

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

REVELYST SALES LLC
Petitioner

v.

BRAINGUARD TECHNOLOGIES INC.
Patent Owner

IPR2025-01030
U.S. Patent No. 9,060,561

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 9,060,561
CHALLENGING CLAIMS 1, 6-10, 12, and 16-20
UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104**

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I. INTRODUCTION

Revelyst Sales LLC (“Petitioner”) respectfully requests *inter partes* review (“IPR”) of claims 1, 6-10, 12, and 16-20 (the “Challenged Claims”) of U.S. Patent No. 9,060,561 (the “’561 Patent”) (Ex.1001[USP561]) under 35 U.S.C. §§311-19 and 37 C.F.R. §42.1 *et seq.*

The ’561 Patent is directed to helmets with layers that can slide relative to each other to increase protection for a wearer upon impact. The safety issues the ’561 Patent seeks to address, including related to rotational acceleration, were known long before the patent. So too were the proffered solutions, which were the subject of extensive prior art analyzing the problem and describing techniques, including directed to relative movement of helmet layers and absorption/dissipation of energy, to protect wearers. The ’561 Patent received no substantive prosecution; minimal art was identified beyond Patent Owner’s sparse disclosures, and the claims received no anticipation or obviousness rejection beyond obviousness-type double patenting. As this Petition demonstrates, however, the concepts and structures of the Challenged Claims were widely known, and the Challenged Claims are anticipated or would have been obvious. For instance, Weber, Von Holst, and Kleiven’s disclosure of helmets with outer, middle, and inner layers separated by energy transformer layers that allow relative sliding and absorption of energy anticipates and/or renders obvious the Challenged Claims.

This Petition, supported by the declaration of Dr. Stefan Duma (Ex.1002), demonstrates a reasonable likelihood Petitioner will prevail with respect to cancelling at least one Challenged Claim. 35 U.S.C. §314(a).

The Board should institute IPR and hold all Challenged Claims unpatentable.

II. MANDATORY NOTICES

A. Real Parties-in-Interest

Under 37 C.F.R. §42.8(b)(1), Petitioner certifies Revelyst Sales LLC, Olibre LLC, Revelyst, Inc., Strategic Value Partners, LLC, Bell Sports, Inc., Fox Head, Inc., and Mips AB are the real parties-in-interest.

B. Related Matters

Pursuant to 37 C.F.R. §42.8(b)(2), Petitioner states that Patent Owner (“PO”) has asserted five patents, including the ’561 Patent, in *BrainGuard Technologies, Inc. v. Revelyst Sales LLC*, No. 8:24-cv-2652-JWH-ADS (C.D. Cal.) (the “-652 Action”).

In the -652 Action, Revelyst has alleged noninfringement, invalidity, and unenforceability of the asserted claims of the Challenged Patent, which are a subset of the claims challenged herein.

C. Counsel

Under 37 C.F.R. §§42.8(b)(3)-(4), Petitioner identifies the following lead and backup counsel, to whom all correspondence should be directed.

Petition for *Inter Partes Review*
of U.S. Patent No. 9,060,561

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Petitioner consents to service by e-mail on lead and backup counsel.

III. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art (“POSA”) as of the ’561 Patent’s earliest claimed priority date (July 21, 2011) would have had at least a Bachelor’s (or

equivalent) degree in mechanical engineering or a related subject, or a medical degree with training in neuroscience or a related subject. A POSA would generally understand brain injury biomechanics and how helmets protect against brain injuries. A POSA would also have two or more years' experience with helmet design or development. Less work experience may be compensated by higher education level or vice versa. Ex.1002, ¶¶32-36.

Petitioner's positions are supported by Dr. Stefan Duma, a helmet-safety design expert with almost 30 years' experience. Ex.1002, ¶¶1-11.

IV. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies under 37 C.F.R. §42.104(a) that the '561 Patent is available for IPR, and under 37 C.F.R. §§42.101(a)-(c) that Petitioner is not barred or estopped from requesting an IPR challenging the patent claims on the grounds identified herein.

V. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Petitioner requests review and cancellation of '561 Patent claims 1, 6-10, 12, and 16-20.

A. Prior Art

The '561 Patent claims priority to July 21, 2011,¹ the filing date of U.S. Provisional No. 61/510,401. Ex.1001[USP561], 1. Petitioner relies on Exhibits including:

- U.S. Patent Application Publication No. US2012/0198604 to Weber et al. (“Weber”) (Ex.1004[Weber]), filed February 8, 2012 and published August 9, 2012, which claims the benefit of U.S. Provisional Application Nos. 61/462914 (filed February 9, 2011) (“*Weber Provisional*”) (Ex.1014[WeberProv]), as §102(e) prior art.
- International Patent Application Publication Number WO01/45526 to Von Holst et al. (“Von Holst”) (Ex.1005[VonHolst]), filed December 21, 1999 and published June 28, 2001, as §102(a), (b) prior art.
- International Patent Application Publication No. WO2011/139224 to Halldin (“Halldin”) (Ex.1006[Halldin]), filed May 3, 2011 and published November 10, 2011, which claims the benefit of U.S. Provisional Application No. 61/333817 (filed May 12, 2010) (“*Halldin Provisional*”) (Ex.1015[HalldinProv]), as §102(e) prior art.

¹Petitioner reserves the right to argue one or more claims are not entitled to this date in District Court.

- U.S. Patent Application Publication No. US2013/0122256 to Kleiven et al. (“Kleiven”) (Ex.1007[Kleiven]), filed May 12, 2011 and published May 16, 2013, which claims the benefit of U.S. Provisional Application Nos. 61/395,344 (filed May 12, 2010) and 61/395,386 (filed May 12, 2010), as §102(e) prior art.
- U.S. Patent Application Publication US2004/0250340 to Piper (“Piper”) (Ex.1009[Piper]), filed February 4, 2004 and published December 16, 2004, as §102(a), (b) prior art.
- U.S. Patent Application No. US2004/0117896 to Madey et al. (“Madey”) (Ex.1047[Madey]), filed July 10, 2003 and published on June 24, 2004, which claims the benefit of U.S. Provisional Application No. 60/416,312 (filed October 4, 2002), as §102(a), (b) prior art.

