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(54) **HEAD AND NECK PROTECTION SYSTEM**

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(57) **ABSTRACT**

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A head and neck protection system includes a head protector, a shoulder protector, and a neck guard for protecting a person from injury. The neck guard detachably connects between the head protector and the shoulder protector and includes a collar. The collar has a first edge and a second edge spaced apart from the first edge. The first and second edges include fastening means for detachably coupling the collar between the head protector and the shoulder protector. In one embodiment, the collar has a perimeter that flares outwardly as the collar extends from the head protector to the shoulder protector. The collar is formed of an anti-ballistic material to protect the person from injury from bullets, fragments and other projectiles. The collar interconnects the head protector with the shoulder protector to form a restraint that limits displacement of the head protector relative to the shoulder protector.

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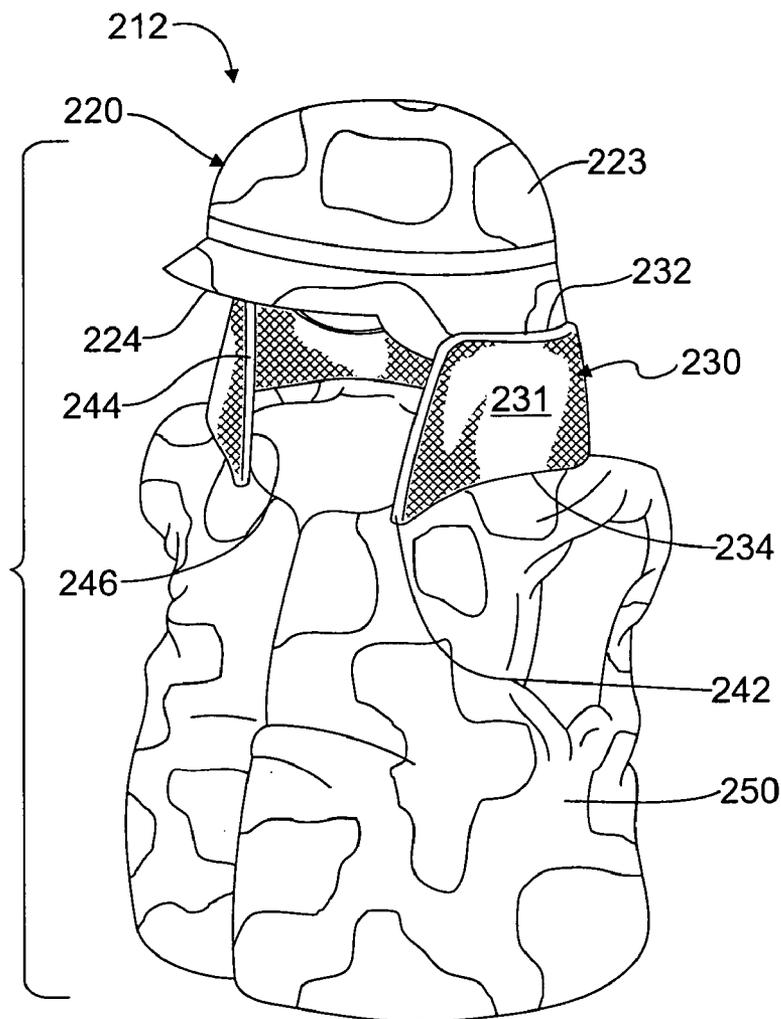
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(63) Continuation-in-part of application No. 10/704,780, filed on Nov. 10, 2003, now Pat. No. 6,874,170.

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(51) **Int. Cl.⁷** **A42B 1/24**



