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Helmet

Abstract

A helmet may include a shell defining a cavity to receive a user's head. The shell may include a shell outer surface and a receiving area recessed into the shell outer surface. A liner may be within the cavity and coupled to the shell. A facemask may be coupled to the shell. A front bumper may be coupled to the shell and the liner. The front bumper may extend from within the cavity to an exterior of the shell. The front bumper may be positioned at least partially within the receiving area of the shell.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. patent application Ser. No. 17/289,131, filed on Apr. 27, 2021, which is a U.S. National Phase of International Application No. PCT/US2019/058941 filed on Oct. 30, 2019, which claims the

benefit of U.S. Provisional Patent Application No. 62/752,808 filed Oct. 30, 2018 entitled "Helmet", each of which is incorporated by reference herein in its entirety.

FIELD OF THE INVENTION

(1) The present invention generally relates to protective headgear and, more particularly, to a football helmet.

BRIEF SUMMARY OF THE INVENTION

(2) In one embodiment, a helmet includes a shell defining a cavity to receive a user's head. The shell may include an exterior shell surface and a receiving area recessed into the exterior shell surface. A liner may be within the cavity and detachably coupled to the shell. A facemask may be coupled to the shell. A front bumper may be coupled to the shell and the liner. The front bumper may be coupled to an exterior of the shell. The front bumper may extend from within the cavity to an exterior of the shell. The front bumper may be positioned at least partially within the receiving area of the shell.

(3) The shell may include a first ridge and a second ridge extending away from a rear surface of the shell. A rearmost point of the first ridge and a rearmost point the second ridge may lie within a reference plane that is rearwardly spaced from the rear surface of the shell when the helmet is resting on a horizontal surface. Each end of the first ridge may be curved upwardly toward a top of the shell and each end of the second ridge may be curved downward toward a bottom of the shell. The shell may include a first opening proximate each end of the first ridge and a second opening proximate each end of the second ridge. The first openings and the second openings may be arranged to form a generally X-shaped pattern. The front bumper may be positioned within the receiving area such that an outer surface of the front bumper is generally flush with the exterior shell surface.

(4) The front bumper may be positioned within the receiving area such that an outer surface of the front bumper is recessed toward a center of the shell relative to the exterior shell surface. The front bumper may include a recess configured to receive at least a portion of the facemask. The front bumper may be positioned within the receiving area such that a top edge of an outer surface of the front bumper is flush with a top edge of the receiving area. The front bumper abuts an edge of the receiving area. The front bumper may be spaced from an edge of the receiving area. The front bumper may be detachably coupled to each of the shell and the liner.

(5) The exterior shell surface may include a first side portion, a second side portion and a central portion extending between the first side portion and the second side portion. The exterior shell surface going from the first side portion to the central portion may be recessed and the exterior shell surface going from the second side portion to the central portion may be recessed. An apex of the central portion may be the top most element of the shell when the helmet is resting on a horizontal surface.

(6) The exterior shell surface may include a rear portion, a front portion, a first side portion, a second side portion and a central portion extending from the front portion to the rear portion and between the first side portion and the second side portion. A perimeter of the central portion may be recessed relative to the first side portion and the second side portion proximate the front portion and protrudes relative to the first side portion and the second side portion proximate the rear portion.

(7) In a further embodiment, each side portion of the shell includes a recessed area and the helmet includes a chin protector coupled to the recessed area of the shell by a chin protector fastener. The liner may be detachably coupled to each of the shell and the front bumper such that the liner can be detached from the shell and the front bumper while the front bumper remains coupled to the shell. The liner may be detachably coupled to the shell. The shell may be comprised of nylon.

(8) In a further embodiment, a football helmet includes a shell, four openings in the rear of the shell, a liner, a facemask, a chin protector, two rear ridges, and a front bumper. The shell may

define a cavity configured to receive a user's head. The shell may include a shell outer surface and a receiving area recessed into the shell outer surface. The four openings in the rear of the shell may allow the shell to flex when impacted. The liner may be within the cavity and coupled to the shell. The facemask may be coupled to the shell. The chin protector may include a strap coupled to a recessed area of the shell. The two rear ridges may protrude from a rear surface of the shell, the two rear ridges may be the rearmost element of the helmet. The front bumper may be detachably coupled to the shell and the liner. The front bumper may extend from within the cavity to an exterior of the shell and the front bumper may be positioned at least partially within the receiving area of the shell.

(9) In a further embodiment, a football helmet includes a shell defining a cavity configured to receive a user's head. The shell may include an exterior shell surface and a receiving area recessed into an outer surface of the shell. The football helmet may include four openings in the rear of the shell that allow the shell to flex when impacted. A liner may be within the cavity and coupled to the shell. A facemask may be coupled to the shell. A chin protector may include a strap coupled to a recessed area of the shell. Two rear ridges may protrude from a rear surface of the shell, the two rear ridges being the rearmost element of the helmet. A front bumper may be detachably coupled to the shell and the liner, the front bumper extending from within the cavity to an exterior of the shell. The front bumper may be positioned at least partially within the receiving area of the shell such that an outer surface of the front bumper is generally flush with the exterior shell surface and the front bumper abuts an edge of the receiving area. The front bumper may include a recess that receives at least a portion of the facemask.