B. Grounds on which the Challenge is Based

Under 37 C.F.R. §§42.22(a)(1) and 42.104(b)(1)-(2), Petitioner requests cancellation of the Challenged Claims on the following grounds:

Ground	Basis	Claims	References
1	§102	1, 7-10, 16-19	Weber
2	§103	20	Weber combined with Piper

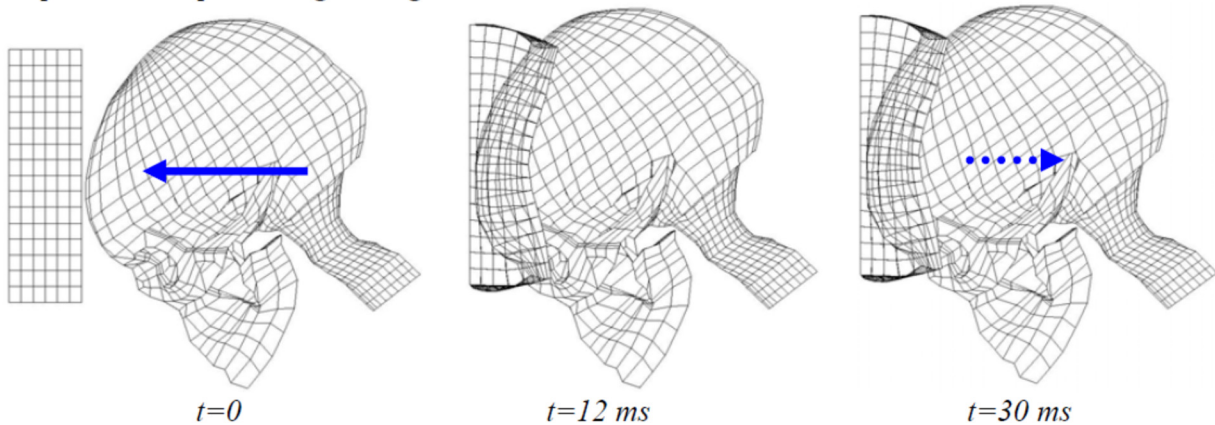
3	§102	1, 6-10, 12, 16-20	Von Holst
4	§103	1, 6-10, 12, 16-20	Von Holst combined with Halldin
5	§102	1, 7-8, 18	Kleiven
6	§103	9-10, 16-17, 19-20	Kleiven combined with Piper
7	§102	10, 16-17	Madey

VI. TECHNOLOGY BACKGROUND

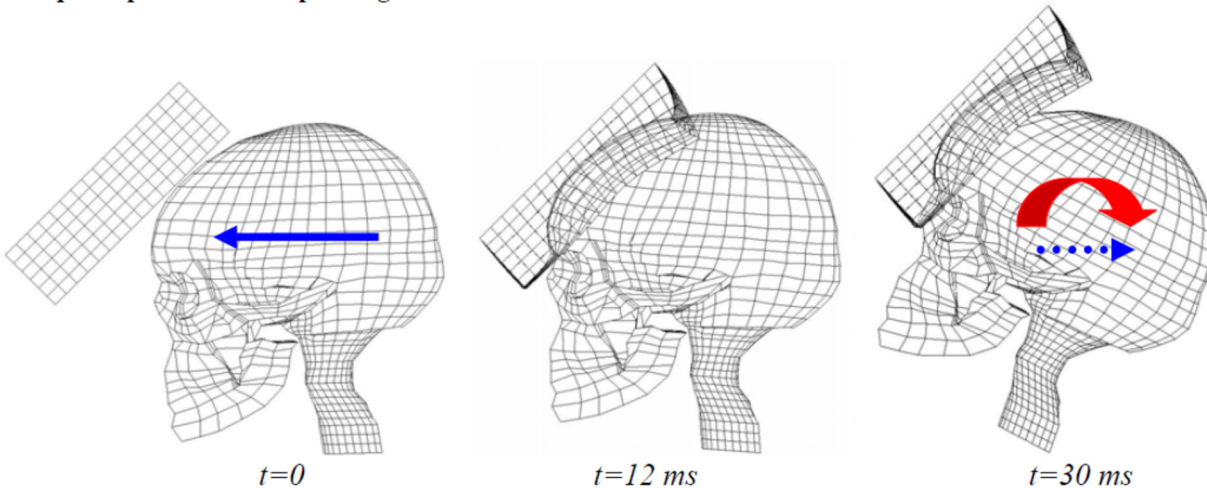
A. Rotational Motion from Impact

As Dr. Duma describes (Ex.1002), during a collision, **linear impact** causes the brain to move predominantly in a linear direction, e.g., forward-backward, side-to-side, or up-down, while **oblique or tangential impact** causes rotational acceleration.