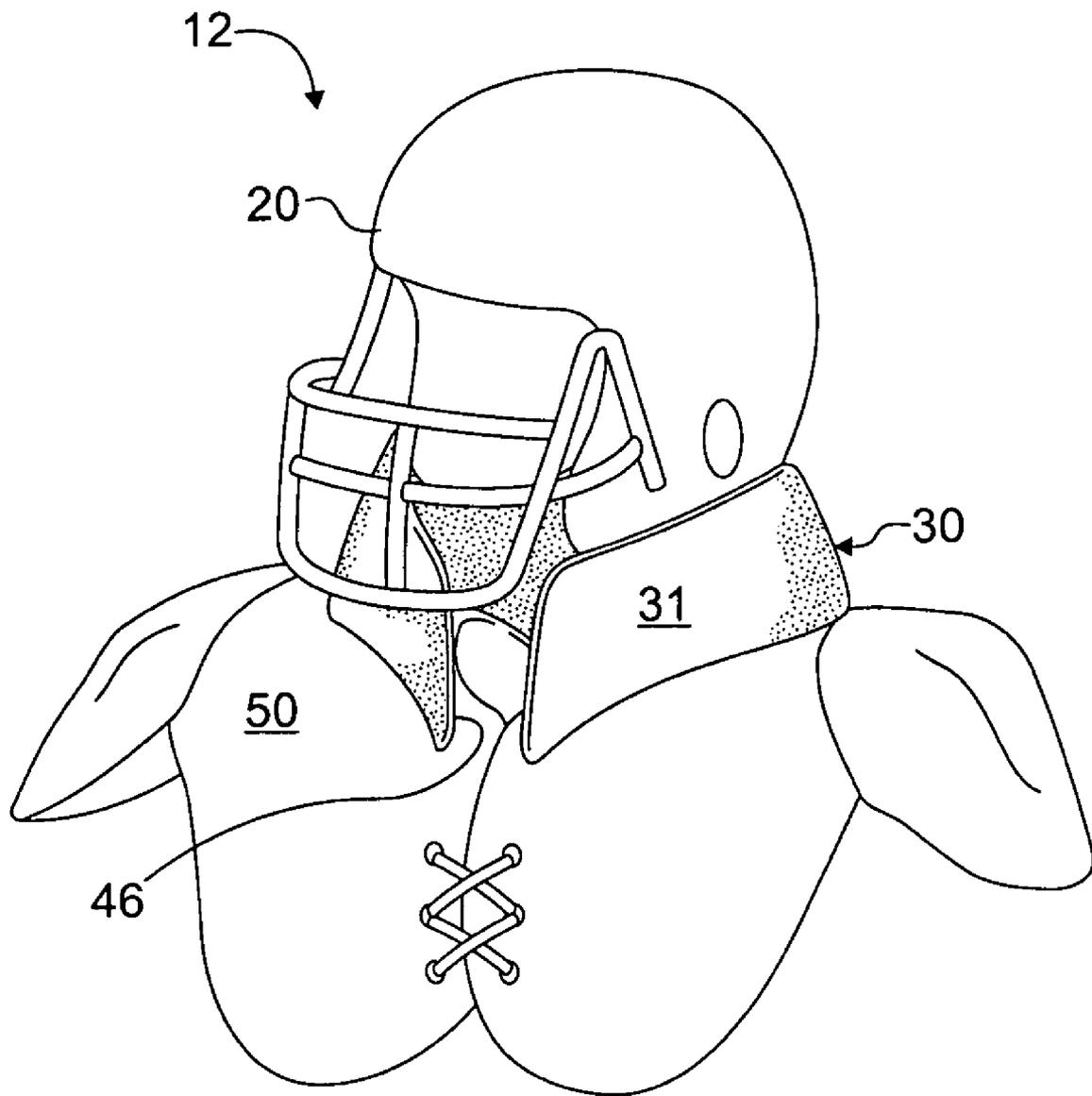


Fig. 1

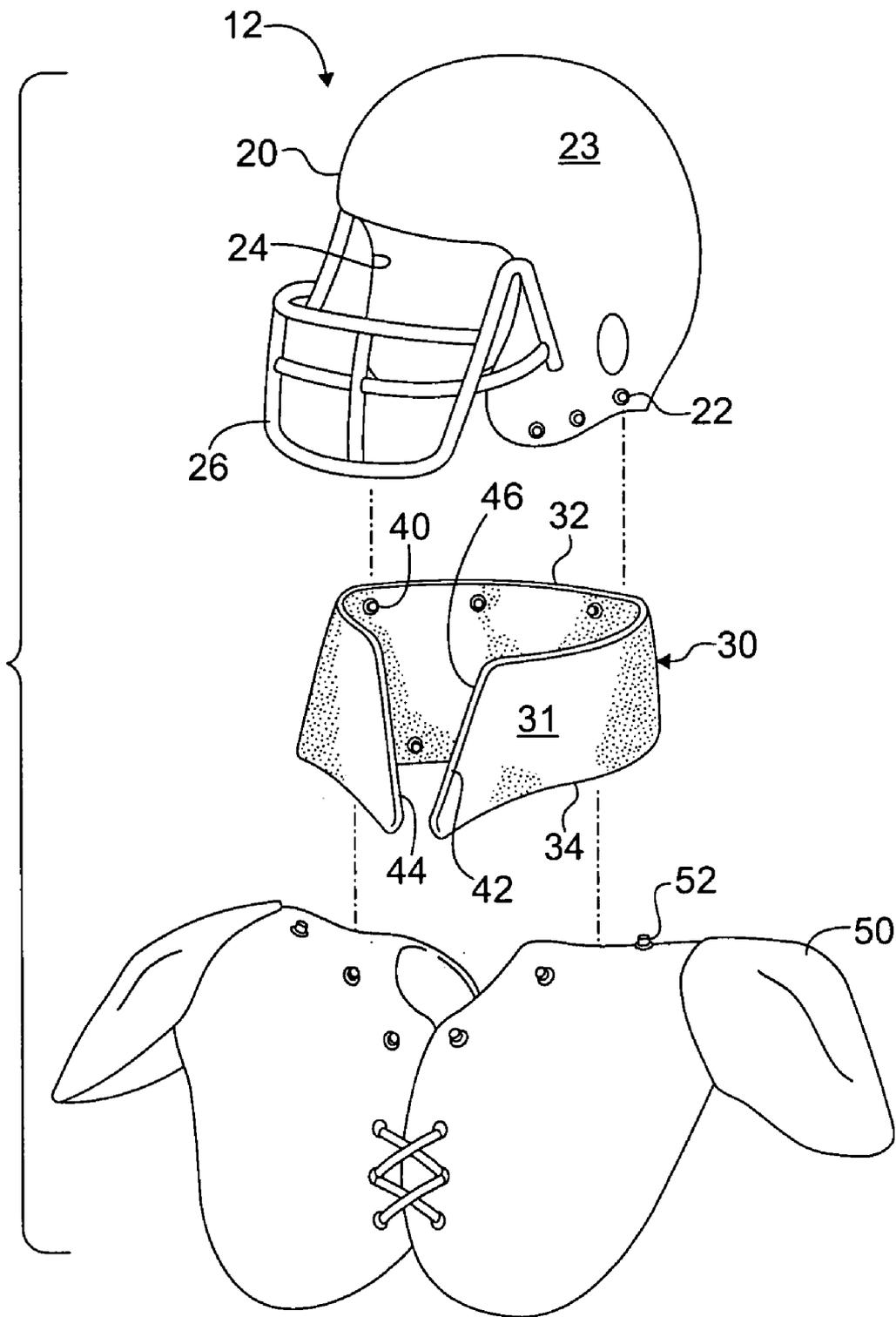
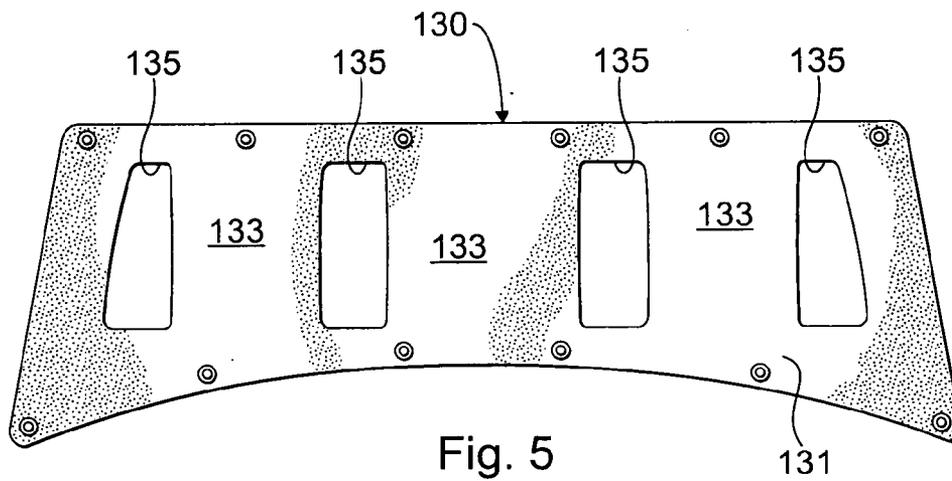
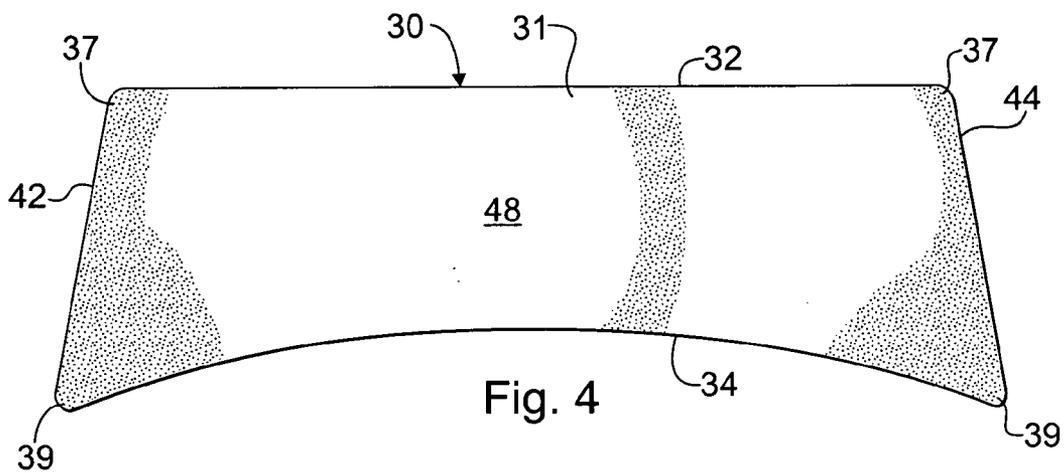
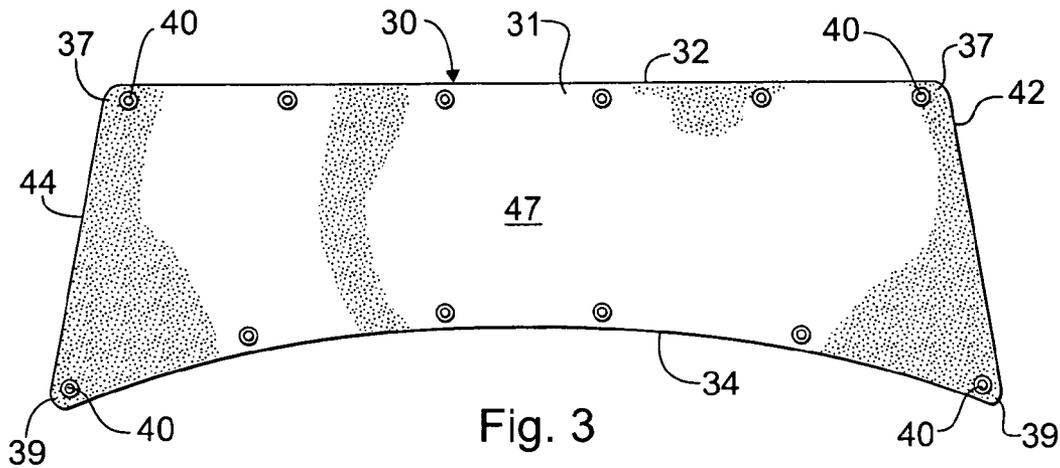


