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(54) **Shock-absorbing facemask attachment assembly**

(57) A facemask coupled to a sports helmet such that it will absorb a very high percentage of the impact energy from a ball or other oncoming force. The shock-absorbing facemask attachment assembly includes a housing attached to a helmet. An insert may be coupled to the facemask and the housing such that the insert is pushed further into the housing in response to an applied force.

Alternatively, one or more springs may be coupled to the facemask and the housing such that the springs are compressed further toward the housing in response to an applied force. As another alternative, a spring assembly may include at least one spring coupled to the helmet and the housing and at least one spring coupled to the facemask and the housing.

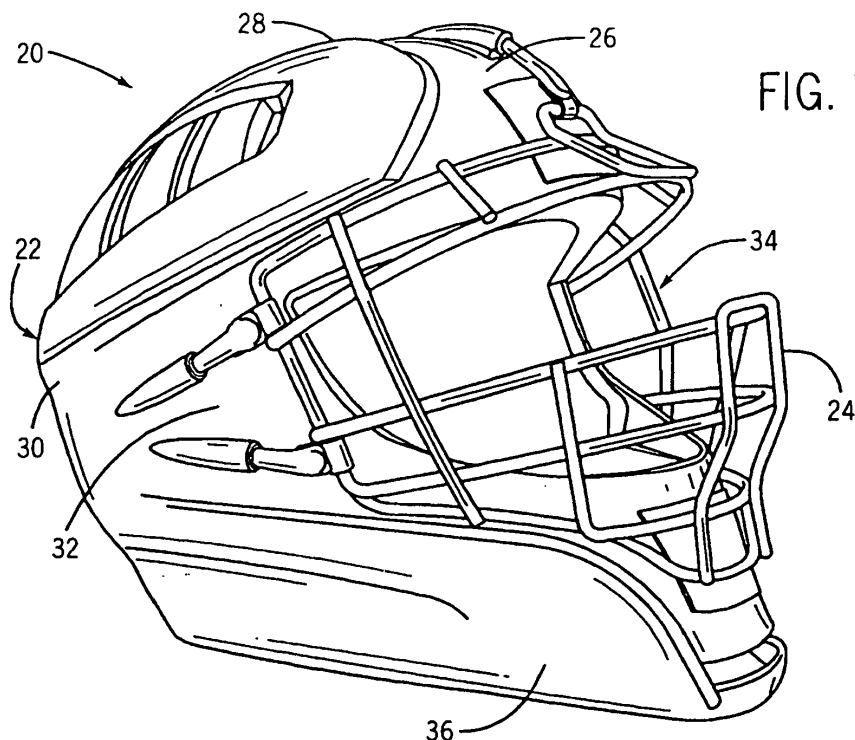


FIG. 1

Description

[0001] The present invention relates to an attachment assembly for mounting a facemask to a sports helmet in such a way that the facemask will absorb and/or dissipate a very high percentage of impact energy from a ball or other oncoming force.

BACKGROUND OF THE INVENTION

[0002] Helmets are used in a wide range of sports. Helmets generally serve the same purpose in each sport, which is to protect the wearer's head from injury by providing a buffer zone between the wearer's head and an oncoming ball, puck, club, or other moving object.

[0003] Helmets worn by umpires and catchers in baseball or softball, football players, hockey players, and lacrosse players are well known and typically include a shell having inner and outer surfaces and a padding assembly connected to the inner surface of the shell. Many sport helmets also typically include corresponding facemasks mounted to the helmet. However, conventional facemask mountings provide little, if any, shock absorption. More particularly, when a moving object strikes the facemask, the force is typically transferred directly to the helmet with very little buffering or dampening. The current design of catcher's helmets, for example, transfers a very high percentage of impact energy from the ball directly to the wearer's head. This problem is also present in umpire masks and other helmets that include facemasks.

[0004] Neither the design of conventional facemask mounts nor the materials used in conventional facemask mounts provide much impact absorption. It would thus be desirable to provide a facemask that is mounted to a helmet such that the facemask can absorb and/or dissipate an increased percentage of impact energy from an oncoming ball, puck, club, or other moving object.

[0005] The present invention presents a shock-absorbing facemask attachment assembly that provides absorption and dissipation of a high percentage of impact energy from an oncoming object. This shock absorption and dissipation is achieved through a mounting configuration and/or mounting materials that allow the facemask to greatly increase the impact absorption and to distribute a large amount of impact energy.

[0006] In one embodiment, the shock-absorbing facemask attachment assembly includes a housing attached to a helmet shell with an insert positioned in the housing, modeled after a hydraulic piston. The insert has a first end coupled to a facemask and a second end disposed in the housing. The insert is adapted to extend the second end further into the housing in response to a force applied to the first end. At least a portion of the insert may include an elastomer. Similarly, at least a portion of the housing may include an elastomer. The housing may include a compressible fluid or gel positioned between a distal surface of the second end of the insert and a bottom surface of the housing, such that the fluid or gel is compressed

when a force is exerted on the facemask.

[0007] In another embodiment, the shock-absorbing facemask attachment assembly includes a housing attached to a helmet shell with a spring positioned in the housing. The spring has a first end coupled to a facemask and a second end disposed in the housing. The spring is adapted to be compressed further toward the housing in response to a force applied to the first end. One or more fasteners may be used to mount the spring to the facemask and/or to the housing. One or more of the fasteners may include nylon for greater flexibility. A compressible intermediate member may be positioned within the spring.

[0008] A bar of the facemask may be coupled to the first end of the spring, with the bar substantially perpendicular to the spring. A cover may be positioned over the portion of the facemask coupled to the first end of the spring. Additionally, a first bar of the facemask may be coupled to the first end of the spring while a second bar may be coupled to the cover.

[0009] More than just one spring may be included in each mounting assembly. For example, at least two springs, or at least three springs, may be coupled to each housing and the facemask. When multiple springs are present in a mounting assembly, the springs may be substantially parallel to one another.

[0010] In yet another embodiment, the shock-absorbing facemask attachment assembly includes a spring assembly in which a first spring has a first end coupled to a helmet shell and a second end coupled to a housing, and a second spring has a first end coupled to a facemask and a second end coupled to the housing. A third spring may also have a first end coupled to the facemask and a second end coupled to the housing. The springs may be substantially perpendicular to the helmet shell. Any or all of the springs may be coupled to the helmet shell, housing, or facemask with one or more fasteners. Any of the fasteners may include nylon for enhanced flexibility.

[0011] Any of the facemask mounting assemblies described herein may be attached to opposing sides of the helmet shell along opposite edges of a face opening portion of the helmet. In certain embodiments, one or more of the mounting assemblies may be attached to each side of the helmet shell. Alternatively or additionally, one or more of the mounting assemblies may be attached to the helmet shell in a central region above a face opening in the helmet. To highlight the shock-absorbing mechanism of the facemask attachment assembly, the housing and/or any cover portion may be transparent.

[0012] Any of the shock-absorbing facemask attachment assembly embodiments described herein may be applied to catcher's masks, umpire's masks, lacrosse helmets, football helmets, hockey helmets, and any other helmet that includes a facemask. Regardless of the type of helmet, shock-absorption is greatly improved by using any of the mounting schemes in this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIGURE 1 is a perspective view of a helmet including a shock-absorbing facemask attachment assembly in accordance with an embodiment of the present invention.