Perpendicular impact through the c.g.:



Oblique impact towards a padding rotated 45°:



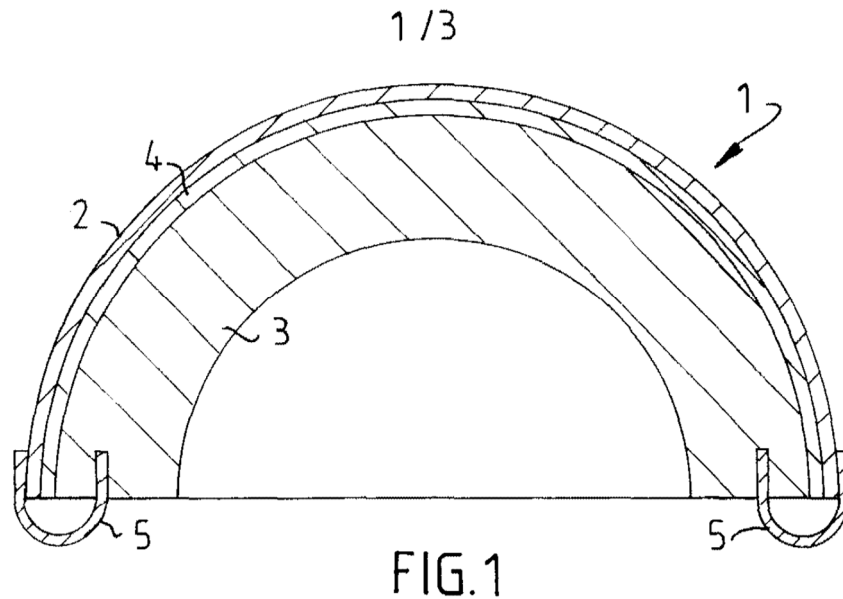
Ex.1026[Kleiven-2007], Fig. 3. “Rotational acceleration” in turn “result[s] in shear strains inside the brain.” Ex.1031[Bosch], 55. “Shearing” results from “shear forces,” which refers to forces from parallel translation in different or opposing directions exerted on the helmet/brain. Ex.1002, ¶¶37-38.

Before 2011, the importance of reducing rotational motion of the brain from oblique impacts was well-understood. Ex.1028[Aare-2003], 246 (“rotational

acceleration” causes injuries); Ex.1022[Kis-2003], 502 (“[R]otational acceleration is more damaging than linear....”). Ex.1002, ¶¶38-41.

B. Helmets to Reduce Rotational Motion

As of 2001, publications described reducing rotational motion using sliding between multiple helmet layers. For example, Von Holst described outer (2) and inner (3) shells with an intermediate “sliding layer 4” for “displacement between” them:



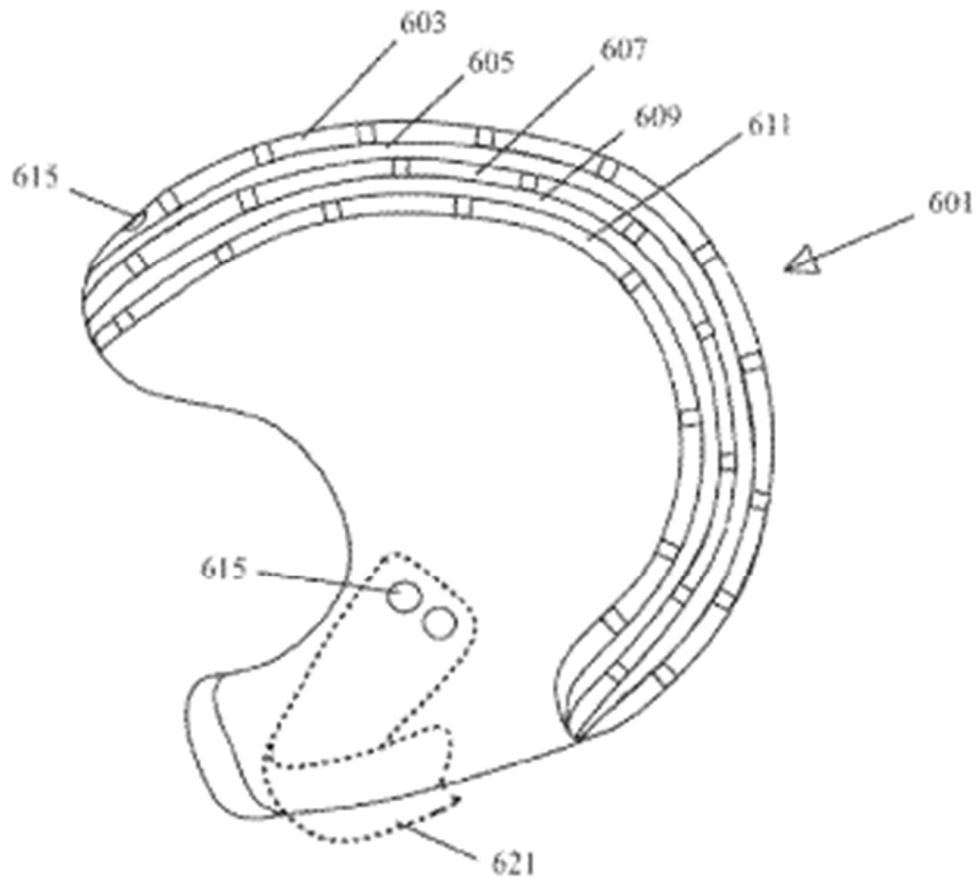
Ex.1005[VonHolst], 4:10-17, Fig. 1. Von Holst taught this arrangement reduces “injurious forces” when the outer shell is “displaced relative to the inner shell” to absorb rotational energy. *Id.*, 2:34-38, 8:12-18; Ex.1032[Mills-2006], 173-174 (“low friction layers” to reduce “rotational acceleration”). By 2011, multi-layered helmets with sliding layers were extensively described in the art. *See, e.g.,*

Ex.1005[VonHolst], 2:34-38, 4:10-17, Fig. 1; Ex.1016[Depreitere],
Ex.1010[Ferrara-2006], Ex.1017[Nichols], Ex.1018[Ferrara-2007],
Ex.1019[Hawkins], Ex.1009[Piper], Ex.1020[Cripton], Ex.1004[Weber],
Ex.1006[Halldin], Ex.1007[Kleiven], Ex.1047[Madey], Ex.1011[Puchalski].
Ex.1002, ¶¶42-48.