Fig. 2



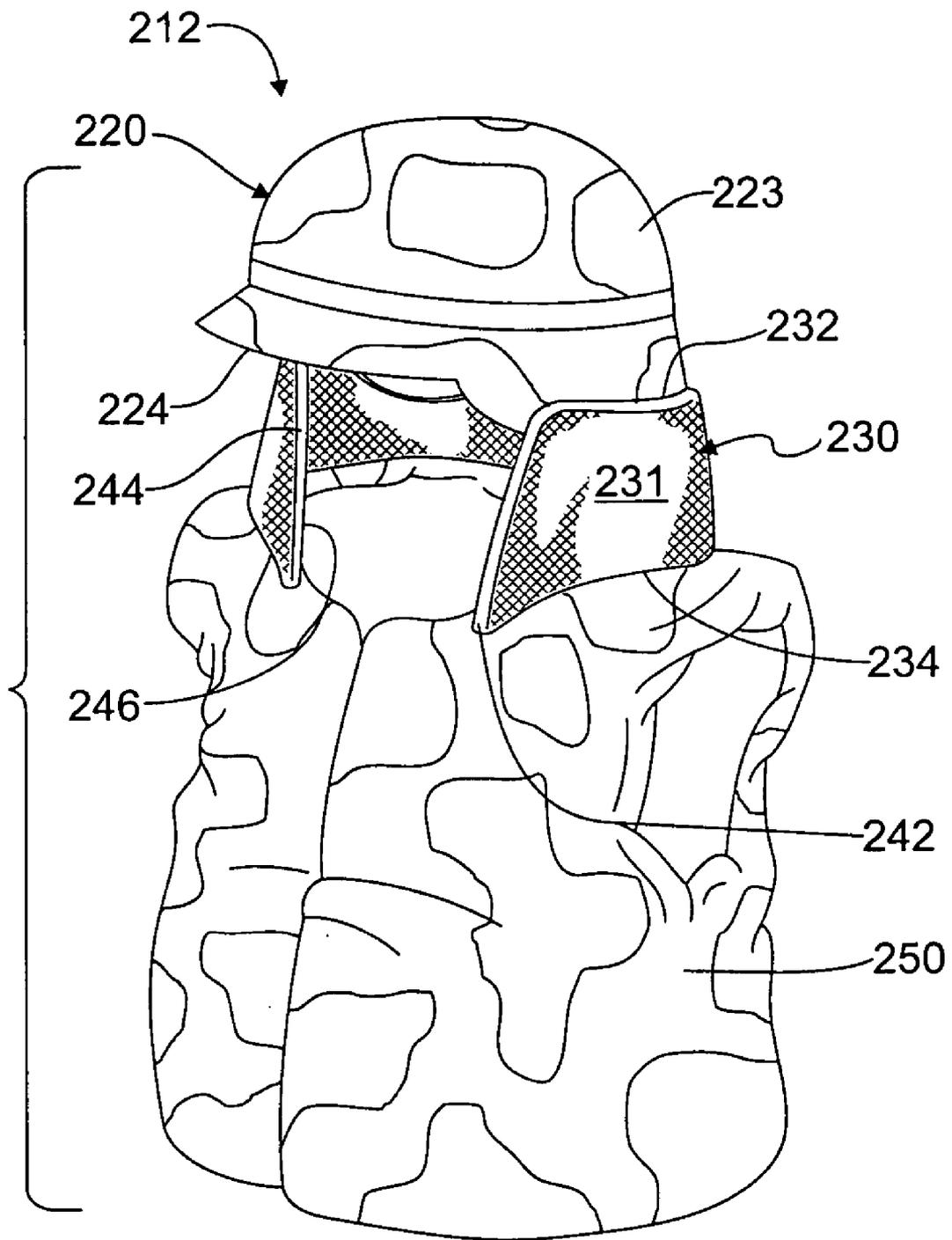


Fig. 6

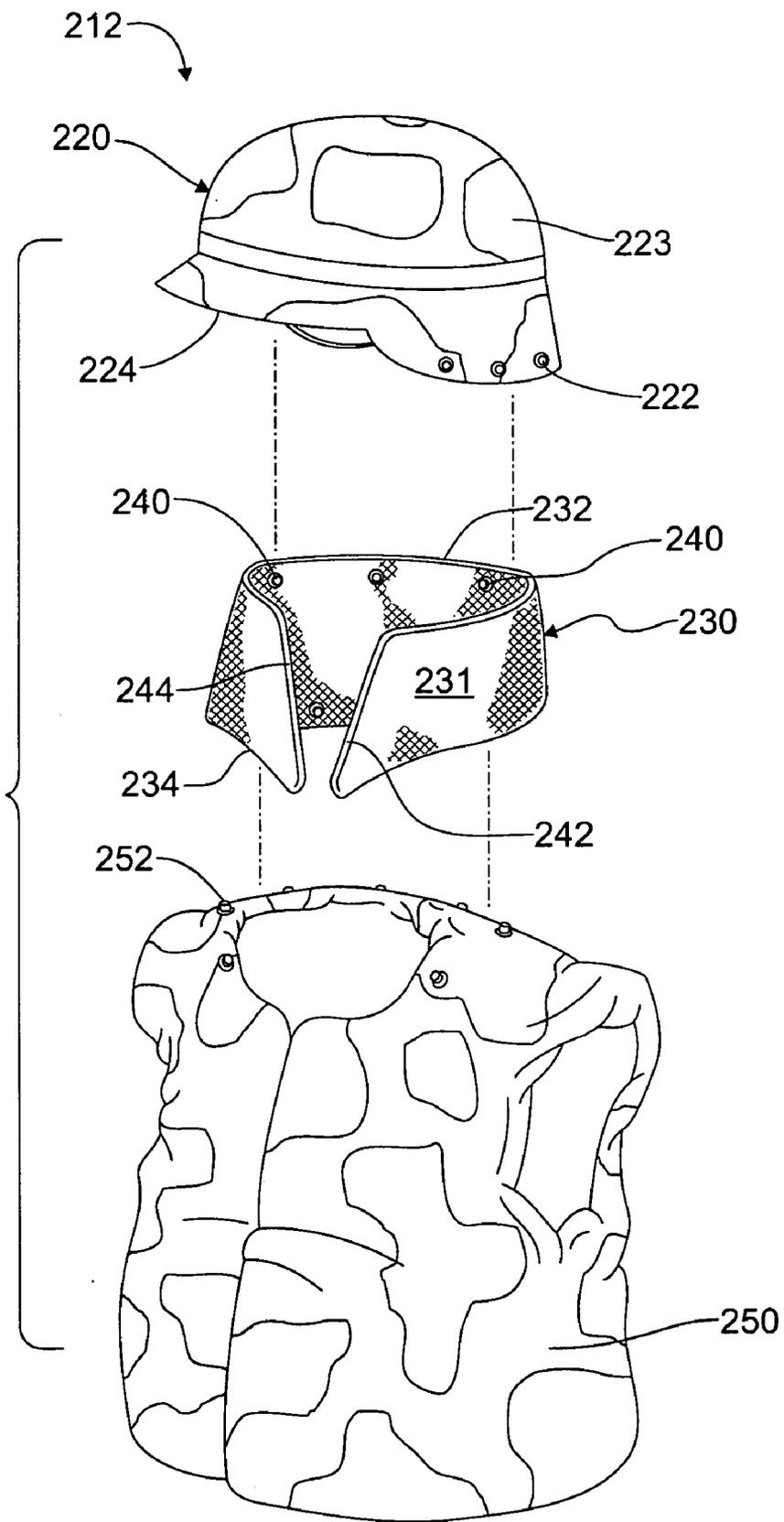
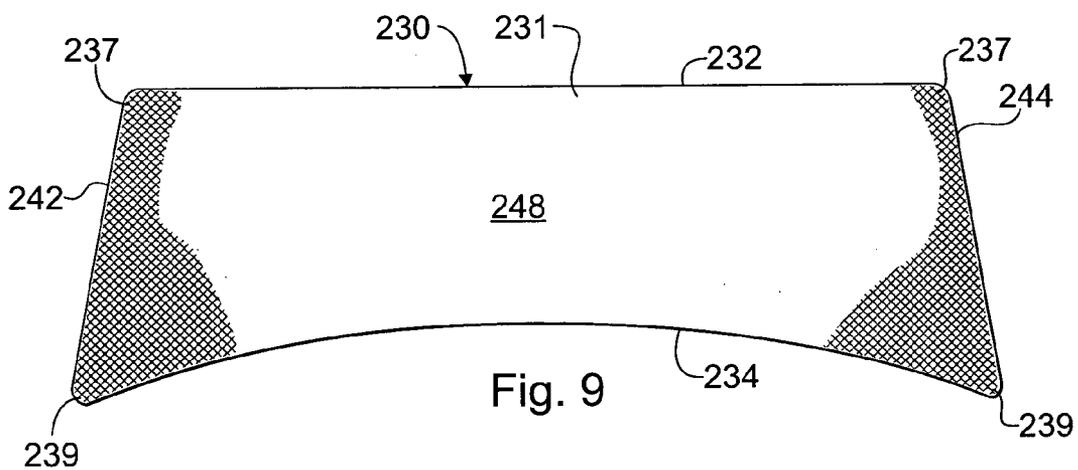
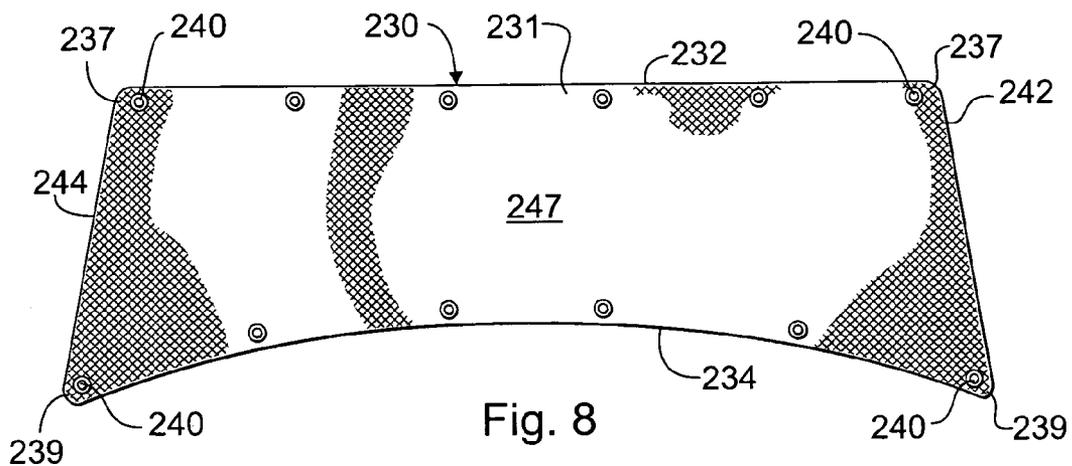


Fig. 7



HEAD AND NECK PROTECTION SYSTEM

RELATED APPLICATIONS

[0001] This application is a continuation-in-part application of U.S. application Ser. No. 10/704,780 filed Nov. 10, 2003, the entirety of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to safety equipment, and particularly to protective gear for the head and neck that can be used in a variety of activities involving risk of injury.

BACKGROUND

[0003] Athletes use a variety of protective helmets and pads when participating in sports. For example, athletes who participate in football, lacrosse, hockey, auto racing and equestrian competition routinely use helmets for head protection. Safety standards for protective gear frequently conflict with other concerns, such as comfort. As a result, many head and neck guards sacrifice comfort for safety, or vice versa. A number of head and neck guards in the present state of the art have large bulky components that surround the head, neck and shoulders. Although these guards reduce the risk of injury, they add significant weight to the athlete's gear and interfere with the athlete's mobility. Some head and neck guards include elaborate cages or masks around the head that obstruct the athlete's vision. A few head and neck guards include springs or hydraulic pistons that are designed to absorb shocks. Although springs and pistons can dissipate energy during a head collision, they are prone to wear and add significant weight to the equipment. Other head and neck guards provide support only for the rear of the head and neck. The rear support protects the person's head and neck when the head is deflected rearwardly, but fails to provide protection when the head is deflected in other directions.

[0004] Head and neck guards in the present state of the art are also costly for the user. Many head and neck guards are designed for specific sports or are compatible only with specific brands of equipment. Individuals who participate in multiple sports must purchase equipment that is specifically designed for each sport. The expense of purchasing separate equipment for each sport can be excessive. In addition to cost, many head and neck guards are difficult to put on and remove. For all of the foregoing reasons it can be seen that head and neck guards in the present state of the art leave much to be desired in the areas of safety, comfort, cost and ease of use.