[0014] FIGURE 2 is a side view of a helmet showing the attachment of a facemask to the helmet of FIG. 1.

[0015] FIGURE 3 is a side view of a helmet showing a force acting upon a facemask attached to the helmet of FIG. 1.

[0016] FIGURE 4 is a cross-sectional view of a shock-absorbing facemask attachment assembly taken along line 4 - 4 in FIG. 2.

[0017] FIGURE 5 is a cross-sectional view of a shock-absorbing facemask attachment assembly taken along line 5 - 5 in FIG. 3.

[0018] FIGURE 6 is a cross-sectional view of a shock-absorbing facemask attachment assembly including a rigid insert in accordance with another embodiment of the present invention.

[0019] FIGURE 7 is a cross-sectional view of a shock-absorbing facemask attachment assembly including a rigid insert and a fluid-filled compartment in accordance with another embodiment of the present invention.

[0020] FIGURE 8 is a side view of a shock-absorbing facemask attachment assembly including a spring system in accordance with another embodiment of the present invention.

[0021] FIGURE 9 is a cross-sectional view of an individual spring taken along line 9 - 9 in FIG. 8.

[0022] FIGURE 10 is an exploded view of a shock-absorbing facemask attachment assembly in accordance with another embodiment of the present invention.

[0023] FIGURE 11 is a top view of a shock-absorbing facemask attachment assembly in accordance with another embodiment of the present invention.

[0024] FIGURE 12 is a cross-sectional view of the shock-absorbing facemask attachment assembly of FIG. 11 showing two of the three springs.

[0025] FIGURE 13 is a cross-sectional view of a leaf spring connecting a facemask to a helmet.

[0026] FIGURE 14 is a side view of a helmet having a shock-absorbing facemask attachment assembly in accordance with another embodiment of the present invention.

[0027] FIGURE 15 is a side view of a helmet having a shock-absorbing facemask attachment assembly in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0028] Referring to FIGS. 1 and 2, a helmet having a shock-absorbing facemask attachment assembly is indicated generally at 20. The helmet 20 of FIG. 1 is configured as a catcher's helmet; however, the invention can also be applied to other types of helmets, such as, for

example, an umpire's helmet and/or mask, a lacrosse helmet, a football helmet, a hockey helmet, and practically any other type of helmet that includes a facemask. The helmet includes a shell 22, a padding assembly (or head support assembly) (not shown), and a facemask 24.

[0029] The shell 22 is a generally hemispherically-shaped head covering, which forms a cranial cavity 26 configured to generally cover and protect the upper portion of a user's head. The shell 22 has a dome-like crown 28, a generally continuous circumferential side wall 30, first and second ear protective regions 32 and 34, and a neck protective region 36 that surrounds a wearer's neck. Preferably, the crown 28, side wall 30, first and second ear protective regions 32 and 34, and the neck protective region 36 are integrally formed to one another. In alternative preferred embodiments, one or more of these shell 22 regions can be connected together in a non-integral manner. Other types of helmets may differ in terms of the shell configuration. For example, football helmets may not include the neck protective region 36.

[0030] The shell 22 is formed of a rigid, durable material, preferably, acrylonitrile-butadiene-styrene ("ABS"). In alternative preferred embodiments, the shell 22 can be formed of other materials, such as, for example, a polycarbonate, plastic, aluminum, or other polymers. One example of a commercially-available material having considerable durability is Surlyn® produced by E.I. du Pont de Nemours and Company, 1007 Market St. Wilmington, Delaware 19898 ("DuPont"). The shell 22 is configured to protect the user's head by resisting, absorbing and distributing impact loads, such as, for example, the impact from a pitched ball, thereby reducing the load transferred to or felt by the user due to an impact. The padding assembly (not shown) is coupled to an inner surface of the shell 22 and may include a plurality of support members configured to dampen, reduce, absorb, and/or dissipate shock resulting from an impact of the helmet with an object, and reduce the shock transferred to, or felt by, the wearer due to an impact. The padding assembly can be formed of a lightweight, cushionable, resilient material, such as a foam material formed of ethyl vinyl acetate ("EVA foam"), or other open or closed cellular or non-cellular foam, a gel, a fluid-filled bladder, a plurality of spherical balls, a plurality of other geometric objects, or an air-filled bladder.

[0031] Referring to FIG. 2, the facemask 24 includes a plurality of generally vertical and horizontal bars 38 fitted over a face opening 40 in the helmet 20 and configured to protect a wearer's face without adversely obstructing the wearer's vision or ability to breathe. Two or more attachment assemblies 42 anchor the facemask 24 to the shell 22. The bars 38 of the facemask 24 are made of a rigid material, such as, for example, ABS, other high-density polymers, such as Surlyn®, aluminum, composite fiber materials, and combinations thereof. The number, size, shape, and placement of the bars 38 may vary among different embodiments, as the attachment assemblies 42 described herein are adaptable for use

with a wide range of facemask 24 configurations. For example, the bars can be formed in other shapes, such as curved shapes, angled shapes, and combinations thereof. In other alternative embodiments, the facemask may be formed of structures other than bars. For example, the facemask can be a one piece molded structure configured to match the size of the face opening of the helmet.

[0032] FIG. 3 illustrates a force (F) acting upon the facemask 24. The attachment assemblies 42 (or energy dissipation assemblies) in combination with the facemask 24 provide absorption and dissipation of a high percentage of impact energy from an oncoming object hitting the facemask, thereby transferring less impact energy to the shell 22. The attachment assemblies 42 serve as a form of a biasing assembly. The facemask 24 is susceptible to being hit from all angles. Consequently, the impact forces are often in directions other than straight back. Although the force (F) illustrated herein is representative of force from an oncoming object, the attachment assemblies 42 described herein are designed to absorb and dissipate energy from multiple directions.

[0033] A cross section of the attachment assembly 42 in FIG. 2 is illustrated in FIG. 4. The same attachment assembly 42 is illustrated in FIG. 5, showing the effects of the force (F) in FIG. 3 acting upon the attachment assembly 42. In this embodiment, the attachment assembly 42 includes a housing 44 attached to the shell 22 of the helmet 20. A rigid insert 46 includes a first end 48 coupled to the facemask 24 and a second end 50 disposed in the housing 44. The rigid insert 46 is adapted to extend the second end 50 further into the housing 44 in response to a force (F) applied to the first end 48. FIG. 6 is a composite view of another embodiment of the present invention showing the displacement of the rigid insert 46 within the housing 44 in response to the force (F).

[0034] In one embodiment, the displacement of the rigid insert 46 within the housing 44 is modeled after a hydraulic piston. For enhanced shock-absorption and energy dissipation, a resilient, compressible cellular material, such as a foam, a resilient sponge-like material, a compressible fluid or a gel 52 may be present within the housing 44 between a distal surface 51 of the second end 50 of the rigid insert 46 and a bottom surface 54 of the housing 44, as shown in FIG. 7.