VII. '561 Patent

A. Specification

The '561 Patent is directed to preventing damage from “rotational” and other forces. Ex.1001[USP561], 2:47-53. It proposes (like the prior art) helmets with layers that move relative to each other to reduce “movement and/or impact” on an outer shell. Ex.1001[USP561], 9:7-12. Figure 6 depicts three helmet layers (603, 607, 611) joined by “energy and impact transformer” layers (605, 609):



Ex.1001[USP561], 9:65-10:2, Fig. 6. The layers are connected (directly or indirectly) through transformer layers, Ex.1001[USP561], 10:37-39, which transfer or “transform” energy—e.g., impact or rotational force—via sliding into, e.g., heat or rotational energy. *Id.*, 9:4-21, 6:16-26, 10:37-58, Fig. 5 (shell 501 “mov[ing]

and/or slid[ing]”² relative to 503). The Patent identifies several materials—in various combinations—that may make up a transformer layer. Ex.1001[USP561], Abstract, 2:35-41, 6:27-7:47, 9:26-64, 11:1-3; 8:56-60 (fluid or gel alone or with mechanical spacers). Ex.1002, ¶¶49-51.

The ’561 Patent further describes typical prior-art helmet components like lining layers, Ex.1001[USP561], 8:4-7, 10:2-4, and chin-straps. *Id.*, 10:4-6, 10:20-22. Ex.1002, ¶51.

B. Prosecution History

The ’561 Patent issued from U.S. Patent Application 14/485,993. Its prosecution was abbreviated, with only one office action with double-patenting and indefiniteness rejections. Ex.1003[Knight-561-FH], 63-68. The claims were allowed after Applicant filed a terminal disclaimer and amended the claims to specify energy transformer layers with “absorptive/dissipative” materials/means. Ex.1003[Knight-561-FH], 77-80, 91-95; Ex.1002, ¶52.

With the ’561 Patent prosecution pending, Applicant prosecuted U.S. application No. 13/554,563, claiming priority to the same provisional. A different

² The ’561 Patent uses “move relative to” and “slide relative to” synonymously.

See, e.g., Ex.1001[USP561], Abstract, 2:31-35, 8:48-55, 9:4-12, 9:13-21; Ex.1002, ¶113.

examiner rejected similar claims *five times* before allowing significantly narrower claims. *See generally* Ex.1013[Knight-162-FH]; Ex.1002, ¶¶53-54.

VIII. PRIOR ART

The following references are pertinent to the Grounds:

A. US2012/0198604 (“Weber”)

Weber recognizes “rotational acceleration” risks “shearing brain tissue.” Ex.1004[Weber], [0006]. Weber’s multi-layered helmets “significantly reduce both rotational and linear forces” from impacts. Ex.1004[Weber], [0009]. Ex.1002, ¶¶74-75.

Weber describes outer, intermediate, and inner liners separated by components that allow relative movement between them. Weber describes isolation dampers that allow “controlled internal omnidirectional relative displacement...including relative rotation and translation.” Ex.1004[Weber], [0010]. Figure 4’s exemplary helmet includes: 1) **an outer liner** affixed to a **hard outer shell**, 2) **an intermediate liner**, 3) **an inner liner** affixed to a comfort liner, and 4) layers of **isolation dampers** connecting intermediate and inner/outer liners.

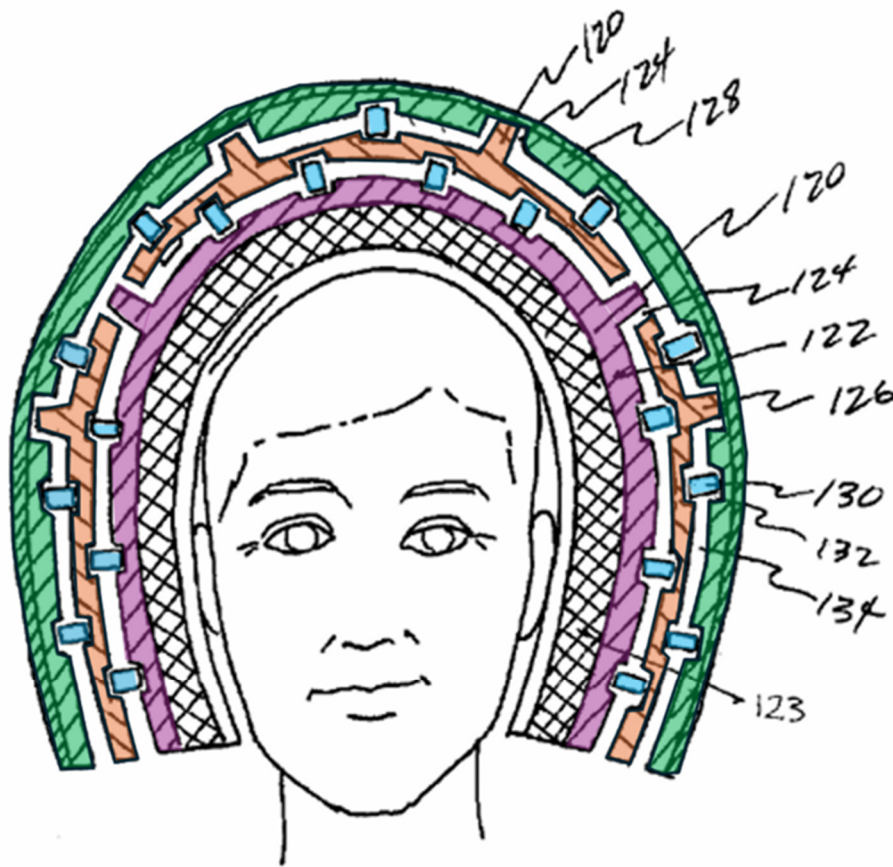


Fig. 4

Ex.1004[Weber], Fig. 4³, [0045-46]. Ex.1002, ¶76.