[0005] The protective gear presently used in football has specific drawbacks arising from the extreme level of physical contact in the sport. Football players routinely collide with opponents as part of the game, and a large number of body contacts occur on a player's helmet. Impact forces on a football helmet are directed into the player's head and down through the neck and spine. As a result, compression forces are directly imposed on the neck and spine, creating significant risk of injury. The known football helmets are usually unrestrained other than by a chin strap. Furthermore, the helmets are usually disconnected from other parts on the uniform. These design limitations permit a player's head to deflect in any direction and at a severe angle during a

collision with another player. If the player experiences a high speed helmet collision, the collision can cause severe neck injury, including neck hyperextension (rearward deflection of the neck) or neck hyperflexion (forward deflection of the neck). Football players seldom wear padding over their necks, leaving their necks completely exposed. As a result, there is no protection against cuts, abrasions, or other surface injuries on the neck, which can be caused by contact with other players. Nor is there any protection against the effects of cold winds, rain, snow, or other elements.

[0006] Most football helmets are secured on the football player's head by a chin strap, which prevents the helmet from being knocked off of the player's head during a helmet collision. The chin strap can rub against the player's chin, collect perspiration, and prove very uncomfortable for the player. This discomfort can discourage players from using chin straps, subjecting the players to a greater risk of head injury. Even when worn, chin straps are not without their own risks, and tightly worn chin straps can actually exacerbate a head injury. The disadvantages of tight chin straps are best understood by appreciating the advantages of a football helmet that slides a small degree on the player's head. To protect a player from head injury, the football helmet must absorb and dissipate energy from the collision before the impact force reaches the player's head. A small amount of sliding between the helmet and the player's scalp is preferable, because the friction between the sliding helmet and the scalp dissipates some of the energy from the helmet collision. A tight chin strap prevents sliding motion of the helmet on the scalp, and energy from the helmet collision travels through the helmet and directly to the player's head. Therefore, it is desirable to have a football helmet restraint that secures the football helmet to the head, while avoiding the problems associated with chin straps.

[0007] The foregoing drawbacks are not just seen in safety equipment used in sports. Helmets used by military and law enforcement personnel have many of the same problems, including excessive bulk and weight, limited flexibility, lack of comfort and insufficient support of the head and neck and other limitations. Many helmets used in the military leave large areas of head and neck exposed and unprotected. In addition, many military helmets are prone to significant shifting on the head, requiring the use of chin straps similar to those used with football helmets. As noted above, chin straps can be very uncomfortable, discouraging many from using them. Military personnel who decline to use chin straps are at risk of losing their helmets, putting themselves at greater risk of sustaining a serious head injury.

SUMMARY OF THE INVENTION

[0008] The problems associated with the known types of protective gear are solved to a great degree by a head and neck protection system in accordance with the present invention. In a first aspect of the invention, a head and neck protector includes a neck guard formed of anti-ballistic material having a first edge and a second edge in spaced relation to the first edge. A first fastening means is disposed along the first edge for attaching the neck guard to clothing or head gear. The neck guard may also include a second fastening means disposed along the second edge for attaching the neck guard to gear worn over the person's torso. The first edge may be shorter in length than the second edge, so that the neck guard forms a frusto-conical shape around the

neck. The anti-ballistic material is preferably formed of one or more para-aramid fiber materials.

[0009] In a second aspect of the invention, a head and neck protection system includes a head protector and a neck guard formed of an anti-ballistic material. The neck guard includes a first edge, a second edge in spaced relation from the first edge, and a first fastening means extending along the first edge of the neck guard. The first fastening means is configured to detachably couple the neck guard with the head protector. The head and neck protection system may include additional components, such as shoulder gear that is connected to the neck guard. The neck guard may include a second fastening means extending along the second edge of the neck guard for coupling the neck guard to the shoulder gear. The neck guard may be adapted to form a frusto-conical shape that surrounds the neck. The anti-ballistic material may be formed of one or more para-aramid fiber materials.

[0010] In a third aspect of the invention, a head and neck guard for use with a head protector and shoulder gear includes a strip of anti-ballistic material having first and second edge portions in spaced relation to each other, and first and second end portions in spaced relation to each other. The strip of anti-ballistic material has a length that is dimensioned such that said strip can be extended substantially around the entire neck area of the person. A first fastening means is disposed along the first edge portion for attaching the strip to the head protector. A second fastening means is disposed along the second edge portion for attaching the strip to the shoulder gear. The strip of anti-ballistic material may be formed of one or more para-aramid fibers. In addition, the strip of anti-ballistic material is preferably adapted to form a frusto-conical shape when attached between the head gear and the shoulder gear and around the neck of a wearer.

DESCRIPTION OF THE DRAWINGS

[0011] The foregoing summary as well as the following description will be better understood when read in conjunction with the drawing figures in which:

[0012] FIG. 1 is a perspective view of a head and neck protection system in accordance with the present invention.

[0013] FIG. 2 is an exploded perspective view of the head and neck protection system of FIG. 1.

[0014] FIG. 3 is a side elevation view of a neck guard used in the head and neck protection system of FIG. 1, showing a first side of the neck guard.

[0015] FIG. 4 is a side elevation view of the neck guard used in the head and neck protection system of FIG. 1, showing a second side of the neck guard.

[0016] FIG. 5 is a side elevation view of an alternate embodiment of a neck guard in accordance with the present invention.

[0017] FIG. 6 is a perspective view of an alternate embodiment of a head and neck protection system in accordance with the present invention.

[0018] FIG. 7 is an exploded perspective view of the head and neck protection system of FIG. 6.

[0019] FIG. 8 is a side elevation view of a neck guard used in the head and neck protection system of FIG. 6, showing a first side of the neck guard.

[0020] FIG. 9 is a side elevation view of the neck guard used in the head and neck protection system of FIG. 6, showing a second side of the neck guard.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0021] Referring to the drawing figures, and in particular to FIG. 1, a head and neck protection system 12 is shown. The protection system 12 includes a head protector 20, a neck guard 30, and shoulder gear 50. The neck guard 30 is connected between the head protector 20 and the shoulder gear 50 to form a shock-absorbing brace between the head protector and shoulder gear that substantially prevents hyperextension of the neck, hyperflexion of the neck, and other serious head and neck injury. The neck guard 30 is sufficiently flexible and light-weight to permit normal head rotation about the axis of the wearer's neck.

[0022] The protective system 12 is intended for use in a variety of activities that involve risk of injury to the head, neck and spine. For example, the protective system 12 may be used in a variety of sports and recreational activities, including but not limited to football, auto racing, motorcycling, lacrosse, and equestrian competition. Therefore, the protective system 12 may include different forms of protective gear. In the case of auto racing, for example, the neck guard 30 may be connected between a racing helmet and a fire suit. In equestrian competition, the neck guard 30 may be connected between a helmet and a jacket or vest. The term "head protector" encompasses a variety of head gear, including but not limited to hats, helmets, face guards and face shields. The term "shoulder gear" or "shoulder protector" encompasses a variety of equipment and apparel worn over the shoulder, chest or torso, including but not limited to shoulder pads, jerseys, vests, jackets, fire suits, or body armor. In the following description, the protection system 12 will be described as it would be applied in sports, and particularly in the sport of football, where the protection system may include a football helmet 20 and shoulder pads 50.

[0023] Referring now to FIG. 2, the neck guard 30 includes a collar 31 that is formed to extend substantially around a person's neck. The collar 31 has a first edge portion 32 constructed to connect with a base portion of the football helmet 20, and a second edge portion 34 constructed to connect with the shoulder pads 50. When the collar 31 is connected with the football helmet 20 and shoulder pads 50, the collar forms a protective restraint that absorbs shock and limits displacement of the head and neck. The neck guard 30 secures the helmet 20 to the shoulder pads 50, substantially preventing the dislodging or removal of the helmet during contact. As a result, the neck guard 30 may be used in conjunction with or in place of a chin strap.