(10) The exterior shell surface may include a rear portion, a front portion, a first side portion, a second side portion and a central portion extending from the front portion to the rear portion and between the first side portion and the second side portion. A perimeter of the central portion may be recessed relative to the first side portion and the second side portion proximate the front portion and protrudes relative to the first side portion and the second side portion proximate the rear portion. The liner may be detachably coupled to each of the shell and the front bumper such that the liner can be detached from the shell and the front bumper while the front bumper remains coupled to the shell.

Description

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

(1) The following detailed description of embodiments of the helmet will be better understood when read in conjunction with the appended drawings of an exemplary embodiment. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. For example, although not expressly stated herein, features of one or more various disclosed embodiments may be incorporated into other of the disclosed embodiments.

In the Drawings

(2) FIG. **1** is a front perspective view of a helmet in accordance with an exemplary embodiment of the present invention;

(3) FIG. **2** is a bottom perspective view of the helmet of FIG. **1**;

(4) FIG. **3** is a front elevation view of the helmet of FIG. **1**;

(5) FIG. **4** is a rear elevation view of the helmet of FIG. **1**;

(6) FIG. **5** is a side elevation view of the helmet of FIG. **1**;

(7) FIG. **6** is a top plan view of the helmet of FIG. **1**;

(8) FIG. **7** is a bottom plan view of the helmet of FIG. **1**;

(9) FIG. **8** is a sectional view of the helmet of FIG. **1** along a plane defined by line **8**-**8** in FIG. **6**;

(10) FIG. **9** is a sectional view of the helmet of FIG. **1** along a plane defined by line **9**-**9** in FIG. **5**;

(11) FIG. **10** is a side perspective view of the helmet of FIG. **1** with the shell removed;
(12) FIG. **11** is a front perspective view of the plate of FIG. **1**;
(13) FIG. **12** is a rear perspective view of the plate of FIG. **1**;
(14) FIG. **13** is a bottom plan view of the plate of FIG. **1**;
(15) FIG. **14** is a front perspective view of the front bumper of FIG. **1**;
(16) FIG. **15** is a rear perspective view of the front bumper of FIG. **1**;
(17) FIG. **16** is a front perspective view of the helmet of FIG. **1** with the facemask and front bumper removed;
(18) FIG. **17** is an enlarged view of a portion of the helmet of FIG. **8**; and
(19) FIG. **18** is an enlarged perspective view of a portion of the helmet of FIG. **5**.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS OF THE INVENTION

(20) Protective helmets are used for contact sports, such as football, hockey, and lacrosse, and are also worn by people in military, construction, police, and firefighters. Protective helmets typically include a rigid outer shell, a pad assembly within the shell, a face guard or facemask, and a chin protector or strap that removably secures the helmet on the wearer's head. Helmets are designed to reduce the force of impact felt by a user when the helmet contacts another object such as the ground or another player. Increasing the thickness of the pad assembly or shell may help to reduce the force of impact felt by the user but may also increase the weight of the helmet leading to fatigue when the helmet is worn for an extended period.

(21) The helmet described herein may decrease the force of impact felt by the user. Some portions of the helmet may be closer to the center of the helmet to lower the center of gravity of the helmet, thereby reducing user fatigue when wearing the helmet. The helmet may include a pad assembly with pads detachably coupled to a liner within the helmet. The pad assembly may include pads having a different design, thickness, or performance characteristic from other pads in the pad assembly. The shell may have recessed areas where the chin strap, front bumper, or facemask are coupled to the shell to reduce or eliminate points that could snag on other players or equipment.

(22) Referring to the drawings in detail, wherein like reference numerals indicate like elements throughout, there is shown in FIGS. **1**-**18** a helmet, generally designated **20**, in accordance with an exemplary embodiment of the present invention. In some embodiments, the helmet **20** is a football helmet.

(23) The helmet **20** may meet or exceed selected National Operating Committee on Standards for Athletic Equipment (“NOCSAE”) certification standards for helmets (e.g., NOCSAE ND002). The facemask **21** may meet or exceed selected certification standards for facemasks (e.g., NOCSAE ND087). The helmet **20** may perform better than existing helmets when subjected to one or more of Virginia Tech Adult Football STAR Methodology, Virginia Tech Youth Football Helmet STAR Methodology, or NFL Linear Impactor Helmet Test Protocol. The helmet **20** may meet or exceed requirements for pneumatic ram testing. Pneumatic ram testing may include measuring rotational forces and linear forces as measure by a headform within the helmet. Pneumatic ram testing may include placing helmet **20** on a headform mounted onto a linear bearing table and impacting the helmet **20** with a pneumatic ram at a selected velocity (e.g., 19.6 meters per second) on six different locations, including one random location in accordance with NOCSAE standards.

