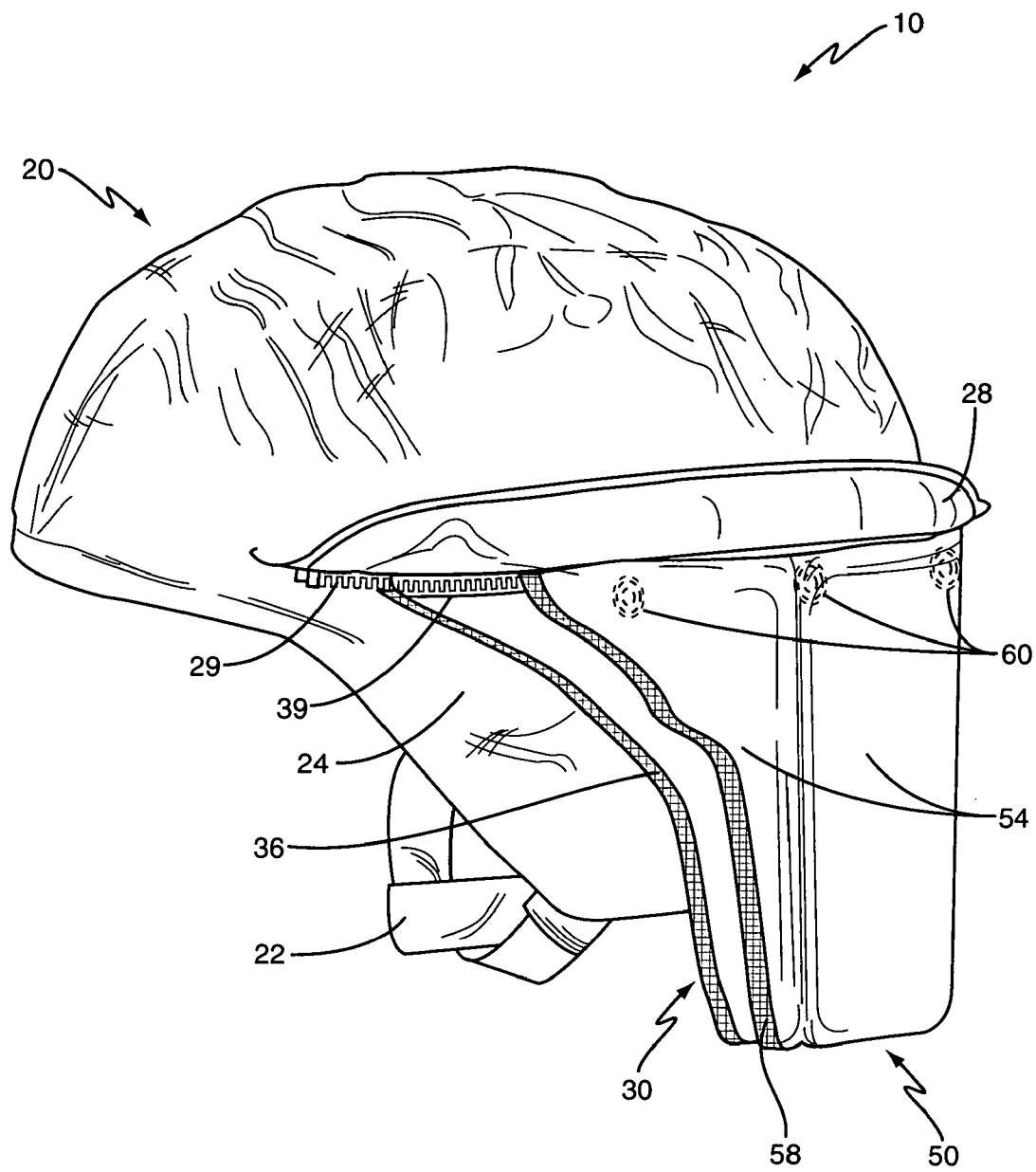


FIG. 9

ARMOR FOR BALLISTIC-RESISTANT HEADGEAR

BACKGROUND

[0001] The present invention relates generally to personal body armor and, more particularly, to armor for ballistic-resistant headgear.