[0035] For enhanced shock-absorption of impact forces and dissipation of energy from various directions, at least a portion of the housing 44 may include a durable, resilient material, such as an elastomer. Additionally or alternatively, at least a portion of the rigid insert 46 may include an elastomer. Examples of suitable elastomers include, but are not limited to, Neoprene polychloroprene, available from DuPont, as well as Lexan® EX L polycarbonate resin, available from GE Plastics, One Plastics Ave., Pittsfield, MA 01201 ("GE Plastics"). Not only is Lexan® EXL impact-modified and capable of providing improved flow and notch sensitivity, this resin is also transparent. In certain embodiments, at least a portion

of the housing 44 may be transparent, translucent, semi-transparent or semi-translucent, thus allowing a consumer to view the shock-absorbing system. Other materials suitable for inclusion in the attachment assembly 42 include Surlyn®, for example. Still further, the insert 46 may be formed of a semi-rigid or generally rigid material. The insert 46 and housing 44 can be configured to enable the insert to change positions within the housing in response to an impact. Alternatively, one or more of the insert and housing can be configured of shock absorbing material to allow for the absorption and dissipation of impact energy with limited relative movement of the insert with respect to the housing. In such an embodiment, the properties of the materials serve to absorb or dissipate energy from an impact.

[0036] The helmet 20 may include at least one of the attachment assemblies 42 on each side of the shell 22 along opposite edges of the face opening portion 40 of the helmet 20. As illustrated in FIG. 3, for example, the helmet 20 may include at least four of the attachment assemblies 42, with at least two of the attachment assemblies 42 positioned on each side of the shell 22 along opposite edges of the face opening 40 in the helmet 20. Additionally, one or more of the attachment assemblies 42 may be mounted to the shell 22 in a central region above the face opening 40 in the helmet 20 or in other locations about the shell 22 including above or below the facemask 24. Overall, the facemask 24 may be mounted to the shell 22 using at least three attachment assemblies 42, and may include as many as about ten attachment assemblies 42. One or more of the attachment assemblies 42 may be a conventional attachment assembly known to those skilled in the art, such as a conventional leaf spring system, as illustrated in FIG. 13.

[0037] Another preferred embodiment of the attachment assembly 42 in accordance with the invention is illustrated in FIG. 8. This type of attachment assembly 42 includes a spring or biasing system. More particularly, this attachment assembly 42 includes a housing 56 attached to the shell 22, with at least one spring 58 having a first end 60 coupled to the facemask 24 and a second end 62 disposed in the housing 56. The at least one spring 58 is adapted to be compressed further toward the housing 56 in response to a force (F) applied to the first end 60. In certain embodiments, two or more springs 58 may be included in each attachment assembly 42. When multiple springs 58 are present in an attachment assembly 42, the springs 58 are suitably substantially parallel to one another. For example, the attachment assembly 42 in FIG. 8 includes three springs 58 coupled to the facemask 24 and the housing 56, with the springs 58 substantially parallel to one another. Additionally, the bar 38 of the facemask 24 to which the first ends 60 of the springs 58 are attached is suitably perpendicular to the springs 58. In alternative embodiments, the springs can be angled with respect to each other to further enhance the ability of the helmet to absorb or otherwise dissipate energy resulting from impacts with an object such as a ball

in multiple directions.

[0038] FIG. 9 is a cross-sectional view of an individual spring 58 taken along line 9-9 in FIG. 8. As shown, the first end 60 of the spring 58 may be coupled to the facemask 24 with a first screw 64 and the second end 62 of the spring 58 may be coupled to the housing 56 with a second screw 66. Alternatively, the springs or biasing members can be coupled to the facemask or the housing using other types of conventional fasteners, such as, for example, rivets, snap-fit joints, etc. A resilient compressible intermediate member 68, such as an elastomer, may or may not be positioned within the spring 58 between the first screw 64 and the second screw 66. One or both of the screws 64, 66 may comprise nylon, thereby allowing for additional sideways flexibility.

[0039] The attachment assembly 42 may also include a cover 70 over the portion of the facemask 24 coupled to the first end 60 of the spring or springs 58, as shown in FIG. 8. This cover 70 may serve as a strike or shatter device to prevent damage to the underlying connection. Additionally, the cover 70 may enhance the aesthetic appeal of the helmet 20. The cover 70 and/or the housing 56 may be transparent, translucent, semi-transparent, or semi-translucent. The cover 70 may also be used to assist in securing the springs 58 to the facemask 24. For example, a first bar 38a of the facemask 24 may be coupled to the first end 60 of the springs 58 and a second bar 38b of the facemask 24 may be coupled to the cover 70.

[0040] FIG. 10 provides an exploded view of an attachment assembly 42 in accordance with another embodiment of the present invention. The attachment assembly 42 is a spring or biasing system that includes the housing 56 attached to the shell 22 of the helmet, a dampener 58, a cover 74, a sleeve 68 and a rigid insert 72. The rigid insert 72 can be welded or otherwise fixedly or removably secured to the facemask 24. The insert 72 extends through the sleeve 68 and the cover 74 and into the dampener 58. The sleeve 68 surrounds a portion of the insert 74 and is typically formed of a resilient material, such as, for example, a plastic or an elastomer. The sleeve 68 is positioned adjacent to, but preferably does not extend into, the cover 74. The sleeve 68 maybe colored or may include a decorative pattern. The cover 74 surrounds the dampener 58 and extends into the housing 56. The cover 74 protects the dampener 58 from binding or otherwise engaging the sleeve or the inner surfaces housing 56. The dampener 58 is a resilient biasing member that is configured to absorb and/or dissipate energy applied to the facemask 24 and the insert 72 from an impact.

[0041] Yet another preferred embodiment of the attachment assembly 42 in accordance with the invention is illustrated in FIGS. 11 and 12. This type of attachment assembly 42 also includes a spring or biasing system. More particularly, this attachment assembly 42 includes a first spring 76 having a first end 78 coupled to the shell 22 and a second end 80 coupled to a housing 82, and a second spring 84 having a first end 86 coupled to the

facemask 24 and a second end 88 coupled to the housing 82. As shown in FIG. 11, a third spring 90 may also have a first end coupled to the facemask 24 and a second end coupled to the housing 82. The springs 76, 84, 90 may each be substantially perpendicular to the surface of the shell 22 at which they are attached.

[0042] As in previous embodiments including spring assemblies, screws may be used to fasten the springs 76, 84, 90 to the other components of the attachment assembly 42. Alternatively, other conventional fasteners can also be used. More particularly, the first end 78 of the first spring 76 may be coupled to the shell 22 with a first screw 92 and the second end 80 of the first spring 76 may be coupled to the housing 82 with a second screw 94. Additionally, the first end 86 of the second spring 84 may be coupled to the facemask 24 with a third screw 96 and the second end 88 of the second spring 84 may be coupled to the housing 82 with a fourth screw 98. The third spring 90 may be attached to the facemask 24 and the housing 82 in the same manner as the second spring 84. Any of the screws 92, 94, 96, 98 may include a dampening element such as nylon for enhanced flexibility, or an elastomeric ring or washer. Additionally, each screw can be a screw assembly of two or more screws or replaced with other forms of conventional fasteners.

[0043] As shown in FIG. 12, the force (F) from an oncoming object hitting the facemask 24 acts on the attachment assembly 42 in a direction perpendicular to the springs 76, 84. Due to the ability of the springs to flex in various directions, the springs absorb a high percentage of this force. At least a portion of the housing 82 may be transparent to allow a consumer to view the shock-absorbing system.

[0044] Conventional attachment assemblies may also be modified in accordance with this invention to provide a greater shock-absorbing mechanism for attaching a facemask 24 to a shell 22. For example, the leaf spring attachment assembly in FIG. 13 appears to be a conventional leaf spring assembly. However, the leaf spring 100 itself and/or the screw 102 securing the leaf spring 100 to the shell 22 may include an elastomeric material to enhance the energy absorption of the attachment assembly 42. Suitable elastomeric materials are described above.