(24) The helmet **20** may include a shell **22** configured to resist impacts. The shell **22** may be manufactured from polycarbonate, ABS, PC-ABS, nylon, or polyethylene. In some embodiments, the shell **22** is configured to flex when impacted to absorb some or all of the force of the impact, thereby reducing the force felt by the user. In other embodiments, the shell **22** is rigid. The shell **22** may define a cavity **24** configured to receive a user's head (not shown).

(25) Referring to FIGS. **1** and **4**, the shell **22** may include a central portion **26** configured to be positioned adjacent a top and/or forehead of a user's head when the user's head is in the cavity **24**. At least part of the central portion may have an arcuate shape with a central portion radius Rep (FIG. **4**) measured from a radial center point **32**. The shell **22** may include a side portion **28**

configured to be positioned adjacent a side of the user's head and a rear portion **30** configured to be positioned adjacent a rear of the user's head. The shell **22** may be manufactured from a rigid material such that the splines defining the shape of the central portion **26** and the side portion **28** retain their shape when a force is applied to the shell **22**. At least part of the side portion **28** (e.g., the part of the side portion adjacent the central portion) may have an arcuate shape with a side portion radius R.sub.sp (FIG. **4**) measured from central point **34**.

(26) In some embodiments, the side portion **28** is defined by a single side portion radius R.sub.sp. In other embodiments, the side portion **28** is defined by a first arcuate portion having a first radius and transitions to a second arcuate portion having a second radius. The first radius may be different than the second radius. In some embodiments, the first arcuate portion is directly adjacent the second arcuate portion. In other embodiments, a transition area is between the first arcuate portion and the second arcuate portion. The transition area between the first arcuate portion and the second arcuate portion may be a straight portion, an angled portion, or a stepped portion.

(27) In some embodiments, the side portion radius R.sub.sp is greater than the central portion radius R.sub.cp. In other embodiments, the side portion radius R.sub.sp is less than the central portion radius R.sub.cp. In still other embodiments, the side portion radius R.sub.sp is equal to the central portion radius R.sub.cp.

(28) Referring to FIG. **1**, an outer surface of the side portion **28** may be further from a center of the helmet **20** than an outer surface of the central portion **26**. The average distance of the central portion **26** to the center of the helmet **20** may be smaller than the average distance of the side portion **28** to the center of the helmet **20**. The central portion **26** being closer to the center of the helmet **20** may help to lower the center of gravity of the helmet **20**. The outer surface of the central portion **26** at the front **36** of the helmet **20** may be closer to the center of the helmet **20** than the outer surface of the side portion **28** at the front **36** of the helmet **20**. The outer surface of the top of the central portion **26** and the outer surface of the top of the side portion **28** may be coplanar. The outer surface of the side of the central portion **26** and the outer surface of the top of the side portion **28** may be coplanar.

(29) The outer surface of the top of the central portion **26** may extend upwardly further than the outer surface of the top of the side portion **28**. The outer surface of the top of the side portion **28** may extend upwardly further than the outer surface of a side of the central portion **26**. The outer surface of the top of the central portion **26** may extend upwardly further than the outer surface of the top of the side portion **28** even when a side of the central portion **26** does not extend upwardly further than the outer surface of the top of the side portion **28**. Extending upwardly may refer to when the helmet **20** is held with a crown of the helmet facing upwardly.

(30) The shell **22** may include one or more first openings **42** in at least one of the side portion **28** and the central portion **26**. The first opening **42** may extend through the shell **22** such that air or heat can vent through the opening. The first opening **42** may reduce the rigidity of the shell **22** in localized areas such that some portions of the shell **22** flex while other areas remain rigid. Allowing some portions of the shell **22** to flex may help to absorb some force of impact or reduce the force felt by the user. The first opening **42** may have a triangular shape. A triangular shaped first opening **42** may provide benefits over an opening having a different shape. In some embodiments, a triangular shaped first opening **42** may allow a larger opening to be adopted while reducing or minimizing the chance of a hand or finger entering the opening compared to openings of other shapes. A triangular shaped first opening **42** may include a major axis and a minor axis. The minor axis of the first opening **42** may limit the size of the opening at any particular cross-section along its length. The shell **22** may include at least two first openings **42** symmetrically positioned about a centerline of the shell **22**.