[0002] Historically, ballistic-resistant helmets were manufactured from steel to form shallow pot-like structures that fit over a user's head. These "steel pots" were heavy and cumbersome and not very comfortable. Further, their protective abilities were, at best, limited. Technological advances, however, now enable ballistic-resistant helmets to be manufactured from high-strength synthetic fibers such as KEVLAR. Due to its chemical structure, helmets manufactured from KEVLAR are much stronger and lighter than steel, and also are remarkably more heat-resistant than steel. As such, KEVLAR helmets provide a user with protection superior to that provided by steel.

[0003] Military and law enforcement personnel routinely face situations in which their survival depends upon the ability of a helmet to deflect various projectiles such as bullets, shrapnel, and other debris. While the conventional helmets mentioned above provide at least some measure of protection, they are typically not strong enough to deflect or stop all types of ballistic objects. For example, very high-speed projectiles, such as bullets and shrapnel, have been known to breach both steel pots and KEVLAR helmets. Future advances may produce materials having even more superior anti-ballistic characteristics, but they are likely to be very costly. Even if such a material were currently available, large-scale replacement of existing inventory would indeed prove prohibitively expensive. Therefore, what is needed is a method and system that will quickly and easily allow users to enhance the ballistic-resistant qualities of their currently available helmets.

SUMMARY

[0004] According to the present invention, one or more armor members may be employed to provide conventional ballistic-resistant helmets with increased anti-ballistic protection. In one embodiment, a first armor member comprises a soft-armor attachment that detachably connects to the user's helmet. One or more corresponding mechanical fasteners, such as snaps or zippers, may be disposed on both the soft-armor attachment and the helmet to allow the user to connect and remove the soft-armor attachment to and from the helmet. The soft-armor attachment is formed to create an interior pocket that may contain a flexible anti-ballistic material and, thus, substantially conforms to the shape of the helmet when connected.

[0005] In an alternate embodiment, a second armor member may further be connected to the first armor member that is connected to the helmet. The second armor member may comprise, for example, a hard-armor attachment having one or more mechanical fasteners. The fasteners allow users to detachably connect the hard-armor attachment to one or more corresponding fasteners disposed on the soft-armor attachment. As above, the hard-armor attachment is formed to create one or more interior pockets that contain a like number of hard-armor plates, such as anti-ballistic ceramic or steel. Each of the hard-armor plates and, thus, the

hard-armor attachment, is formed to substantially conform to the shape of the helmet and the soft-armor attachment when connected.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] **FIG. 1** illustrates the armor system according to one embodiment of the present invention.

[0007] **FIG. 2** illustrates a type of ballistic-resistant helmet that may be armored according to one embodiment of the present invention.

[0008] **FIGS. 3A-3B** illustrate a soft-armor attachment that may be used to armor a ballistic-resistant helmet according to one embodiment of the present invention.

[0009] **FIGS. 4A-4B** illustrate a hard-armor attachment that may be used to armor a ballistic-resistant helmet according to one embodiment of the present invention.

[0010] **FIGS. 5A** illustrates a soft-armor attachment detachably connected to a ballistic-resistant helmet according to one embodiment of the present invention.

[0011] **FIG. 5B** illustrates a soft-armor attachment and a hard-armor attachment detachably connected to a ballistic-resistant helmet according to one embodiment of the present invention.

[0012] **FIG. 6** illustrates a type of ballistic-resistant helmet that may be armored according to an alternate embodiment of the present invention.

[0013] **FIGS. 7A-7B** illustrate a soft-armor attachment that may be used to armor a ballistic-resistant helmet according to an alternate embodiment of the present invention.

[0014] **FIG. 8** illustrates a soft-armor attachment and a hard-armor attachment detachably connected to a ballistic-resistant helmet according to an alternate embodiment of the present invention.

[0015] **FIG. 9** illustrates a soft-armor attachment and a hard-armor attachment detachably connected to a ballistic-resistant helmet according to another alternate embodiment of the present invention.

DETAILED DESCRIPTION

[0016] Turning now to the drawings, an anti-ballistic headgear system according to one embodiment of the present invention is shown therein and indicated generally by the number **10**. As seen in **FIG. 1**, system **10** comprises a ballistic-resistant helmet **20**, a first armored member **30**, and a second armored member **50**. First armor member **30** and/or second armor member **50** may be used alone or in combination to provide anti-ballistic protection to a user of helmet **20**.