[0045] As an alternative preferred embodiment, the attachment assembly 42 may include the housing 44 positioned on the facemask 24 and the rigid insert 46 mounted to the shell 22, as shown in FIG. 14. FIG. 14 shows two of a total of four attachment assemblies 42. In this preferred embodiment, the housing 44 and the insert 46 are substantially similar to the earlier described embodiments, other than the housing 44 is mounted to the facemask 24 rather than the shell 22 and the insert 46 is mounted to the shell 22. Other quantities of attachment assemblies are also contemplated.

[0046] As yet another alternative preferred embodiment, illustrated in FIG. 15, the shock absorbing attachment assembly 42 may be wholly incorporated within the

facemask 24, such that the housing 44 is mounted to one or more bars 38 of the facemask 24 and the rigid insert 46 is mounted to other bars 38 of the facemask 24. One or more attachment assemblies 42 may be incorporated within the facemask 24, and may be mounted to one or more bars 38. In this embodiment, the facemask 24 may be mounted to the shell 22 using either conventional attachment assemblies or any of the attachment assemblies 42 described herein. In each of the preferred embodiments of this invention, the attachment assembly 42 enables the facemask 24 to absorb a high percentage of impact energy.

[0047] The shock-absorbing facemask 24 embodiments described herein greatly reduce the amount of impact energy transferred from the facemask 24 to the shell 22. This accomplishment is achieved through the structural design of the attachment assemblies 42 and/or through the materials used to form the attachment assemblies 42.

[0048] While the preferred embodiments of the invention have been illustrated and described, it will be appreciated that various changes can be made therein without departing from the spirit and scope of the invention. For example, while the embodiments described herein are illustrated in a catcher's helmet, the principles of the present invention could also be used for practically any other helmet that includes a facemask. Accordingly, it will be intended to include all such alternatives, modifications and variations set forth within the spirit and scope of the appended claims.

Claims

1. A sports helmet (20) defining a face opening (40), comprising:

a shell (22) having opposing sides;
a facemask (24) including at least four inserts (72); and
at least four attachment assemblies (42), each attachment assembly (42) including,
a housing (56) attached to one of the sides of the shell (22) and positioned rearward of the face opening (40), the housing (56) defining an elongate cavity having an open forward end; and
a dampener (58) positioned within the cavity, the inserts (74) of the facemask (24) extending through the open forward ends of the housings (56) and into the cavities of the housings (56), each of the dampeners (58) adapted to be compressed in response to a force applied to the front of the facemask (24).

2. The helmet (20) of claim 1, wherein two of the housings (56) are attached to each of the sides of the shell (22) on opposite sides of the face opening (40) of the helmet (20).

3. The helmet (20) of claim 1, wherein the attachment assembly (42) further comprises a sleeve (68) surrounding a portion of the insert (72).

4. The helmet (20) of claim 3, wherein the sleeve (68) is positioned within the cavity of the housing (56).

5. The helmet (20) of claim 3, wherein the attachment assembly (42) further comprises a cover (74).

6. The helmet (20) of claim 5, wherein the cover (74) is positioned within the cavity of the housing (56), and wherein the cover (74) surrounds the dampener (58).

7. The helmet (20) of claim 6, wherein the cover (74) includes a forwardly positioned surface that defines an opening for receiving the insert (72).

8. The helmet (20) of claim 5, wherein the forwardly positioned surface of the cover (74) contacts the sleeve (68) during use.

9. The helmet (20) of claim 1, wherein the dampener (58) includes an aperture for receiving the insert (72).

10. The helmet (20) of claim 1, wherein the attachment assemblies (42) are positioned on the shell (22) such that the attachment assemblies (42) are substantially parallel to one another.

11. The helmet (20) of claim 1, wherein the facemask (24) includes at least one bar (38), wherein the bar (38) of the facemask (24) is coupled to the insert (72), and wherein the bar (38) is substantially perpendicular to the insert (72).

12. The helmet (20) of claim 1, wherein at least a portion of the housing (56) is transparent, translucent, semi-transparent or semi-translucent.

13. A shock-absorbing facemask attachment assembly for a sports helmet, comprising:
a facemask;
a housing attached to the helmet;
an insert having a first end coupled to the facemask and a second end coupled to the housing, wherein the insert is adapted to interact with the housing in response to a force applied to the first end to absorb and/or dissipate energy created by application of the force, wherein the second end of the insert is positioned within the housing, and wherein at least a portion of the housing comprises an elastomer.

14. The attachment assembly of Claim 13, wherein the second end of the insert is positioned within the housing, wherein at least a portion of the insert comprises a rigid material, and wherein at least a portion of the

insert comprises an elastomer.

15. The attachment assembly of Claim 13, further comprising a resilient cellular material, compressible fluid or gel positioned within the housing to engage the second end of the rigid insert. 5
16. The attachment assembly of Claim 13, comprising at least two of the housings, with at least one of the housings attached to each side of the helmet along opposite edges of a face opening portion of the helmet. 10
17. The attachment assembly of Claim 13, comprising at least four of the housings, with at least two of the housings attached to each side of the helmet along opposite sides of a face opening in the helmet. 15
18. The attachment assembly of Claim 13, wherein the housing is attached to the helmet in a central region above a face opening in the helmet. 20
19. The attachment assembly of Claim 13, wherein at least a portion of the housing is transparent, translucent, semi-transparent or semi-translucent. 25
20. The attachment assembly of Claim 13, wherein the helmet is selected from the group consisting of a catcher's mask, an umpire's mask, a lacrosse helmet, a football helmet, and a hockey helmet. 30