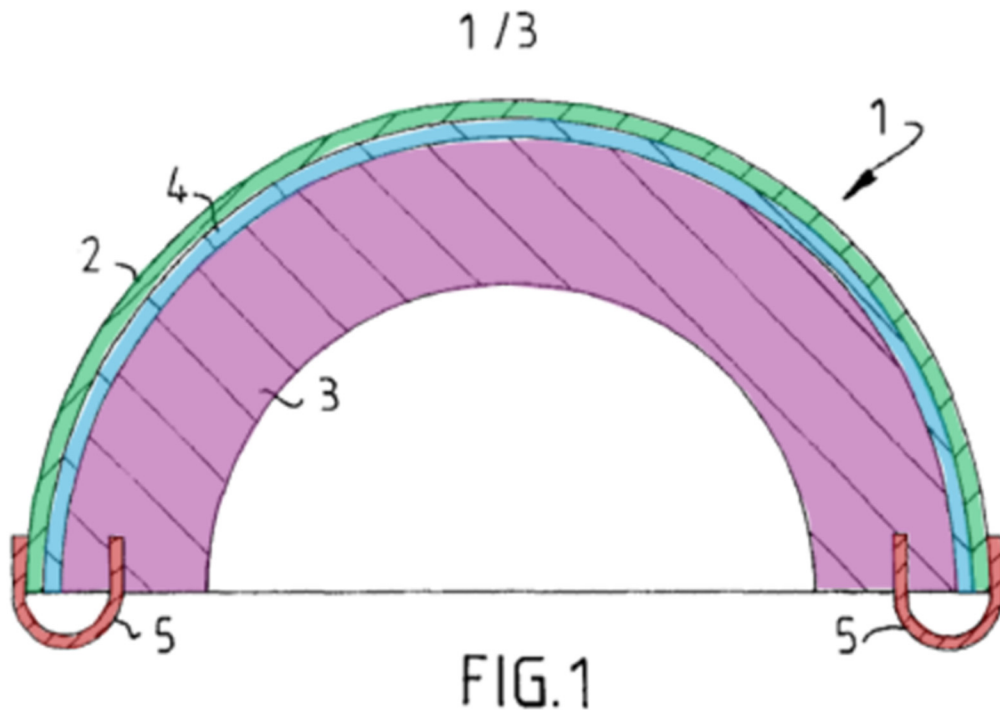
Weber’s “isolation dampers 130” “disposed between” liners “dissipate” impact energy, *id.*, e.g., “enabl[ing] the inner and intermediate liners 122 and 126 to move relative to each other and/or the outer liner 128.” Ex.1004[Weber], [0045-46]. Ex.1002, ¶77.

³ All annotations and emphases added unless stated.

B. WO01/45526 (“Von Holst”)

Von Holst discloses helmets with layers that slide relative to one another upon impact: “outer shell...can be displaced relative to the inner shell during simultaneous absorption of rotational energy....” Ex.1005[VonHolst], 2:34-39; Ex.1002, ¶79.

Figure 1’s helmet has **outer shell 2**, **inner shell 3**, and **intermediate sliding layer 4** that allows displacement between outer and inner shells. Ex.1005[VonHolst], 4:10-21, 5:39-4:2. A **connecting member 5** further connects the shells and absorbs energy. Ex.1005[VonHolst], 4:38-5:2, 4:10-21. Ex.1002, ¶80.



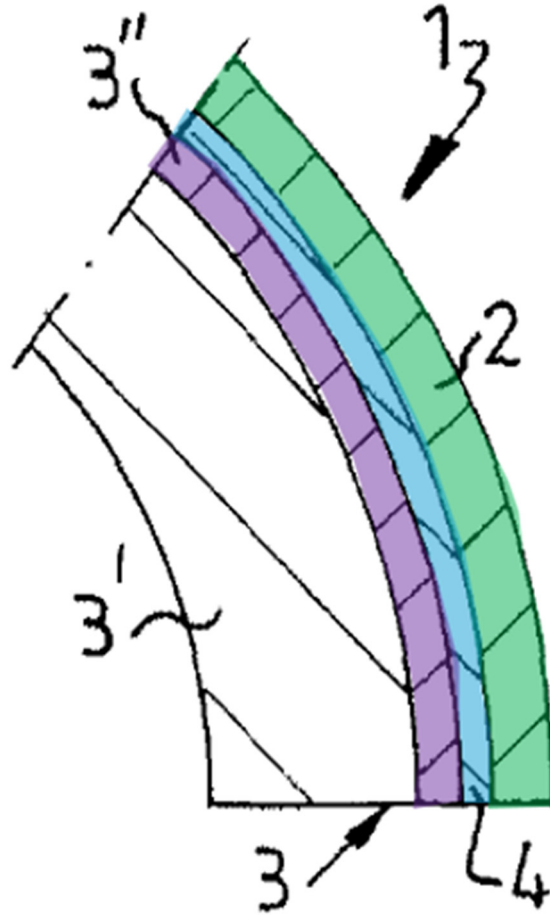


FIG. 3a

Ex.1005[VonHolst], Figs. 1, 3.

Von Holst's Figure 3b helmet is a five-layer variant of the Figure 1 helmet with **intermediate shell 6** between “**two sliding layers 4.**” Ex.1005[VonHolst], 6:2-6; Ex.1002, ¶¶80-82.