(31) Referring to FIGS. **1**, **4**, and **5**, the central portion **26** may extend from a front **36** of the helmet **20** toward a rear **38** of the helmet **20**. The rear part of the central portion **26** may extend rearwardly further than the rear portion **30** of the shell **22**. A first ridge **40** may be located where the central

portion **26** meets the rear portion **30**. The first ridge **40** may have a height H.sub.1 that is the distance that the first ridge **40** extends away from an outer surface of the rear portion **30**. Height H.sub.1 may be about 2 millimeters to about 30 millimeters, about 1 millimeter to about 5 millimeters, about 5 millimeters to about 10 millimeters, about 10 millimeters to about 15 millimeters, about 15 millimeters to about 20 millimeters, about 20 millimeters to about 25 millimeters, or about 25 millimeters to about 30 millimeters. The first ridge **40** may at least partially define a border between the central portion **26** and the rear portion **30** of the shell **22**.
(32) Referring to FIGS. **4** and **5**, a second ridge **44** may protrude from the outer surface of the rear portion **30**. The second ridge **44** may have a height H.sub.2 that is the distance that the second ridge **44** extends away from the outer surface of the rear portion **30**. Height H.sub.2 may be about 2 millimeters to about 30 millimeters, about 1 millimeter to about 5 millimeters, about 5 millimeters to about 10 millimeters, about 10 millimeters to about 15 millimeters, about 15 millimeters to about 20 millimeters, about 20 millimeters to about 25 millimeters, or about 25 millimeters to about 30 millimeters. The second ridge **44** may extend from the rear portion **30** onto the side portion **28**. The second ridge **44** may be closer to a bottom edge **46** of the shell **22** than the first ridge **40**. The distance between the second ridge **44** and the first ridge **40** may be greater than the distance between the second ridge **44** and the bottom edge **46** of the shell **22**.
(33) In some embodiments, the height H.sub.2 of the second ridge **44** is greater than the height H.sub.1 of the first ridge **40**. In other embodiments, the height H.sub.2 of the second ridge **44** is less than the height H.sub.1 of the first ridge **40**. In still other embodiments, the height H.sub.2 of the second ridge **44** is equal to or within 10% of the height H.sub.1 of the first ridge **40**. One of the first ridge **40** and the second ridge **44** may be the most rearward element of the helmet **20**. The first ridge **40** and second ridge **44** may be the only elements that contact a surface (e.g., the ground) when the rear **38** of the helmet **20** is place in contact with the surface. The second ridge **44** may be the rearmost element of the shell **22** even when height H.sub.1 is greater than height H.sub.2. At least one of the first ridge **40** and the second ridge **44** may flex when contacted by an external object (e.g., another player or the ground) to absorb the force of impact.
(34) Referring to FIG. **5**, a portion of the first ridge **40** (e.g., the peak of the first ridge **40**) and a portion of the second ridge **44** (e.g., the peak of the second ridge **44**) may lie within a plane P.sub.1. The plane P.sub.1 may be the rear most portion of the helmet **20**. Plane P.sub.1 may be rearwardly spaced from the rear of the shell **22**.
(35) Referring to FIG. **4**, one or more second openings **45** may be formed in one or more of the rear portion **30** and the central portion **26**. The second openings **45** may allow portions of the shell **22** to flex when contacted, thereby absorbing some or all of the force of an impact. The second openings **45** may isolate flexing of the shell **22** to certain areas of the shell **22** when impacted. At least a portion of one or more of the first openings **40** and second openings **45** may be positioned between the first ridge **40** and the second ridge **44**. The first ridge **40**, the second ridge **44**, and the second openings **45** may help lower the center of gravity of the helmet **20**, thereby increasing user comfort and reducing fatigue when wearing the helmet **20**.
(36) Still referring to FIG. **4**, the second openings **45** may be oriented in an overall X shaped pattern. The second openings **45** may have a triangular shape and the hypotenuse of the second openings **45** may define an X shaped pattern. The second openings may have a triangular shape and the hypotenuse of the second openings **45** may be closer to a vertical centerline of the shell **22** than the legs of the triangular second openings **45**. The top second openings **45** may widen as they extend from front to back. A sidewall of the top second openings **45** may slant toward a centerline (e.g., a front to back centerline) of the shell **22** as the top second openings **45** extend from front to back. The bottom second openings **45** may widen as they extend from back to front. A sidewall of the bottom second openings **45** may slant toward the centerline of the shell **22** as the bottom second openings **45** extend from back to front. The first ridge **40** and second ridge **44** may have opposing U-shapes. The second openings **45** may define partial vents on each side of the U shaped ridges.

(37) Referring to FIGS. **5** and **18**, a recessed area **48** may be positioned between the bottom edge **46** and the side portion **28** of the shell **22**. The recessed area **48** may be closer to a center of the helmet **20** than at least one of the bottom edge **46** and the side portion **28**. In some embodiments, the recessed area extends around the helmet **20** along the bottom edge **46**. The recessed area **48** may be closer to the center of the helmet **20** than the bottom edge **46** or the side portion **28**. A rim **47** may extend along the bottom edge **46** of the shell **22**. The recessed area **48** may be closer to the center of the helmet **20** than the rim **47** of the side portion **28**. A ridge **101** (FIG. **18**) may separate the recessed area **48** from the side portion **28**. The ridge **101** may form a ledge that overhangs the recessed area **48**. The ridge **101** may have a ridge height that is the distance that the ridge extends away from the recessed area **48**. The ridge **101** may be positioned between the bottom edge **46** of the shell **22** and an car opening **99**.