[0024] The helmet 20 has a hollow body 23 and a face opening 24 that partially exposes the player's face when the helmet is placed over the player's head. A face mask 26 extends over the face opening 24 to protect the player's face from injury. The neck guard 30 engages with the base of helmet 20 and provides an annular buttress or brace around the base of the helmet. The first edge 32 of the collar 31

extends around the base of the helmet **20** in a generally circular arrangement. The neck guard **30** extends downwardly toward the shoulder pads **50** and surrounds the person's neck. The second edge **34** of the collar **31** connects with the shoulder pads **50** in a generally circular arrangement, similar to the circular arrangement of the first edge **32**.

[0025] The neck guard **30** extends around the player's neck in a tubular fashion, covering a substantial portion of the player's neck. In this arrangement, the neck guard shields the neck to substantially prevent the occurrence of neck abrasions, lacerations, cuts or irritations caused by contact with other players, harsh winds or other elements. Referring to **FIGS. 3-4**, the second edge **34** of the collar **31** is preferably longer than the first edge **32**, so that the collar **31** has a generally trapezoidal shape when the collar is laid flat. In this configuration, the collar **31** forms a generally frusto-conical enclosure around the player's neck when the collar is connected between the helmet **20** and shoulder pads **50**. The collar **31** flares radially outwardly as it extends from the helmet **20** toward the shoulder pads **50**. The flared profile of the neck guard **30** distributes forces outwardly and away from the neck and spine. The neck guard **30** may also be formed with other configurations to distribute forces away from the helmet. For example, the strip may be hourglass-shaped with the first and second edges of the collar **31** of more or less equal length so as to form a generally cylindrical tube of uniform diameter when the neck guard is placed around the neck between the helmet **20** and shoulder pads **50**.

[0026] The outwardly expanding neck guard **30** in the preferred embodiment provides significant advantages over other neck guard configurations. Since the wall of the collar **31** expands outwardly as it extends from the helmet **20** to the shoulder pads **50**, the collar absorbs forces applied to the helmet and disperses those forces outwardly to the shoulders and torso. With this arrangement, forces are directed outwardly and away from the spine and vertebrae, reducing the risk of head and spinal injury. The collar **31** also anchors the position of the helmet **20** relative to the shoulder pads **50** to limit lateral deflection of the head and over extension of the neck during a helmet collision. The collar **31** is configured to extend substantially around the entire neck area, limiting displacement of the neck regardless of the direction of contact.

[0027] The collar **31** may be formed using a variety of materials, and the specific material used may be selected based on a number of factors, including but not limited to the desired amounts of flexibility and ventilation of body heat from the neck area. In the embodiment shown in **FIGS. 1 and 2**, the collar **31** is formed of a strip of resilient elastomer, such as neoprene. The elastomeric material has a thickness which is selected to provide resistance to lateral deflection while providing sufficient flexibility to permit rotation of the head about the axis of the neck. Other materials and having different properties and thicknesses may also be used in the neck guard **30** with satisfactory results. The elastic property of elastomers provides variable resistance to stress that increases as the material deforms. During initial stress, the elastomer provides a relatively small amount of tensile elasticity, allowing the collar to deform a small degree. This permits the player to turn his/her head through a limited range about the axis of the neck. As the collar material is stressed further, however, the tensile

elasticity increases dramatically to limit further movement of the head about any of the axes of rotation relative to the shoulder pads. As a result, the elastomer provides controlled displacement of the head and neck relative to the shoulder pads. Aside from their elastic properties, many elastomers provide a relatively light-weight material that adds very little weight to the player's uniform. The tensile elasticity of elastomeric material can also provide beneficial exercise to neck muscles when worn and stretched between a helmet and shoulder pads.

[0028] The collar **31** may be formed of one or more solid panels or sections of material that connect around the base of the helmet **31** to form an annular restraint and shock absorbing brace. The number of sections that form the collar is not a critical aspect of the present invention. In **FIGS. 1-5**, the collar **31** is formed from a single solid strip of material. The collar **31** may also be formed of two or more separate panels or sections that connect around the base of the helmet. The separate panels collectively form a restraint and shock absorbing brace, similar to a single strip of material.

[0029] Thus far, the collar **31** has been illustrated and described as a solid strip of material, or solid sections of material, that surround a substantial portion of the player's neck when connected between the helmet **20** and shoulder pads **50**. However, a solid collar is not essential, and other collar configurations may be desirable within the scope of the present invention. Referring to **FIG. 5**, an alternate neck guard **130** is shown. The neck guard **130** includes a partially open collar **131** with an array of web-like panels or extensions **133**. The panels **133** are spaced incrementally from one another between apertures **135** formed in the collar **131**. In this arrangement, the panels **133** provide restraints that stabilize the helmet and limit displacement of the helmet relative to the shoulder pads. The apertures **135** provide increased flexibility and ventilation, while reducing the weight of the neck guard **130**. The neck guard **130** may be desirable for use during hotter weather, football practices, football scrimmages, or other conditions where greater flexibility and ventilation are desired.

[0030] The neck guard **30** may be connected with the helmet **20** and shoulder pads **50** in a variety of ways. For example, the neck guard **30** may be permanently connected with the helmet **20**, permanently connected with the shoulder pads **50**, or permanently connected with both the helmet and the shoulder pads. The neck guard **30** may be permanently attached to the helmet and shoulder pads using any suitable connection, including but not limited to high strength adhesive or metallic rivets. In the preferred embodiment, the neck guard **30** is detachably connected with the helmet **20** and shoulder pads. A variety of detachable connection means may be used, including but not limited to zippers, hook and loop fastener strips, snap fasteners, and combinations thereof.

[0031] Referring to **FIGS. 2-4**, the neck guard **30** comprises a plurality of snap fasteners **40** for connecting the collar **31** to the helmet **20** and shoulder pads **50**. The collar **31** has an inner face **47** and an outer face **48**. The inner face **47** has a plurality of snap fasteners **40** incrementally spaced along the first and second edges **32, 34** of the collar **31**. The helmet **20** includes a series of snap connectors **22** incrementally spaced around the base of the helmet. The shoulder pads **50** include a series of similar snap connectors **52** that

extend around the neck opening. The snap fasteners **40** on the first edge **32** of the collar **31** detachably connect with the snap connectors **22** on the helmet **20**, and the snap fasteners on the second edge **34** of the collar detachably connect with the snap connectors **52** on the shoulder pads **50**.