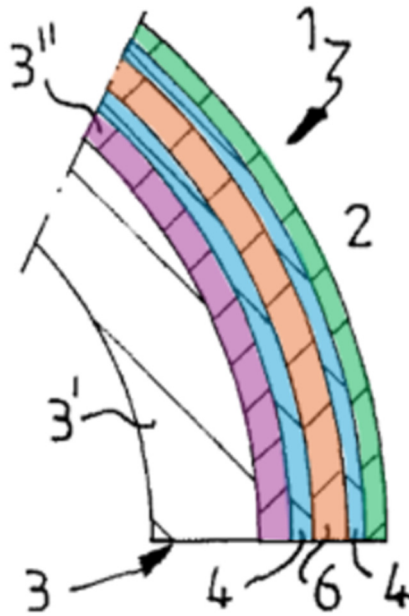


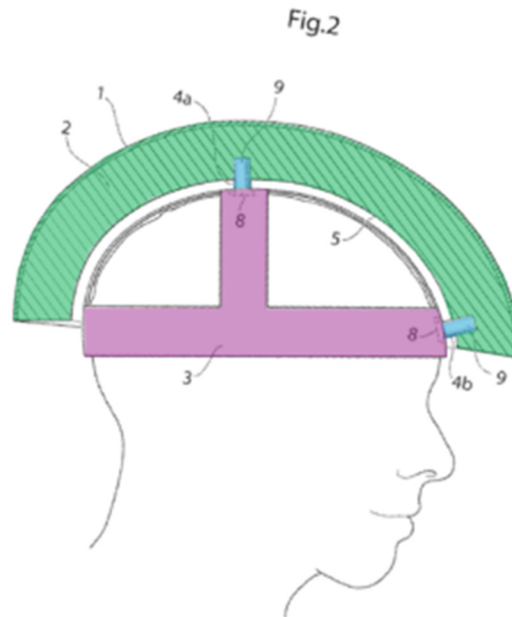
FIG.3b

Ex.1005[VonHolst], Fig. 3b. Ex.1002, ¶¶81-82.

C. WO2011/139,224 (“Halldin”)

Halldin addresses reduction of “rotational acceleration affecting the brain.”

Ex.1006[Halldin], [0013]. Halldin’s helmet has **outer shell 1**, **energy absorbing layer 2**, and **inner attachment device 3**. Ex.1006[Halldin], [0046-47]. **Fixation members 4a and 4b** fix **attachment device 3** to the **energy absorbing layer**, and upon impact allow “energy absorbing layer 2 to slide in relation to” attachment device 3. Ex.1006[Halldin], [0046-47]. Ex.1002, ¶84.



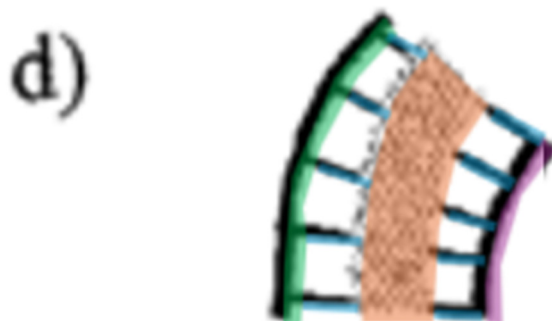
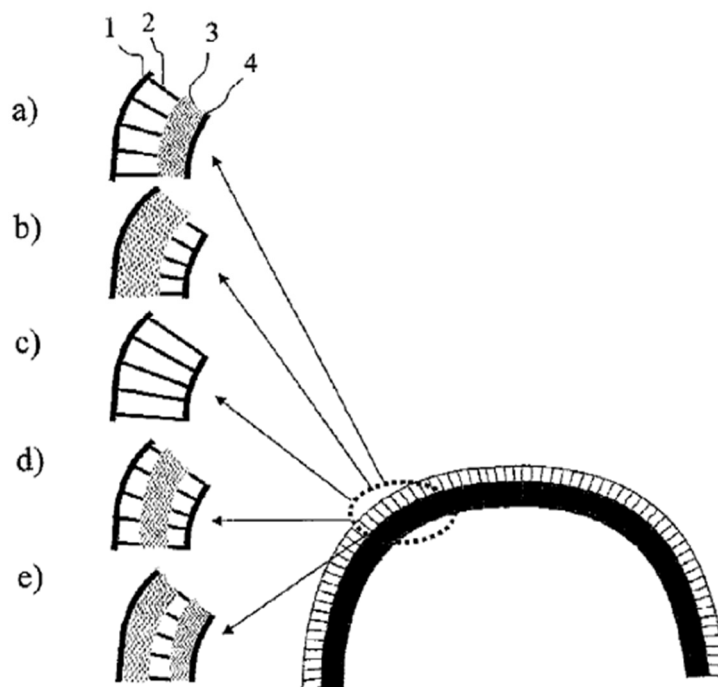
Ex.1006[Halldin], Fig. 2. Ex.1002, ¶84.

D. US2013/0122256 (“Kleiven”)

Kleiven recognizes “[a]ngular or rotational motion” induced by oblique impact causes brain damage. Ex.1007[Kleiven], [0004]. Kleiven’s helmet thus has “layers” separated by flexible “spikes or beams” that permit relative displacement. Ex.1007[Kleiven], Abstract, [0002], [0020], [0048-49], [0062]. Ex.1002, ¶86.

Figures 1 and 2 disclose **outer shell 1**, **inner shell 4**, **spike/beam layer 2**, and **energy absorbing foam layer 3**. Ex.1007[Kleiven], [0031], Fig. 2. Figure 2(d) shows a five-layer embodiment with two **spike/beam layers** separating the **intermediate**, **inner**, and **outer** layers. Ex.1007[Kleiven], [0031], Fig. 2; *id.*, [0020], [0048]. Ex.1002, ¶¶87-88.

Fig. 2.



Ex.1007[Kleiven], Figs. 2, 2(d). Ex.1002, ¶¶87-88.

E. US2004/0250340 (“Piper”)

Piper discloses “protective headguard[s]” including helmets that allow sliding between layers. Ex.1009[Piper], cl. 1, Fig. 1, [0015], [0017], [0122]. Piper teaches a “**comfort liner 212**,” made of “foam material that easily conforms to the head 200....” Ex.1009[Piper], [0109]. Ex.1002, ¶¶90-91.