(38) Referring to FIGS. **7-10**, the helmet **20** may include a liner **54** configured to reduce the force felt by a user when the shell **22** is impacted. The liner may also be referred to as a bonnet or matrix. One or more central pads **50** may be coupled to the liner **54**. The central pad **50** may be coupled to or adjacent the central portion **26**. Examples of pads that are contemplated for use with the helmet **20** is described in U.S. Pat. Nos. 7,895,618, 8,814,150, 8,950,735, and 7,774,866. The helmet **20** may include a central thickness T.sub.C (FIG. **8**) as measured from an inner surface **52** of the central pad **50** to an outer surface of the central portion **26**.

(39) Referring to FIGS. **8-9**, one or more side pads **56** may be coupled to the liner **54**. The side pad **56** may be coupled to the side portion **28**. The helmet **20** may include a side thickness T.sub.S as measured from an inner surface **58** of the side pad **56** to an outer surface of the side portion **28**. One or more rear pads **60** may be coupled to the liner. The rear pad **60** may be coupled to the rear portion **30**. The helmet **20** may include a rear thickness T.sub.R as measured from an inner surface **62** of the rear pad **60** to an outer surface of the rear portion **30** (FIG. **8**). In some embodiments, the central thickness T.sub.C is less than the side thickness T.sub.S. In some embodiments, the central thickness T.sub.C is less than the rear thickness T.sub.R. In some embodiments, the central thickness T.sub.C is less than each of the side thickness T.sub.S and the rear thickness T.sub.R. The central thickness T.sub.C may be about 10 millimeters to about 60 millimeters, about 10 millimeter to about 15 millimeters, about 15 millimeters to about 20 millimeters, about 20 millimeters to about 25 millimeters, about 25 millimeters to about 30 millimeters, about 30 millimeters to about 35 millimeters, about 35 millimeters to about 40 millimeters, about 40 millimeters to about 45 millimeters, about 45 millimeters to about 50 millimeters, about 50 millimeters to about 55 millimeters, or about 55 millimeters to about 60 millimeters. The side thickness T.sub.S may be about 10 millimeters to about 60 millimeters, about 10 millimeter to about 15 millimeters, about 15 millimeters to about 20 millimeters, about 20 millimeters to about 25 millimeters, about 25 millimeters to about 30 millimeters, about 30 millimeters to about 35 millimeters, about 35 millimeters to about 40 millimeters, about 40 millimeters to about 45 millimeters, about 45 millimeters to about 50 millimeters, about 50 millimeters to about 55 millimeters, or about 55 millimeters to about 60 millimeters. The rear thickness T.sub.R may be about 10 millimeters to about 60 millimeters, about 10 millimeter to about 15 millimeters, about 15 millimeters to about 20 millimeters, about 20 millimeters to about 25 millimeters, about 25 millimeters to about 30 millimeters, about 30 millimeters to about 35 millimeters, about 35 millimeters to about 40 millimeters, about 40 millimeters to about 45 millimeters, about 45 millimeters to about 50 millimeters, about 50 millimeters to about 55 millimeters, or about 55 millimeters to about 60 millimeters.

(40) In some embodiments, the helmet **20** includes a single liner **54** and each of the central pad **50**, side pad **56**, and rear pad **60** are coupled to the liner **54**. In other embodiments, the helmet **20** includes more than one liner **54** and one or more of the central pad **50**, side pad **56**, and rear pad **60** are coupled to each liner **54**. In some embodiments, the central pad **50**, side pad **56**, and rear pad **60** are fixed to the liner **54**. In other embodiments, at least one of the central pad **50**, side pad **56**, and

rear pad **60** are detachably coupled to the liner. The liner **54** may be coupled to the shell **22** (e.g., via adhesive, ultrasonic weld, or fastener). The liner **54** may include a strap **64** (FIG. **10**) having a fastener **66** configured to be coupled to the shell **22**. In some embodiments, the fastener **66** is coupled to the shell **22** using existing holes in the shell **22** for a chin protector, as explained in greater detail below.

(41) Referring to FIGS. **8** and **11-13**, the helmet **20** may include a plate **68** configured to prevent the bottom edge **46** of the shell **22** from contacting a user's neck when the user's neck is arched back. The plate **68** may extend below the bottom edge **46** of the shell **22**. The plate **68** may be padded. An inner surface **70** of the plate **68** may be curved to generally follow the contour of a user's neck (FIG. **13**). The inner surface **70** may include a first curve **82**, a second curve **84**, and a third curve **86**. The first curve **82** may be selected such that portions of the plate **68** contact a user's neck but the plate **68** does not contact a user's spine. The second curve may be selected such that the plate **68** generally follows the contours of a user's neck next to the spine. The third curve **86** may be selected such that the ends of the plate **68** are flared to prevent undesired contact between the end of the plate and the user's neck. A rear surface **72** of the plate **68** may be curved to generally follow the contour of the cavity **24** defined by the shell **22**.