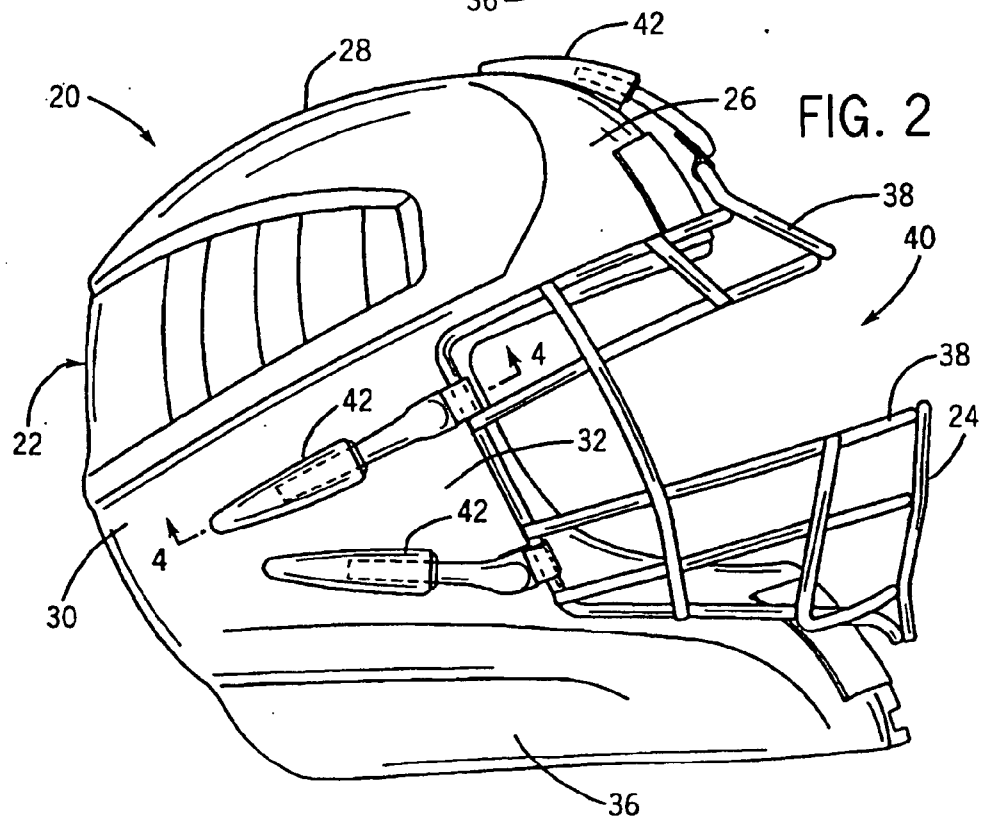
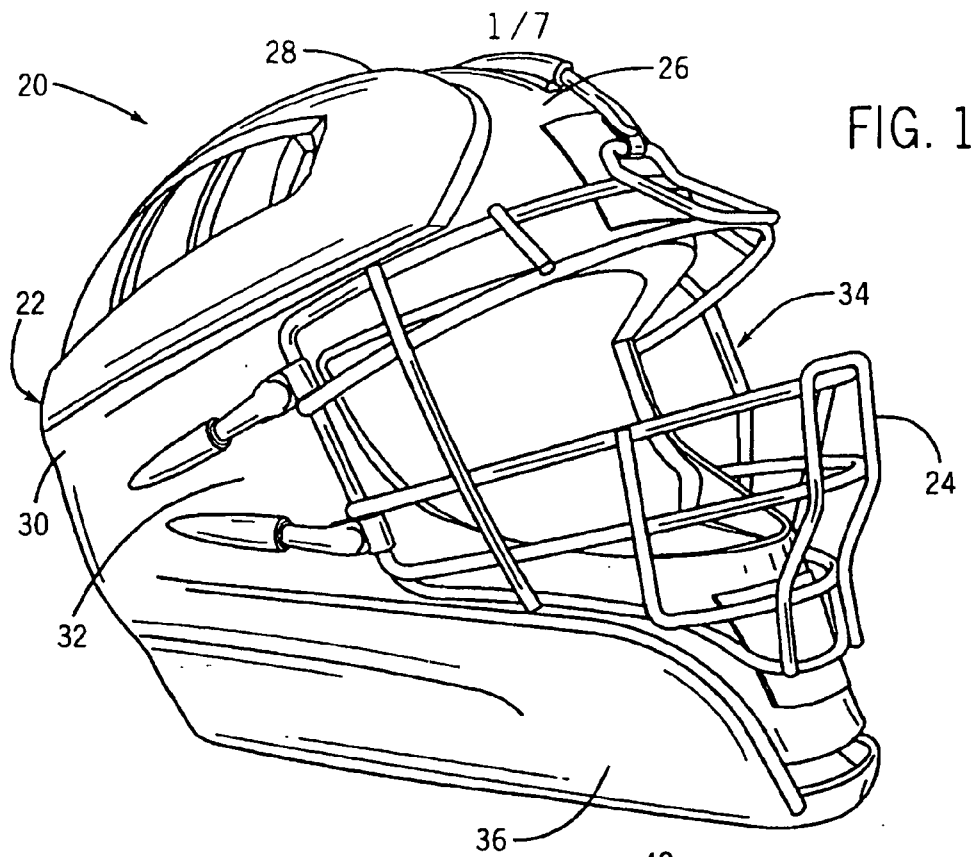
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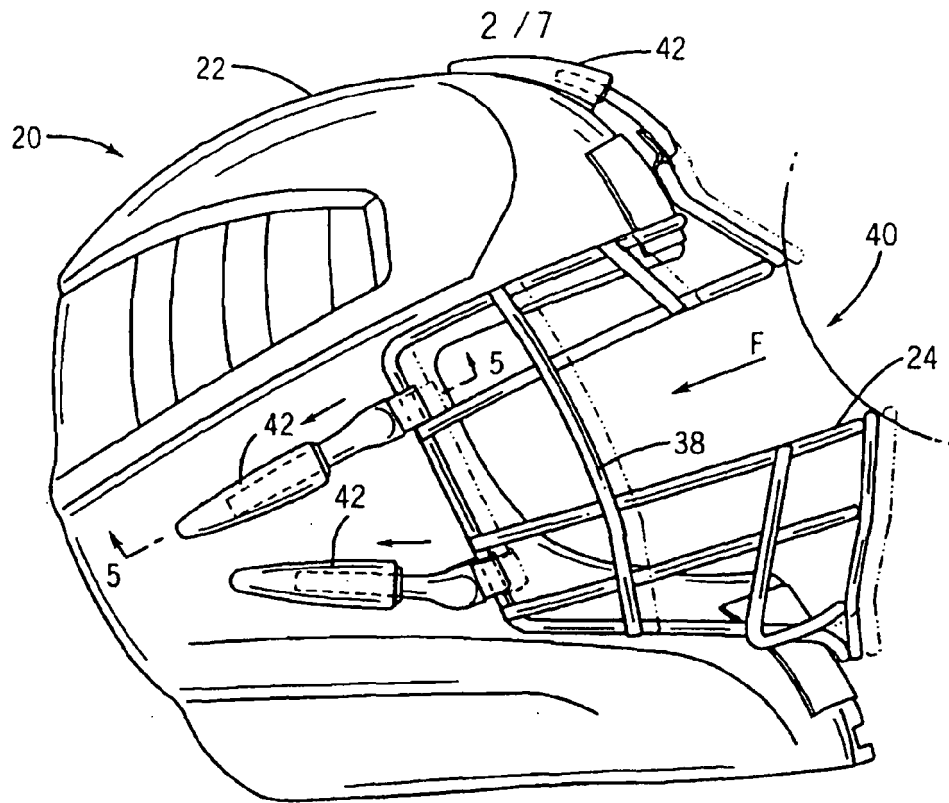