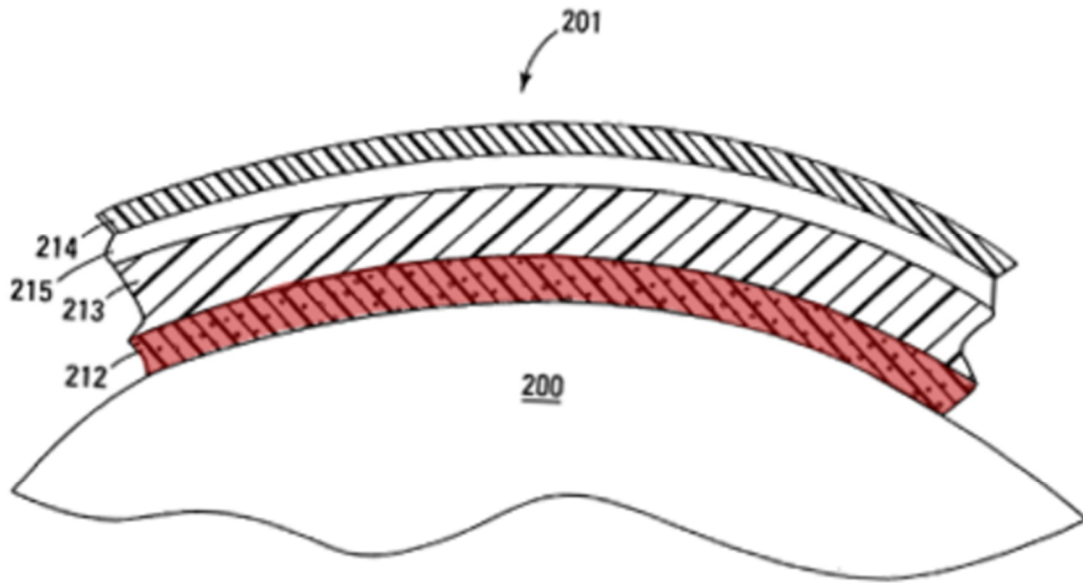
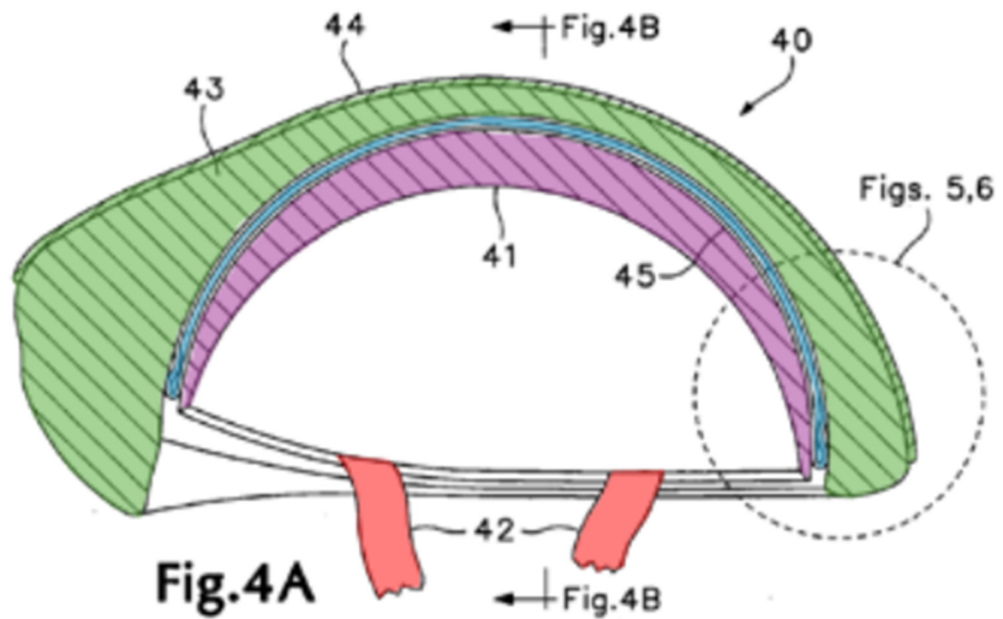


Fig. 3

Ex.1009[Piper], Fig. 3. Ex.1002, ¶91.

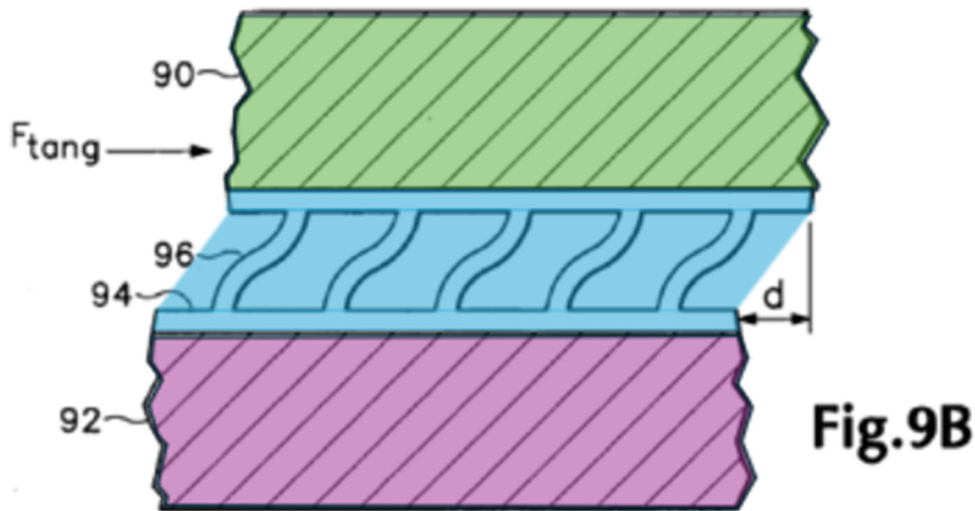
F. US2004/0117896 (“Madey”)

Madey’s helmets have **outer helmet layer 43/44**, **inner helmet layer 41**, and **interface layer 45**, which allows the “outer helmet layer to displace with respect to the inner helmet layer, thereby absorbing and/or diverting forces.” Ex.1047[Madey], Abstract, Figs. 4A, 5; Ex.1002, ¶93.



Ex.1047[Madey], Fig. 4A; Ex.1002, ¶93.