[0017] According to one embodiment of the present invention, for example, the first armored member **30** detachably couples to helmet **20** to protect a user's head and/or neck area against various high and low speed projectiles including, but not limited to, bullets, fragments, secondary projectiles, and debris. In an alternate embodiment, the second armored member **50** may further be detachably coupled to the first armored member **30** to provide the user with an even greater level of protection against the various projectiles mentioned above. The protection provided by the first and/or

second armored members **30,50** is in addition to any protection that might already be provided by helmet **20**.

[0018] **FIG. 2** illustrates helmet **20** in more detail. Helmet **20** may be any type of helmet known in the art that provides some measure of protection to a user's head. In one embodiment, for example, helmet **20** is a combat helmet having ballistic-resistant capabilities. One such type of helmet **20** might be a helmet commonly referred to as a KEVLAR helmet. Helmets such as these are currently employed by both the military, and civilian law enforcement agencies.

[0019] Helmet **20** typically includes a chinstrap **22** that helps to maintain helmet **20** squarely and securely on the user's head. Chinstrap **22** may comprise, for example, a pair of straps, each fixedly attached at one end to helmet **20**. As those skilled in the art will appreciate, any of a variety of buckles or other mechanisms may be used to connect the free ends of the straps to secure helmet **20** to the user's head. Helmet **20** may also include a helmet cover **24** that substantially covers the exterior surface **26** of helmet **20**. Cover **24** may be, for example, constructed of a plurality of cloth panels stitched together to fit over exterior surface **26** of helmet **20**. Alternatively, cover **24** may be a unitary piece of elastic material that permits the user to stretch cover **24** over helmet **20**.

[0020] Cover **24** also comprises a flap **28** that is secured along one of its lengths to cover **24**, for example, by stitching. Flap **28** may be constructed of the same material used to construct cover **24**, although as those skilled in the art will appreciate, this is not required. In one embodiment, flap **28** extends substantially around the perimeter of helmet **20**, and may be lifted and lowered along its length to expose and cover, respectively, one or more mechanical fasteners used to detachably connect the armor members **30, 50** of the present invention. When lowered, flap **28** protects against dirt, moisture, and other foreign materials that may compromise the integrity of the connection between helmet **20** and any connected armor members. As seen in **FIG. 2**, the mechanical fasteners comprise snaps **27** that may be integrally formed with cover **24** or, alternatively, the exterior surface **26** of helmet **20**.

[0021] **FIGS. 3A and 3B** illustrate the first armor member **30** as it might be configured according to one embodiment of the present invention. As seen in **FIG. 3A**, the first armor member **30** is constructed of tear-resistant fabric that may be sewn, for example, to form an interior pocket **32**. A mechanical fastener, such as a zipper, may be sewn or otherwise attached to the fabric to form an optional access opening **34** that permits access to the interior pocket **32**. The access opening **34** allows the user to insert and extract soft armor **36** into the interior pocket **32**, thereby facilitating as-needed cleaning of first armor member **30** and/or replacement of soft armor **36**. One or more mechanical fasteners, which in **FIG. 3A** comprise snaps **38**, are disposed adjacent a peripheral edge of first armor member **30**. Snaps **38** mate with snaps **27** disposed on helmet **20** and/or cover **24** to allow the user to detachably connect the first armor member **30** to helmet **20**.

[0022] **FIG. 3B** illustrates the opposing side of first armor member **30**. In **FIG. 3B**, an additional set of one or more snaps **40** are disposed adjacent a peripheral edge of first armor member **30**. As will be described in more detail later, snaps **40** may be coupled to corresponding snaps disposed

on second armor member **50** to allow the user to detachably connect the second armor member **50** to the first armor member **30**.

[0023] The soft armor **36** used in the present invention may be any soft-armor known in the art having anti-ballistic or ballistic-resistant capabilities. There are many types of commercially available soft armor that would readily be suitable for use in the present invention. For example, in one embodiment of the present invention, soft armor **36** comprises one or more layers of an anti-ballistic woven fabric known as KEVLAR. Briefly, KEVLAR is manufactured by inter-weaving high-strength aramid fibers to form dense sheets of fabric. These sheets are highly flexible and may be used as a weave to create various articles of clothing, such as bulletproof vests. Alternatively, multiple sheets of KEVLAR may be resin-bonded at high temperatures to create a harder, less flexible product, such as helmet **20**. According to the present invention, however, one or more layers of the flexible fabric sheets are inserted into the interior pocket **32** of first armor member **30** to form the flexible soft armor **36**. The flexibility of the KEVLAR fabric permits the first armor member **30** to substantially conform to the shape of helmet **20** when it is connected.