(42) The plate **68** may be coupled to the liner **54**. The plate **68** may include a receiver **74** (FIG. **12**) configured to be coupled to a suspension system, as explained in greater detail below. The receiver **74** may be a loop configured to receive a strap or belt. The plate **68** may be positioned between the user's head and the rear pad **60**. The plate **68** may include a receiving area **76** having a shape generally similar to the rear pad **60** such that the plate **68** overlaps the rear pad **60** and the rear pad **60** helps secure the position of the plate **68**. The plate **68** may be configured to protect the base of the skull and the neck. The bottom **78** of the plate **68** may be the thickest portion of the plate **68** as measured between the inner surface **70** and rear surface **72**. The plate **68** may be tapered such that the bottom **78** of the plate is the thickest portion and the top 80 of the plate is the thinnest portion. The top of the plate **68** may have a thickness of about 1 millimeter to about 25 millimeters, about 1 millimeter to about 5 millimeters, about 5 millimeters to about 10 millimeters, about 10 millimeters to about 15 millimeters, about 15 millimeters to about 20 millimeters, about 20 millimeters to about 25 millimeters, or about 25 millimeters to about 30 millimeters. The bottom of the plate **68** may have a thickness of about 5 millimeters to about 35 millimeters, about 1 millimeter to about 5 millimeters, about 5 millimeters to about 10 millimeters, about 10 millimeters to about 15 millimeters, about 15 millimeters to about 20 millimeters, about 20 millimeters to about 25 millimeters, about 25 millimeters to about 30 millimeters, or about 30 millimeters to about 35 millimeters.

(43) Referring to FIG. **8**, the helmet **20** may include a jaw pad **88** configured to be adjacent a user's jaw (e.g., upper jaw, lower jaw, or both upper and lower jaws) when the helmet **20** is on the user's head. In some embodiments, the jaw pad **88** is coupled to the shell **22**. In other embodiments, the jaw pad **88** is coupled to the liner **54**. The jaw pad **88** may be the thickest pad of the helmet **20**. The jaw pad **88** may be detachably coupled to the liner **54** or shell **22**. A kit may include a plurality of jaw pads **88** having different thickness to provide a snug fit between the shell **22** and the user's jaw.

(44) Referring to FIGS. **2**, **8**, **10**, and **18**, the helmet **20** may include a suspension system **90** configured to secure the helmet **20** on a user's head in a desired position and orientation. The suspension system **90** may include one or more of a chin protector **92**, the liner **54**, and the plate **68**. The chin protector **92** may be configured to protect a user's chin from impact. The chin protector **92** may include a rigid outer surface and a padded inner surface. The chin protector **92** may be coupled to the shell **22** by a first connector **94** and a second connector **96**. The first connector **94** and/or the second connector **96** may be a strap. Each of the first connector **94** and the second connector **96** may include a fastener **98** configured to be coupled to the shell **22**. The fastener **98** on the first connector **94** may be coupled to the shell **22** via the same opening used to couple the fastener **66** of the liner **54**. The fastener **98** on the second connector **96** may be coupled

to the shell **22** in the recessed area **48**. The fastener **98** and strap **94** may extend away from the recessed area **48** by a fastener distance. The ridge distance that the ridge **101** extends away from the recessed area **48** may be at least about 1% to about 10%, about 10% to about 20%, about 20% to about 30%, about 30% to about 40%, about 40% to about 50%, about 50% to about 60%, about 60% to about 70%, about 70% to about 80%, about 80% to about 90%, or about 90% to about 100% of the fastener distance. The fastener **98** coupled to the recessed area **48** may reduce the chance of the fastener **98** snagging on other players or equipment. The liner **54** may include a second fastener that is coupled to the shell **22** in the same opening as the fastener **98** of the second connector **96**.

(45) Referring to FIGS. **8** and **10**, the suspension system **90** may include a base strap **100** configured to extend around at least a portion of the helmet **20**. The base strap **100** may be coupled to each of the chin protector **92** and the plate **68**. The base strap **100** may be configured to be positioned in the receiver **74** of the plate **68** (FIG. **12**). The second connector **96** and the base strap **100** may be a unitary construct such that as the second connector **96** is tightened, the base strap **100** is cinched, thereby securing the chin protector **92** and the plate **68** on the user's neck and chin. The chin protector **92** and the base strap **100** may at least partially encircle a user's head or neck when the helmet **20** is worn. The liner **54** may be coupled to the shell **22** via strap **64** such that the pads (e.g., central pad **50**, side pad **56**, or rear pad **60**) are in contact with an interior of the shell **22**. One or more pads (e.g., central pad **50**, side pad **56**, or rear pad **60**) may move out of contact with the interior of the shell **22** as the base strap **100** is tightened while strap **64** remains coupled to the shell **22**. A portion of the base strap **100** may be positioned between the jaw pad **88** and the shell **22**.