FIG. 3

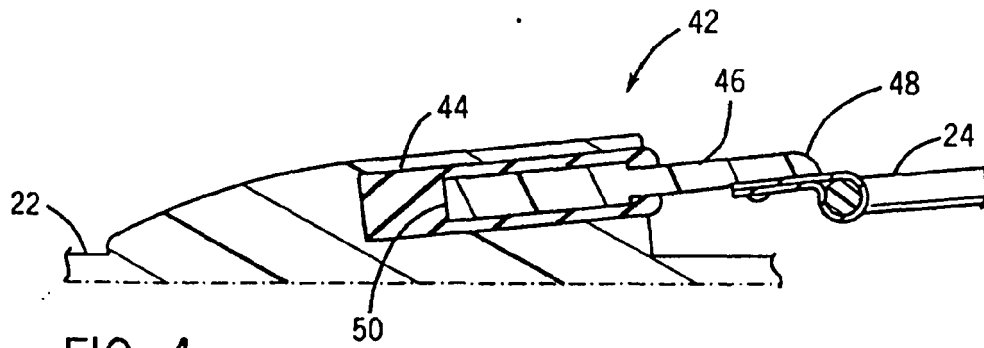


FIG. 4

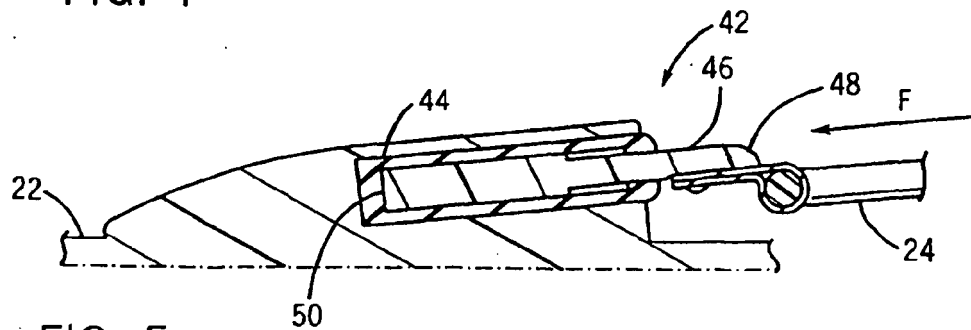
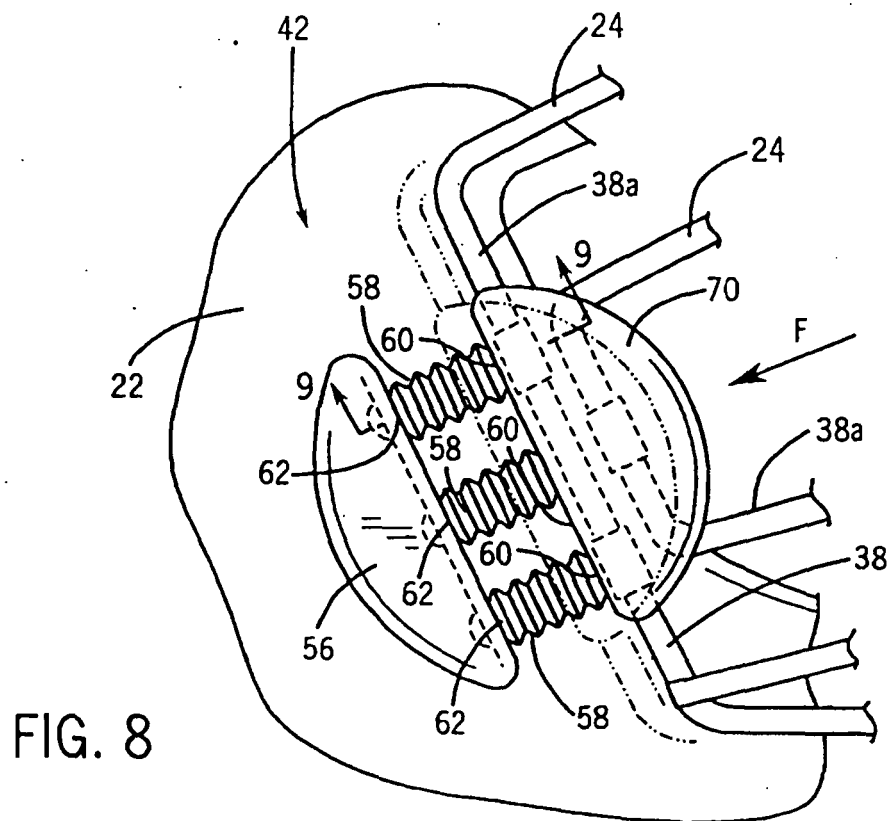
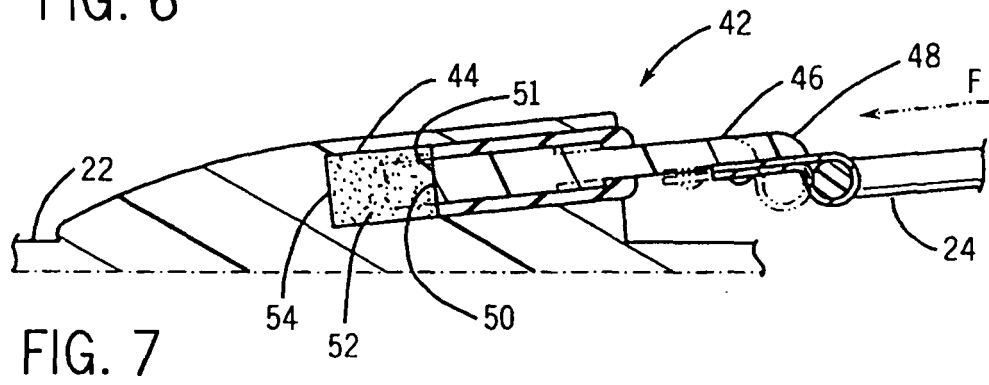
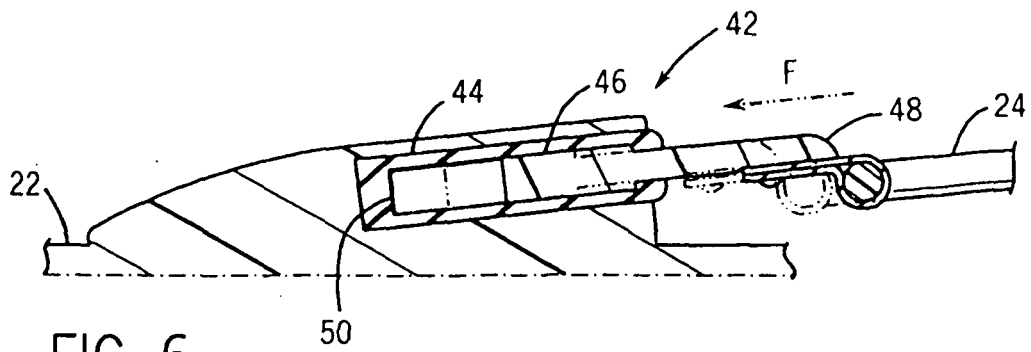