[0032] Referring to FIGS. 3-4, the collar **31** includes a third edge **42** and a fourth edge **44** that extend between the first and second edges **32**, **34**. The first edge **32** of the collar **31** intersects with the third and fourth edges **42**, **44** of the collar to form a pair of upper corners **37**, and the second edge **34** of the collar **31** intersects with the third and fourth edges **42**, **44** of the collar to form a pair of lower corners **39**. The upper corners **37** each preferably include a snap fastener **40** configured to connect with a snap connector **22** on the sides of face opening **24** on the helmet **20**. The lower corners **39** each preferably include a snap connector **40** configured to connect with a snap connector **52** on the front section of the shoulder pads **50**. When the neck guard **30** is connected between the helmet **20** and shoulder pads **50**, the third and fourth edges **42**, **44** of the collar are preferably separated, forming a gap or opening **46** beneath the face mask at the front of the helmet. The gap **46** permits ventilation of body heat that accumulates between the neck guard and the player's skin. The gap **46** also forms a clearance space through which the player may insert one or more fingers to remove the neck guard from the helmet and shoulder pads, while leaving the helmet and shoulder pads on. In this arrangement, the neck guard can be readily connected to and detached from the helmet **20** and shoulder pads **50**. The snap fasteners **40** and snap connectors **22**, **52** may be mounted to the collar **31**, helmet **20** and shoulder pads **50** with a bonding agent, stitching, a combination of bonding and stitching, or other connection suitable for mounting the snap fasteners and connectors.

[0033] The operation and function of the protective system **12** will now be described in more detail. In football, a large number of head collisions occur on the side of the helmet, with impact forces concentrated on one side of the player's helmet. In response to the impact, the player's head deflects away from the source of impact. Without neck restraints or guards, the player's head is free to tilt and deflect in response to the collision. Helmet collisions that occur at high speed can result in hyperextension of the neck, hyperflexion of the neck, or other serious neck injury. The neck guard **30** is configured to substantially prevent serious head and neck injury by partially immobilizing the head and neck relative to the shoulders. The collar **31** extends between the helmet **20** and shoulder pads **50** in a relatively snug arrangement that limits the extent to which the player's helmet can be tilted relative to the shoulder pads. When the player experiences contact at the front of the helmet, for example, the impact force is directed rearwardly. The front section of the collar **31**, which is initially in a relaxed state, deflects and deforms a small amount before being pulled taut. The small amount of deflection and deformation in the collar permits the player's head to tilt back slightly until the collar is pulled taut. At this point, the tensile strength of the collar **31** resists additional deformation at the front of the collar (beneath the player's chin), thereby limiting rearward displacement of the player's head. In the relaxed condition, the annular collar **31** is pulled snugly between the helmet **20** and shoulder pads **50** on all sides of the player's helmet. Therefore, the collar **31** provides tensile resistance against head and neck displacement in any direction. As the tensile resistance of the

elastomeric collar increases during elastic deformation, the collar effectively absorbs energy from the impact. The flexibility of the collar **31** allows limited horizontal rotation of the neck to permit the player's head to pivot in the horizontal plane.

[0034] The head and neck protection system of the present invention is not limited to use in sports and recreational activities. The system can be used in any activity, occupation or endeavor which poses a risk of injury to the head, the neck, and/or the spine. For example, the head and neck protection system may be used by riot police or military personnel to absorb shock, limit displacement of the person's head and neck, and protect the person's head and neck from being injured by flying projectiles.

[0035] Referring now to FIGS. 6 and 7, an alternate embodiment of a head and neck protection system **212** is shown, in an arrangement for use by police and military personnel. The protection system **212** includes a helmet **220**, a neck guard **230**, and a vest **250**. The neck guard **230** is connected between the helmet **220** and the vest **250**, forming a shock-absorbing brace between the helmet and vest that substantially prevents hyperextension of the neck, hyperflexion of the neck, and other serious head and neck injury. The neck guard **230** is sufficiently flexible and light-weight to permit normal head rotation about the axis of the wearer's neck.

[0036] The neck guard **230** includes one or more strips of material that extend substantially around a person's neck. Referring now to FIGS. 8 and 9, the neck guard includes a collar **231** having the same attributes shown and described in connection with the collar shown in FIGS. 3 and 4. The collar **231** has a first edge portion **232** adapted to connect with a base portion of the helmet **220** or other head protector, and a second edge portion **234** adapted to connect with the vest **250** or other shoulder gear. When the collar **231** is connected to the helmet **220** and vest **250**, the collar forms a protective restraint that absorbs shock and limits displacement of the head and neck. The neck guard **230** also secures the helmet **220** on the head by limiting movement of the helmet relative to the vest **250**, substantially preventing the dislodging or removal of the helmet during contact. As a result, the neck guard **230** may be used in place of a chin strap.

[0037] The head and neck protection system **212** may include one or more pieces of armor that shield and protect the body from high speed projectiles. In the embodiment shown in FIGS. 6 and 7, the helmet **220**, neck guard **230** and vest **250** are formed of anti-ballistic materials to shield the head, neck and torso from bullets, fragments and other high speed projectiles. The helmet **220**, neck guard **230** and vest **250** may be formed of one or more anti-ballistic materials, including but not limited to ceramic materials or para-aramid fiber materials, such as "KEVLAR" brand fiber or "TWARON" brand fiber. Preferably, the material in the neck guard **230** has a thickness which is selected to provide resistance to lateral deflection while providing sufficient flexibility to permit rotation of the head about the axis of the neck.

[0038] The helmet **220** has a hollow body **223** and a face opening **224** that partially exposes the wearer's face when the helmet is placed on the wearer's head. The neck guard **230** engages with the base of helmet **220** and provides an

annular buttress or brace around the base of the helmet. The first edge **232** of the collar **231** extends around the periphery of the base of the helmet **220**. The neck guard **230** extends downwardly toward the vest **250** and surrounds the wearer's neck. The second edge **234** of the collar **231** connects with the vest **250** around the periphery of the head opening, similar to the arrangement of the first edge **232**. In this arrangement, the neck guard **230** forms a continuous barrier substantially completely around the person's neck and portions of his/her head.

[0039] The neck guard **230** wrapped around the neck forming a protective brace that covers a substantial portion of the neck. The anti-ballistic materials in the neck guard **230** protects the head and neck area from bullets, fragments and other high speed projectiles. The neck guard **230** also shields the head and neck to substantially prevent the occurrence of abrasions, lacerations, insect bites, sun burn and other injuries. In addition, the neck guard **230** acts as a noise insulator over the person's ears. If desired, areas of the neck guard **230** that cover the person's ears may be padded with noise insulating materials such as polyurethane acoustical foam to provide additional noise insulation. This may be desirable for personnel who discharge firearms or artillery, or who operate loud machinery.

[0040] The second edge **234** of the collar **231** is preferably longer than the first edge **232**, so that the collar **231** has a generally trapezoidal shape when the collar is laid flat. The collar **231** forms a generally frusto-conical enclosure when it is wrapped around the neck and connected between the helmet **220** and vest **250**. The collar **231** flares radially outwardly as it extends from the helmet **220** toward the vest **250**. The flared profile of the neck guard **230** distributes forces outwardly and away from the neck and spine. The neck guard **230** may also be formed with other configurations to distribute forces away from the helmet. For example, the collar **231** may be hourglass-shaped with the first and second edges of more or less equal length so as to form a generally cylindrical tube of uniform diameter when the neck guard **230** is placed around the neck and connected between the helmet **220** and vest **250**.

[0041] The neck guard **230** may be connected with the helmet **220** and vest **250** in a variety of ways. For example, the neck guard **230** may be permanently connected with the helmet **220**, permanently connected with the vest **250**, or permanently connected with both the helmet and the vest. The neck guard **230** may be permanently attached to the helmet **220** and vest **250** using any suitable connection, including but not limited to high strength adhesive or metallic rivets. In the preferred embodiment, the neck guard **230** is detachably connected with the helmet **220** and vest **250**. A variety of detachable connection means may be used, including but not limited to zippers, hook and loop fastener strips, snap fasteners, and combinations thereof.