(46) Referring to FIGS. **1**, **8**, and **14-17**, the helmet **20** may include a front bumper **102**. The front bumper **102** may wrap around an edge (e.g. a front edge) of the shell **22**. The front bumper **102** may extend from within the cavity **24** of the shell **22** and onto an outer surface of the shell **22**. The shell **22** may include a receiving area **122** for the front bumper **102** (FIG. **16**). The receiving area **122** may be recessed compared to an adjacent portion or portions of the shell **22**. At least a portion of the front bumper **102** may be flush with an outer surface of the shell **22** when the front bumper **102** is within the receiving area **122** as explained in greater detail below.

(47) Referring to FIGS. **8** and **14-17**, the front bumper **102** may include a base **106** configured to be positioned on or adjacent the front **36** of the shell **22**. The base **106** may include openings **108** configured to receive a fastener **115** (e.g., threaded connector, hook and loop fastener, or rivet) to couple the front bumper **102** to the shell **22**. Assembling the helmet **20** may include coupling the front bumper **102** to the shell **22** before coupling the liner **54** to the shell. Coupling the front bumper **102** to the shell **22** before the liner **54** may allow a user to access the inner portion of fastener **115** (FIG. **17**) without the fastener **115** being obstructed by the liner **54**. A body **110** may protrude from the base **106**. The base **106** may be positioned against the shell **22** but the body **110** may be spaced from the shell **22** such that the body **110** may resiliently deform when impacted, thereby reducing the force of impact felt by the user. The transition between the base **106** and the body **110** may be defined by an arc **112** (FIG. **14**).

(48) Referring to FIGS. **8** and **14-17**, the front bumper **102** may be coupled to the liner **54**. In some embodiments, the front bumper **102** is detachably coupled (e.g., via snap fit or hook and loop fastener) to the liner **54**. The front bumper **102** may include an aperture **104** configured to receive a connector **107** (FIG. **17**) to couple the front bumper **102** to the liner **54**. The front bumper **102** may include a flange **105**. Aperture **104** may extend through the flange **105**. The liner **54** may include a liner plate **124** (FIG. **17**) that includes an aperture to receive fastener **107**. The front bumper **102** may be fixed to the liner **54** with fastener **107**. The liner **54** may be coupled to the front bumper **102** after the front bumper **102** is coupled to the shell **22**. The liner **54** may be detachable from the front bumper **102** and the shell **22** while the front bumper **102** is coupled to the shell **22**. The front bumper **102** may be coupled directly to the shell **22**. The front bumper **102** may be a different color than the shell **22**. The color of the front bumper **102** and shell **22** may be selected to follow a

desired color scheme. The front bumper **102** may be commercially available separately from the shell **22**.

(49) Referring to FIG. **17**, the shell **22** may include an extension **118**. The extension **118** may define at least a portion of the receiving area **122** for the front bumper **102**. The receiving area **122** may be positioned between the central portion **26** and a lower rim of the front of the helmet **20**. The base **106** of the front bumper **102** may be positioned adjacent or in contact with the outer surface of the receiving area **122**. The extension **118** may be positioned closer to the center of the helmet **20** than other portions of the shell **22** (e.g., central portion **26**). An outer surface of the receiving area **122** may be recessed compared to an outer surface **23** of the shell **22**. A shoulder **120** may be formed where the shell **22** meets the extension **118**. The shoulder **120** may have a thickness similar to, or the same as, the body **110**. The shoulder **120** may be sized such that an outer surface **116** of the body **110** is flush with, or recessed compared to, the outer surface **23** (e.g., front surface) of the shell **22** when the front bumper **102** is coupled to the shell **22**. The front bumper **102** may be positioned within the receiving area **122** such that an outer surface **116** of the front bumper **102** may be recessed toward a center of the shell **22** compared to an outer surface of the receiving area **122**. A body **110** that is flush with the outer surface **23** of the shell **22** may reduce the likelihood of the front bumper **102** snagging on another player or equipment. A top edge of the front bumper **102** may abut an edge of the receiving area **122**. The top edge of the front bumper **102** may be spaced from the edge of the receiving area **122**.