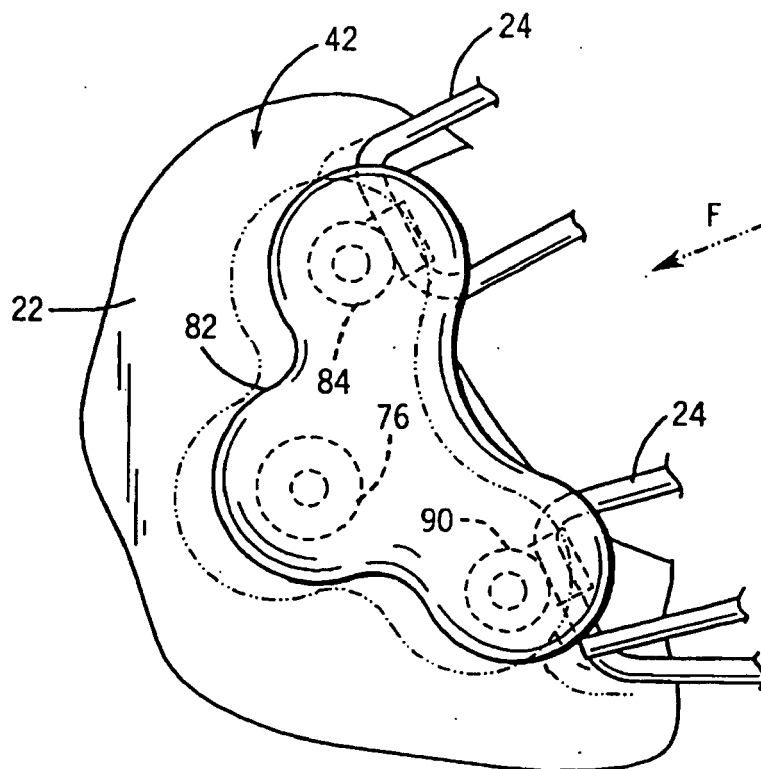
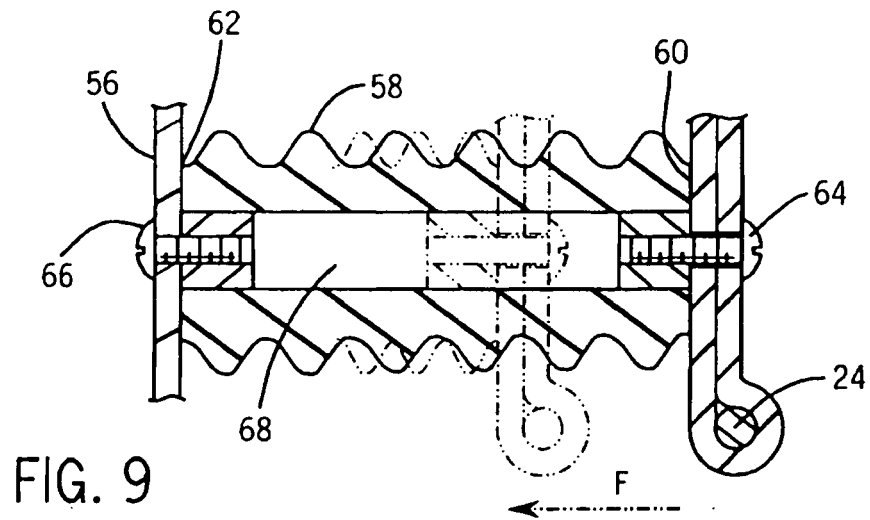
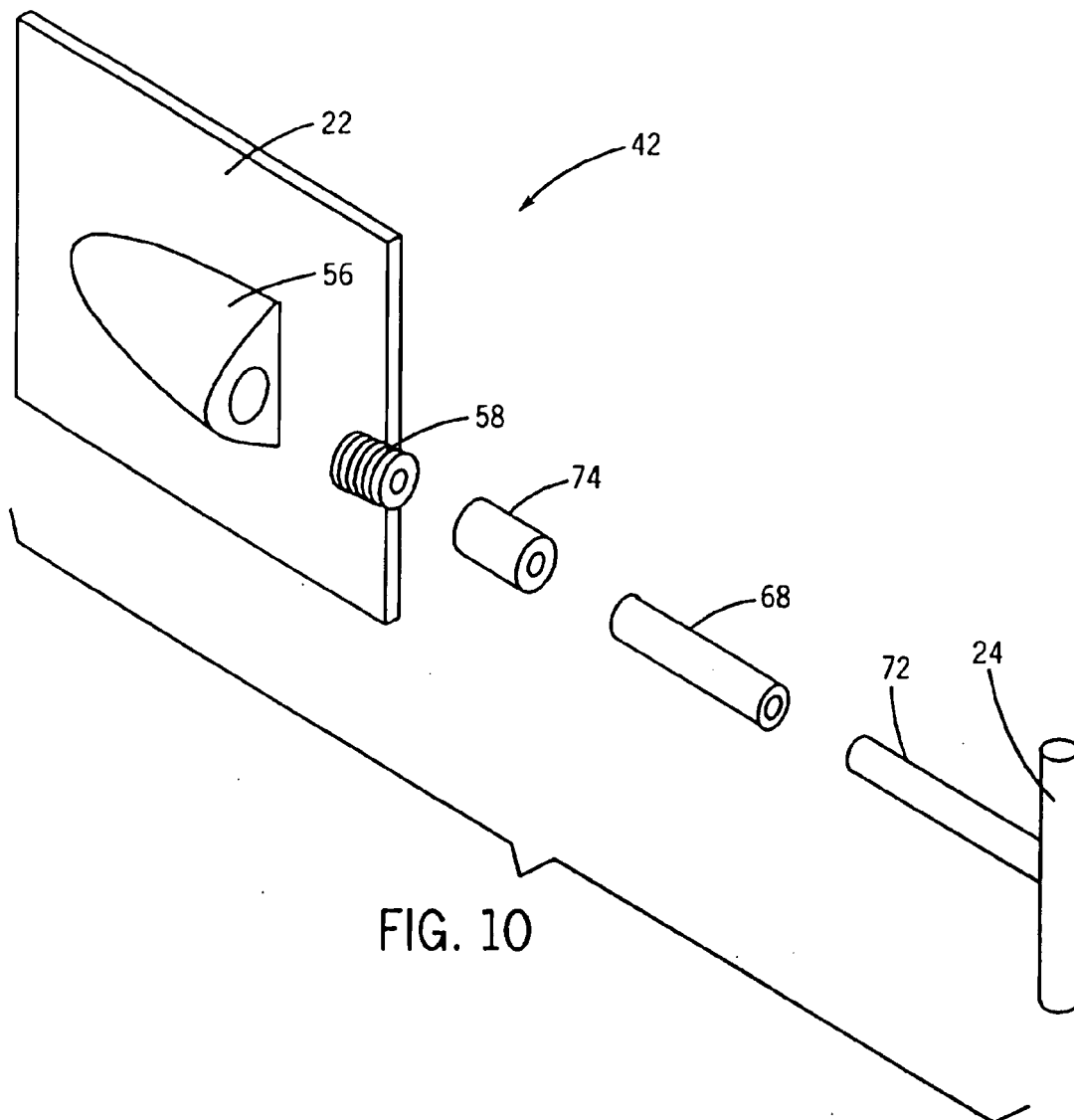
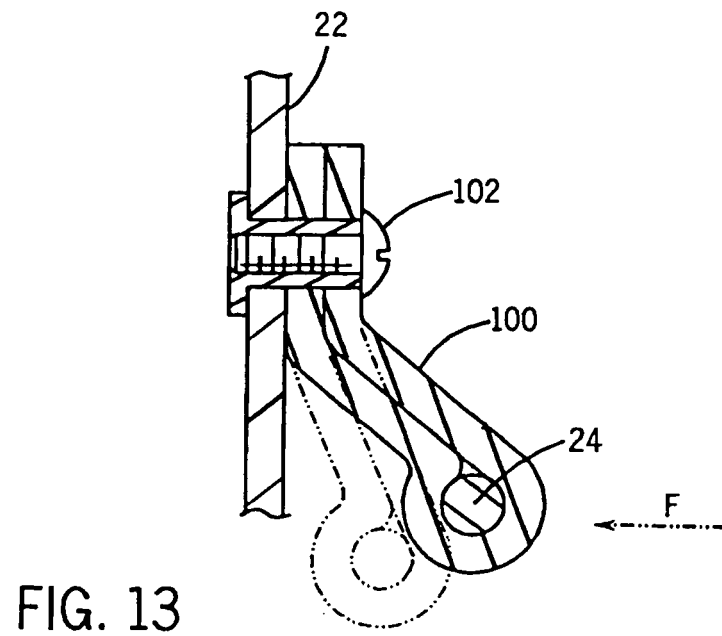
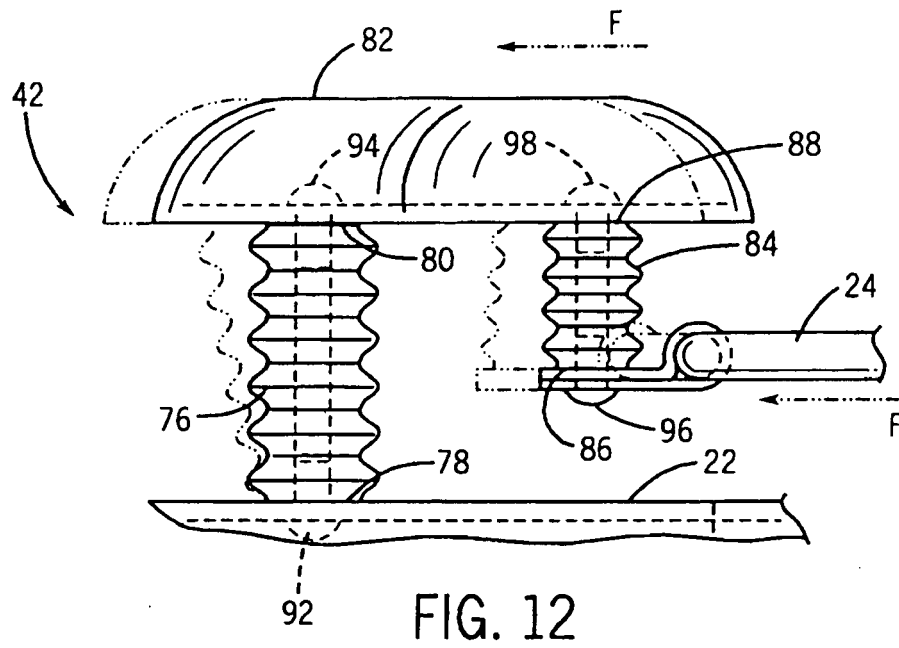