[0024] **FIGS. 4A and 4B** illustrate the second armor member **50** as it might be configured according to one embodiment of the present invention. Like first armor member **30**, second armor member **50** may also be constructed from tear-resistant fabric formed to create an interior pocket **52**. In addition, the tear-resistant fabric may also be sewn, for example, at selected positions to partition second armor member **50** into multiple segments **54**; however, partitioning second armor member **50** into multiple segments is not required. In this embodiment, second armor member **50** is partitioned into three segments **54**, each having an interior pocket **52** and a zipper that forms an access opening **56** into the interior pockets **52**. As above, the access openings **56** permit a user to insert and extract one or more hard-armor members **58** into the interior pockets **52**, thereby facilitating both cleaning and replacement. One or more mechanical fasteners, which in **FIG. 4A** comprise snaps **60**, are disposed near the periphery of second armor member **50** and permit the second armor member **50** to be detachably connected to the first armor member **30**. More particularly, snaps **60** would couple to corresponding snaps **40** disposed on first armor member **30**.

[0025] The hard armor **58** used in the present invention may be any hard armor known in the art that is suitable for deflecting and/or stopping projectiles. This includes, but is not limited to, currently available hard-armor constructed from materials such as steel, multiple layers of resin-bonded KEVLAR, and ceramic. In the embodiment of **FIGS. 4A and 4B**, the hard armor **58** comprises a plurality of ceramic plates; however, hard-armor **58** may alternately comprise a single plate. In embodiments that employ multiple plates of hard armor **58**, the edges of the plates may be formed to interlock or overlap by a desired amount. One side of each of the ceramic plates has a concave surface that faces inwardly toward the helmet **20**. The opposing side, or strike face side, has a convex surface that faces outwardly from the helmet **20**. The convex/concave surfaces of hard armor **58** permit the second armor member **50** to substantially conform to the shape of helmet **20**.

[0026] As previously stated, both first armor member 30 and second armor member 50 may be detachably connected to helmet 20. However, the present invention does not require using both the first armor member 30 and the second armor member 50. Rather, first armor member 30 and second armor member 50 may be used alone or in combination to enhance the level of protection provided by helmet 20 alone. The ability to connect and detach the first and/or second armor members 30, 50 permits a user to tailor the level of protection to an expected threat.

[0027] As seen in FIG. 5A, for example, only the first armor member 30 is coupled to a rear area of helmet 20. This configuration might be useful for military troops or law enforcement personnel expecting a low threat level, such as that coincident with a riot or localized uprising. When connected to helmet 20, the soft armor 36 of first armor member 30 enhances the protective capabilities of helmet 20 by deflecting or blocking at least some types of high-speed projectiles that might otherwise penetrate helmet 20.

[0028] To couple first armor member 30 to helmet 20, the user merely connects snaps 38 on first armor member 30 to corresponding snaps 27 on cover 24. Alternatively, corresponding snaps 27 may be integrally formed on the exterior surface 26 of helmet 20. Because soft armor 36 is flexible, first armor member 30 substantially conforms to the shape of helmet 20 when the two are connected. In addition, the flexibility and lightweight of first armor member 30 does not hinder or impede the user's head and neck movement.

[0029] For situations that might require an even higher level of anti-ballistic protection, second armor member 50 may further be detachably coupled to first armor member 30 as seen in FIG. 5B. To connect second armor member 50 to first armor member 30, the user need merely to connect snaps 60 on second armor member 50 to corresponding snaps 40 disposed on first armor member 30. Because second armor member 50 comprises hard armor 58, it offers anti-ballistic protection to a level that might be required to deflect or block high-velocity projectiles that might otherwise penetrate soft armor 36 and/or helmet 20. Particularly, hard armor 58 decelerates these high-velocity projectiles upon impact and may cause the projectile to fragment. However, hard armor 58, when constructed of ceramic or like material, may likewise fracture or even shatter when struck by a high-velocity projectile. In these cases, soft armor 36 of the first armor member 30 could prevent the decelerated high-velocity projectile and/or any resultant fragments from perforating helmet 20 and causing serious injury or death to the user.