[0042] Referring again to FIGS. 8 and 9, the neck guard **230** comprises a plurality of snap fasteners **240** for connecting the collar **231** to the helmet **220** and vest **250**. The collar **231** has an inner face **247** and an outer face **248**. The inner face **247** has the plurality of snap fasteners **240** incrementally spaced along the first and second edges **232**, **234** of the collar **231**. The helmet **220** includes a series of snap connectors **222** incrementally spaced around the base of the helmet. The vest **250** includes a series of similar snap

connectors **252** that extend around the neck opening. The snap fasteners **240** on the first edge **232** of the collar **231** detachably connect with the snap connectors **222** on the helmet **220**, and the snap fasteners on the second edge **234** of the collar detachably connect with the snap connectors **252** on the vest **250**.

[0043] The collar **231** includes a third edge **242** and a fourth edge **244** that extend between the first and second edges **232**, **234**. The first edge **232** of the collar **231** intersects with the third and fourth edges **242**, **244** of the collar to form a pair of upper corners **237**, and the second edge **234** of the collar **231** intersects with the third and fourth edges **242**, **244** of the collar to form a pair of lower corners **239**. The upper corners **237** each preferably include a snap fastener **240** configured to connect with a snap connector **222** on the sides of face opening **224** on the helmet **220**. The lower corners **239** each preferably include a snap connector **240** configured to connect with a snap connector **252** on the front section of the vest **250**. When the neck guard **230** is attached to the helmet **220** and vest **250**, the third and fourth edges **242**, **244** of the collar are preferably separated, forming a gap or opening **246** beneath the face opening **224** at the front of the helmet. The gap **246** permits ventilation of body heat that accumulates between the neck guard and the person's skin. The gap **246** also forms a clearance space through which the person may insert one or more fingers to remove the neck guard from the helmet and vest, while leaving the helmet and vest on. In this arrangement, the neck guard can be readily attached to and detached from the helmet **220** and vest **250**. The snap fasteners **240** and snap connectors **222**, **252** may be mounted to the collar **231**, helmet **220** and vest **250** with a bonding agent, stitching, a combination of bonding and stitching, or other means suitable for mounting the snap fasteners and connectors.

[0044] The dimensions on the neck guard will vary depending on the desired amount of neck protection. In some instances, it may be desirable to use a neck guard that protects the neck without interfering with a person's hearing. In such a case, the neck guard may include a shorter collar that covers the back of the neck but does not extend over the ears. Alternatively, the neck guard may include a longer collar that extends over the ears and includes small apertures to expose a small area around the ear opening.

[0045] The components of the head and neck protection system may be manufactured, distributed and sold individually, or as a package containing two or more items of protective gear. For example, the neck guard may be sold alone or in conjunction with helmets, jerseys, vests, or other gear having fasteners designed to interconnect with fasteners on the neck guard. Alternatively, the neck guard may be sold in conjunction with kits that permit helmets, jerseys, vests and other gear to be retrofitted with fasteners that connect with fasteners on the neck guard. The neck guard may be sold with a helmet, a helmet and vest, or any other combination of items.

[0046] The terms and expressions which have been employed are used as terms of description and not of limitation. There is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof. It is recognized, therefore, that various modifications are possible within the

scope and spirit of the invention. Accordingly, the invention incorporates variations that fall within the scope of the following claims.

I claim:

1. A head and neck protector for use with head gear and gear worn over the torso, comprising:

A. a neck guard formed of anti-ballistic material having a first edge and a second edge in spaced relation to the first edge; and

B. a first fastening means disposed along the first edge for attaching said neck guard to said head gear.

2. The head and neck protector of claim 1 comprising a second fastening means disposed along the second edge of said neck guard for attaching said neck guard to said gear worn over the person's torso.

3. The head and neck protector of claim 1, wherein the first fastening means comprises a detachable fastening means selected from the group consisting of snap fasteners, zippers, hook and loop fasteners, and combinations thereof.

4. The head and neck protector of claim 1, wherein the first fastening means comprises a plurality of snap fasteners that engage with a plurality of snap connectors on the head gear.

5. The head and neck protector of claim 1, wherein the first edge is shorter in length than the second edge, and said neck guard forms a frusto-conical neck brace surrounding the neck.

6. The head and neck protector of claim 1, wherein the neck guard forms a continuous barrier surrounding the neck.

7. The head and neck protector of claim 1, comprising a third edge and a fourth edge, said third edge and said fourth edge extending generally transverse to the first and second edges.

8. The head and neck protector of claim 1, wherein the anti-ballistic material comprises a para-aramid fiber.

9. A head and neck protection system for protecting a person against injury, comprising:

A. a head protector; and

B. a neck guard formed of an anti-ballistic material, said neck guard being connected with the head protector, said neck guard comprising:

(1) a first edge and a second edge in spaced relation from the first edge; and

(2) a first fastening means extending along the first edge of the neck guard, said first fastening means being configured to detachably couple the neck guard with the head protector.

10. The head and neck protection system of claim 9 comprising shoulder gear connected with said neck guard.

11. The head and neck protection system of claim 10 comprising a second fastening means extending along the second edge of the neck guard, said second fastening means being configured to detachably couple the neck guard with said shoulder gear.

12. The head and neck protection system of claim 10 wherein said shoulder gear is selected from the group consisting of a vest, a jacket and a uniform.

13. The head and neck protection system of claim 9, wherein the first fastening means comprises a detachable fastener selected from the group consisting of snap fasteners, zippers, hook and loop fasteners, and combinations thereof.

14. The head and neck protection system of claim 9, wherein the neck guard comprises a frusto-conical neck brace surrounding the neck.

15. The head and neck protection system of claim 9, wherein the neck guard comprises a continuous barrier around the neck.

16. The head and neck protection system of claim 9, wherein the neck guard comprises a third edge and a fourth edge, said third edge and said fourth edge extending generally transverse to the first and second edges.

17. The head and neck protection system of claim 9, wherein the anti-ballistic material comprises a para-aramid fiber.

18. A head and neck guard for use with a head protector and shoulder gear for protecting a person against injury to the head or neck, comprising:

a strip of anti-ballistic material having first and second edge portions in spaced relation to each other, and first and second end portions in spaced relation to each other, said strip of anti-ballistic material having a length that is dimensioned such that said strip can be extended substantially around the entire neck area of the person;

a first fastening means disposed along the first edge portion for attaching said strip to the head protector; and

a second fastening means disposed along the second edge portion for attaching said strip to the shoulder gear.

19. A head and neck guard as set forth in claim 18 wherein said strip of anti-ballistic material comprises a para-aramid fiber.

20. A head and neck guard as set forth in claim 18 wherein the first edge portion has a length that is shorter than the length of the second edge portion, whereby said strip of anti-ballistic material is adapted to form a frusto-conical shape when attached between the head gear and the shoulder gear.

21. A head and neck guard as set forth in claim 18 wherein said strip of anti-ballistic material has a thickness that is selected to provide resistance to elongation, and provide flexibility to permit rotation of the person's head about a vertical axis of the person's neck.

22. A head and neck guard as set forth in claim 18 wherein the length of said strip is dimensioned to provide a gap between the first and second end portions when the guard is positioned around the neck area of the person.

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