(50) The helmet **20** may include a facemask **21** coupled to the shell **22**. Referring to FIGS. **1** and **3**, the helmet **20** may include a coupler **114** (e.g., a clip) configured to secure the facemask **21** to the shell **22**. The coupler **114** may be coupled positioned on the base **106** of the front bumper **102** adjacent the body **110**. The front surface of the body **110** protruding away from the base **106** may provide a recess configured to receive the coupler **114**. The recess may reduce or eliminate unwanted snagging or contact of the coupler **114** on other players or equipment. The coupler **114** may be coupled to the shell **22** by fastener **115**. The facemask **21** and front bumper **102** may be coupled to the shell **22** with fastener **115** before the liner **54** is coupled to the shell **54**.

(51) It will be appreciated by those skilled in the art that changes could be made to the exemplary embodiments shown and described above without departing from the broad inventive concepts thereof. It is understood, therefore, that this invention is not limited to the exemplary embodiments shown and described, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the claims. For example, specific features of the exemplary embodiments may or may not be part of the claimed invention and various features of the disclosed embodiments may be combined. Unless specifically set forth herein, the terms “a”, “an” and “the” are not limited to one element but instead should be read as meaning “at least one”.

(52) It is to be understood that at least some of the figures and descriptions of the invention have been simplified to focus on elements that are relevant for a clear understanding of the invention, while eliminating, for purposes of clarity, other elements that those of ordinary skill in the art will appreciate may also comprise a portion of the invention. However, because such elements are well known in the art, and because they do not necessarily facilitate a better understanding of the invention, a description of such elements is not provided herein.

(53) Further, to the extent that the methods of the present invention do not rely on the particular order of steps set forth herein, the particular order of the steps should not be construed as limitation on the claims. Any claims directed to the methods of the present invention should not be limited to the performance of their steps in the order written, and one skilled in the art can readily appreciate that the steps may be varied and still remain within the spirit and scope of the present invention.

Claims

1. A helmet comprising: a shell defining a cavity configured to receive a user's head, the shell including an exterior shell surface and a receiving area recessed into the exterior shell surface; a liner within the cavity and coupled to the shell; a facemask coupled to the shell; and a front bumper coupled to the shell and positioned at least partially within the receiving area of the shell.
2. The helmet of claim 1, wherein the shell includes a first ridge and a second ridge extending away from a rear surface of the shell, wherein a rearmost point of the first ridge and a rearmost point the second ridge lie within a reference plane that is rearwardly spaced from the rear surface of the shell when the helmet is resting on a horizontal surface.
3. The helmet of claim 2, wherein each end of the first ridge is curved upwardly toward a top of the shell and each end of the second ridge is curved downward toward a bottom of the shell.
4. The helmet of claim 2, wherein the shell includes a first opening proximate each end of the first ridge and a second opening proximate each end of the second ridge.
5. The helmet of claim 4, wherein the first openings and the second openings are arranged to form a generally X-shaped pattern.
6. The helmet of claim 1, wherein the front bumper is coupled to the shell and the liner and the front bumper extends from within the cavity to an exterior of the shell.
7. The helmet of claim 1, wherein the front bumper is positioned within the receiving area such that an outer surface of the front bumper is generally flush with the exterior shell surface.
8. The helmet of claim 1, wherein the front bumper is positioned within the receiving area such that an outer surface of the front bumper is recessed toward a center of the shell relative to the exterior shell surface.
9. The helmet of claim 1, wherein the front bumper includes a recess configured to receive at least a portion of the facemask.
10. The helmet of claim 1, wherein the front bumper is positioned within the receiving area such that a top edge of an outer surface of the front bumper is flush with a top edge of the receiving area.
11. The helmet of claim 1, wherein the front bumper abuts an edge of the receiving area.
12. The helmet of claim 1, wherein the front bumper is spaced from an edge of the receiving area.
13. The helmet of claim 1, wherein the front bumper is detachably coupled to each of the shell and the liner.
14. The helmet of claim 1, wherein the exterior shell surface includes a first side portion, a second side portion and a central portion extending between the first side portion and the second side portion, wherein the exterior shell surface going from the first side portion to the central portion is recessed and the exterior shell surface going from the second side portion to the central portion is recessed, wherein an apex of the central portion is the top most element of the shell when the helmet is resting on a horizontal surface.
15. The helmet of claim 1, wherein the exterior shell surface includes a rear portion, a front portion, a first side portion, a second side portion and a central portion extending from the front portion to the rear portion and between the first side portion and the second side portion, wherein a perimeter of the central portion is recessed relative to the first side portion and the second side portion proximate the front portion and protrudes relative to the first side portion and the second side portion proximate the rear portion.
16. The helmet of claim 1, wherein each side portion of the shell includes a recessed area, the helmet further comprising: a chin protector coupled to the recessed area of the shell by a chin protector fastener.
17. The helmet of claim 1, wherein the liner is detachably coupled to each of the shell and the front bumper such that the liner can be detached from the shell and the front bumper while the front bumper remains coupled to the shell.
18. The helmet of claim 1, wherein the liner is detachably coupled to the shell.
19. The helmet of claim 1, wherein the shell is comprised of nylon.