[0030] Those skilled in the art will realize that the snaps illustrated in the drawings are not the only mechanical fasteners that may be used to detachably connect the first and/or second armor members 30, 50 to helmet 20. Rather, any type of mechanical fastener known in the art is suitable for use with the present invention. FIGS. 6-8, for example, illustrate an alternate embodiment wherein a zipper 29 is sewn to cover 24. Zipper 29 comprises one portion of a zipper that mates with a corresponding portion 39 disposed on the first armor member 30. Snaps 60 on second armor member 50 may then be detachably coupled to corresponding snaps 40 disposed on first armor member 30. Still other embodiments use other types of mechanical fasteners to detachably couple first and/or second armor members 30, 50

to helmet 20 including, but not limited to, screws and hook-and-loop types fasteners.

[0031] Additionally, it should be noted that the present invention is not limited to the positioning of the first and/or second armor members 30, 50 shown in the figures. Specifically, the figures illustrate the lower-most edges of first and second armor members 30, 50 as being substantially flush with the lower-most edge of the rear of helmet 20. However, those skilled in the art will readily appreciate that this positioning is for illustrative purposes only, and first and/or second armor members 30, 50 may be detachably connected to helmet 20 in any position as needed or desired. FIG. 9, for example, illustrates an embodiment where the first and second armor members 30, 50 extend below the helmet 20. Further, the lateral edges of the first and/or second armor members 30, 50 may be extend forwardly towards the front of helmet 20 by any amount desired. In this position, the present invention may provide protection to areas of the user's head and neck typically not covered or protected by helmet 20. Such areas include, but not limited to, the lower and/or side areas of the neck and/or the temporal regions of the user's head.

[0032] The specification to this point has described the armor of the present invention as having two separate armor modules. However, depending upon the armor material used, the present invention may be practiced using only a single armor member. For example, it is known to manufacture a unitary armor member that includes both soft armor 36 and hard armor 58. One or more of these unitary armor members may then be inserted into one of the first or second armor members 30, 50 and detachably coupled to helmet 20. Other materials that may be suitable for use as armor members include, but are limited to, steel plating and resin-bonded synthetic fibers such as KEVLAR.

[0033] In addition, the figures illustrate both the first and second armor members 30, 50 as skirts that include optional access openings 34, 56. As used herein, a skirt is defined as an attachment that connects to a headgear such that it wraps at least partially around a portion of the headgear. Those skilled in the art will readily appreciate, however, that first and/or second armor members 30, 50 need not be a skirt, but instead, may take any desired shape or form that permits the armor members 30, 50 to detachably connect to helmet 20. Further, the access openings 34, 56 might be positioned at any angle and on any surface of the first and/or second armor members 30, 50. Additionally, while the figures illustrate access openings 34, 56 as including zippers, any fastening or covering mechanism known in the art may be used. Examples of suitable fastening devices include, but are not limited to, snaps, hook and loop, flaps, and the like. Alternatively, access opening 34, 56 may not include access openings at all. In embodiments that do not include access openings 34, 56, the fabric used to form the first and/or second armor members 30, 50 may be sewn around their respective peripheries, for example, to encase the soft armor 36 and hard armor 58 within their respective interior pockets 32, 52.

[0034] Those skilled in the art will also realize that the present invention may be suitable for headgear other than combat helmets to provide appropriate levels of protection to their users as well. In addition, the type, material, flexibility, placement, and positioning of the armor of the

present invention may be tailored to meet an expected threat level. For example, hardened plastic, varying thicknesses of steel or other lightweight metals, metal alloys, composites, or the like are examples of some of the materials that are suitable for use with the present invention.

[0035] The present invention may, of course, be carried out in other ways than those specifically set forth herein without departing from essential characteristics of the invention. The present embodiments are to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

What is claimed is:

1. Armor for a helmet comprising:
 - an attachment having an interior pocket, the attachment being detachably mountable to the helmet; and
 - armor disposed within the pocket of the attachment.
2. The armor of claim 1 wherein the attachment includes an opening to allow the access to the pocket.
3. The armor of claim 1 wherein the attachment is sealed around its periphery to encase the armor within the pocket.
4. The armor of claim 1 wherein the attachment includes a fastener that mates with a corresponding fastener associated with the helmet.
5. The armor of claim 4 wherein the corresponding fastener is disposed on an exterior of the helmet.
6. The armor of claim 4 wherein the corresponding fastener is disposed on a cover that substantially surrounds the exterior of the helmet.
7. The armor of claim 1 wherein the armor comprises flexible soft armor having one or more layers of ballistic-resistant fibers.
8. The armor of claim 7 wherein the attachment comprises a first attachment, and further comprising a second attachment having a second pocket, the second attachment being detachably mountable to the first attachment and including a hard-armor member disposed within the second pocket.
9. The armor of claim 8 wherein the hard armor comprises one or more hard armor plates.
10. The armor of claim 1 wherein the attachment comprises a skirt that substantially surrounds a rear portion of the helmet.
11. The armor of claim 1 wherein the armor comprises one or more hard-armor members.
12. Armor for a helmet comprising:
 - a soft-armor attachment detachably mountable to the helmet; and
 - a hard-armor attachment detachably mountable to the soft-armor attachment.
13. The armor of claim 12 wherein the soft-armor attachment includes a first fastener that mates with a corresponding second fastener associated with the helmet.
14. The armor of claim 13 wherein the hard-armor attachment includes a third fastener that mates with a corresponding fourth fastener disposed on the soft-armor attachment.
15. The armor of claim 12 wherein the soft-armor attachment encases one or more soft armor members.
16. The armor of claim 15 wherein the one or more soft armor members comprises a flexible anti-ballistic material having one or more layers.

17. The armor of claim 15 wherein the soft-armor attachment includes an opening to allow access to the one or more soft armor members.

18. The armor of claim 12 wherein the hard-armor attachment encases one or more armor members.

19. The armor of claim 18 wherein the hard-armor attachment comprises a segmented attachment wherein each segment encases a hard-armor member.

20. The armor of claim 18 wherein the hard-armor attachment includes one or more openings to allow access to the one or more hard-armor members.

21. The armor of claim 18 wherein the one or more armor members comprise a ceramic armor.

22. The armor of claim 12 wherein the soft-armor attachment comprises flexible soft-armor, and the hard-armor attachment comprises one or more hard-armor members.

23. The armor of claim 12 wherein the soft-armor attachment and the hard-armor attachment wrap substantially around at least a portion of the rear of the helmet.

24. The armor of claim 12 wherein at least one of the soft-armor attachment and the hard-armor attachment includes an edge that is substantially parallel to a bottom edge of the helmet.

25. A ballistic-resistant helmet comprising:

a helmet that substantially surrounds a user's head; and

a first attachment to encase a first ballistic-resistant member, the first attachment being detachably mountable to the helmet.

26. The ballistic-resistant helmet of claim 25 further comprising a second attachment to encase a second ballistic-resistant member, the second attachment being detachably mountable to the first attachment.

27. The ballistic-resistant helmet of claim 26 wherein the first attachment includes an opening to allow access to the interior of the first attachment.

28. The ballistic-resistant helmet of claim 26 wherein the second attachment includes an opening to allow access to the interior of the second attachment.

29. The ballistic-resistant helmet of claim 26 wherein the first ballistic-resistant member comprises a flexible soft-armor member, and wherein the second ballistic-resistant member comprises one or more hard-armor members.

30. The ballistic-resistant helmet of claim 29 wherein the second attachment is segmented, and wherein each segment in the second attachment encases a hard-armor member.

31. A method of enhancing the protection of a helmet comprising:

forming a first attachment to include a first armor member; and

disposing a fastener on the first attachment to allow the first attachment to detachably connect to the helmet.

32. The method of claim 31 wherein the fastener on the first attachment detachably connects to a corresponding fastener associated with the helmet.

33. The method of claim 32 wherein the corresponding fastener associated with the helmet is disposed on an exterior surface of the helmet.

34. The method of claim 32 wherein the corresponding fastener associated with the helmet is disposed on a cover that covers at least a portion of the helmet.

35. The method of claim 31 further comprising:

forming a second attachment to include a second armor member; and

disposing an additional fastener on the second attachment to allow the second attachment to detachably connect to the first attachment.

36. The method of claim 35 wherein the additional fastener on the second attachment detachably connects to a corresponding fastener disposed on the first attachment.

37. The method of claim 34 wherein the first armor member comprises a flexible soft-armor member, and wherein the second armor member comprises one or more hard armor members.

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