FIG. 5









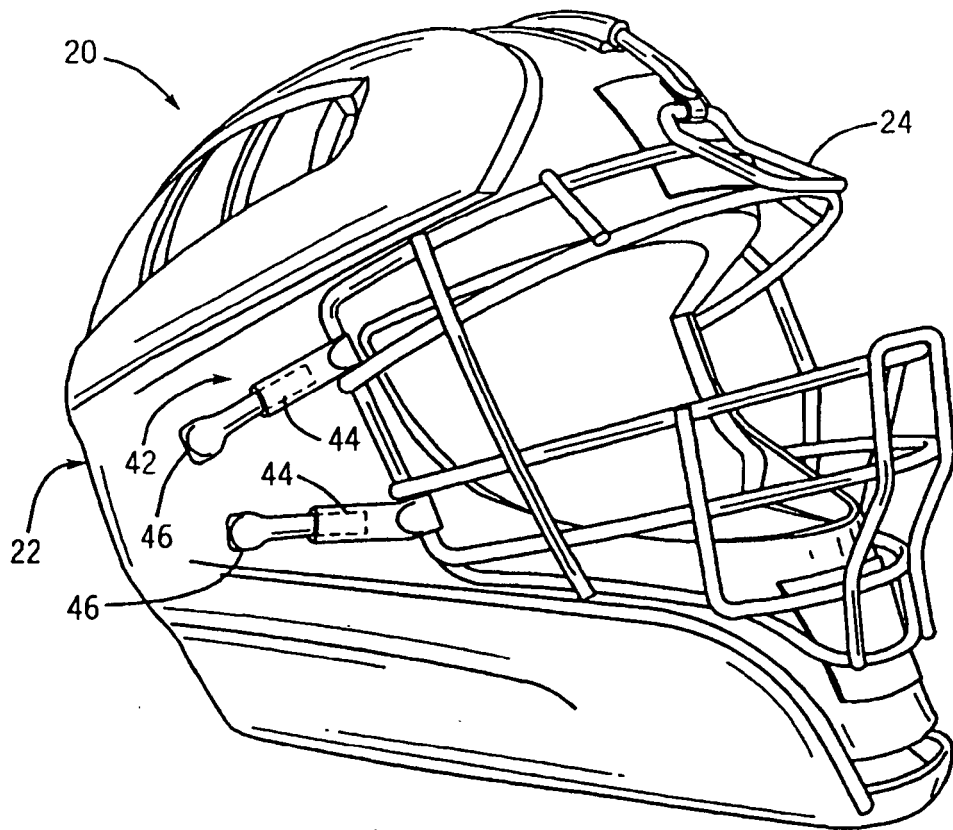


FIG. 14

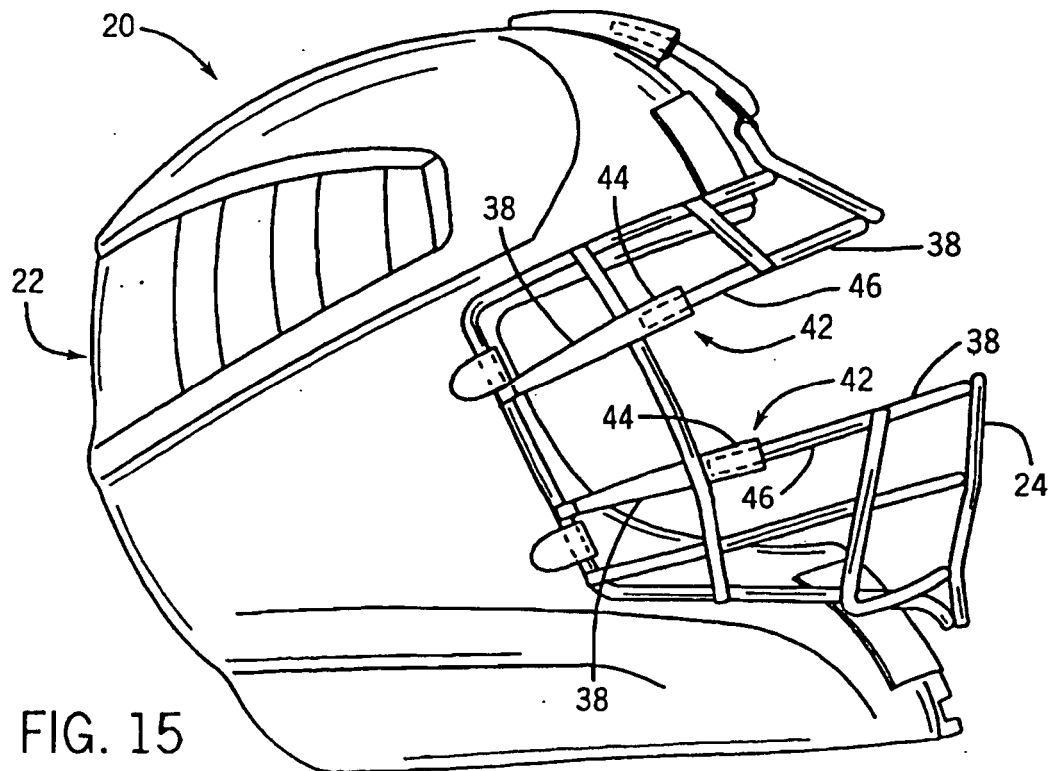


FIG. 15