Figure 9B describes “**interface layer 94** disposed between [outer and inner] layers 90 and 92...comprises a lamellar structure of **hyper-elastic columns 96**,” that bend and stretch upon impact, thereby deflecting and absorbing it. Ex.1047[Madey], [0037]; Ex.1002, ¶93.



Ex.1047[Madey], Fig. 9B; Ex.1002, ¶93.

IX. CLAIM CONSTRUCTION

A. “first absorptive/dissipative means to allow the first shell layer to slide relative to the second shell layer”

This term should be construed under 35 U.S.C. §112 ¶6⁴ as follows:

Function: “absorbing and/or dissipating energy and allowing the first shell layer to slide relative to the second shell layer,” Ex.1001[USP561], Claim 18.

Structure: The structures described as performing the recited function at the following passages of the ’561 Patent:

⁴ “Means to” presumptively invokes §112 ¶6. *Kemco Sales, Inc. v. Control Papers Co.*, 208 F.3d 1352, 1361 (Fed. Cir. 2000). Petitioner reserves the right to argue PO’s structure disclosure is insufficient. Ex.1002, ¶58.

- Shear truss layer/thin elastomeric truss layer in a comb structure (with or without fluids/gels). Ex.1001[USP561], 6:31-37, 6:42-44, 8:48-55, 9:24-30.
- Fluids/smart fluids (including electro-rheological or magneto-rheological elements). Ex.1001[USP561], 6:45-53, 6:63-7:3, 6:54-62.
- Conical structures, 3D pyramid or parabolic structures, or cylinders. Ex.1001, 9:33-64.
- Dampers. Ex.1001[USP561], 11:1-3, 10:51-58; *see also id.*, 2:31-35.
- Or structural equivalents thereof.⁵

Ex.1002, ¶¶58-64.

B. “a second absorptive/dissipative means,”

This term should be construed under 35 U.S.C. § 112 ¶6 as follows:

⁵ To the extent PO argues the structure of either claimed “means” encompasses any structure with certain characteristics, like connection or sliding distance, that is incorrect. Proper means-plus-function construction must identify specific structure associated with the claimed function, and mere reference to characteristics or function is insufficient. *See, e.g., Aristocrat Techs. Australia Pty Ltd. v. Int’l Game Tech.*, 521 F.3d 1328, 1336 (Fed. Cir. 2008) (requiring identification of specific structure in specification and rejecting argument “appropriate programming” sufficient).

Function: “absorbing and/or dissipating energy,” Ex.1001[USP561], Claim 18.

Structure: The structures described as performing the recited function at the following passages of the ’561 Patent:

- Shear truss layer/thin elastomeric truss layer in a comb structure (with or without fluids/gels). Ex.1001[USP561], 6:31-37, 6:42-44, 8:48-55, 9:24-30.
- Fluids/smart fluids (including electro-rheological or magneto-rheological elements). Ex.1001[USP561], 6:45-53, 6:63-7:3, 6:54-62.
- Conical structures, 3D pyramid or parabolic structures, or cylinders. Ex.1001[USP561], 9:33-64.
- Dampers. Ex.1001[USP561], 11:1-3, 10:51-58; *see also id.*, 2:31-35.
- Foams/memory foam. Ex.1001[USP561], 7:4-7, 8:56-60.
- Accordions with a fluid or gel or a compressed fluid/piston/spring with a piston/cylinder and a compressed fluid between. Ex.1001[USP561], 7:25-35.
- Or structural equivalents thereof.

Ex.1002, ¶¶65-72.

All other claim terms should be given their plain and customary meaning as understood by a POSA. Petitioner reserves the right to propose or respond to claim constructions in parallel litigation and respond to any claim construction PO advances here.

X. SPECIFIC GROUNDS FOR UNPATENTABILITY

Under 37 C.F.R. §42.104(b)(4)-(5), and as Dr. Duma confirms (Ex.1002, ¶¶94–343), the prior art anticipates and/or renders obvious the Challenged Claims.

A. Ground 1: Weber Anticipates Claims 1, 7-10, and 16-19

Weber discloses Claims 1, 7-10, and 16-19 arranged as in each Challenged Claim for the reasons below. Ex.1002, ¶¶96-151.

1. *Dynamic Drinkware Analysis: Weber*

Under pre-AIA §102(e), the effective prior-art date of a published patent application is the filing date of a beneficially-claimed provisional when 1) the portion relied upon has written description in the provisional application, and 2) at least one claim has written description in the provisional application. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375 (Fed. Cir. 2015); *In re Riggs*, 131 F.4th 1377, 1384-85 (Fed. Cir. 2025); M.P.E.P. §2136.03. *Weber* qualifies as prior art as of February 9, 2011, the date of the *Weber Provisional* (Ex.1014[WeberProv]).

The relied-upon subject matter of *Weber* has 35 U.S.C. §112, first paragraph, support from *Weber Provisional* as follows, and as Dr. Duma discusses:

<i>Weber</i>	<i>Weber Provisional</i>
FIG. 2	FIG. 2
FIG. 4	FIG. 3

[0002]	p.3: helmets to e.g. “reduce...rotational brain injury [and] shearing of brain matter...”
[0004]	pp.3-5: linear and rotational translation and acceleration, injuries
[0006]	p.3: helmets to e.g. “reduce...rotational brain injury [and] shearing of brain matter...” and “force applied to the helmet...result[ing] in...rotational brain injury...”
[0008]	p.4: helmets to e.g. “absorb and dissipate as much energy as possible, in the shortest amount of time possible” where energy includes “direct linear translational energy” and “angular acceleration or deceleration energy” to “reduce or significantly diminish the risk of head and brain injury.”
[0009]	p.4: helmet “omni-directional impact energy management system” and its effects
[0034]	p.4: “omni-directional impact energy management system...to significantly reduce the rotational and linear forces...from impacts.”
[0036]	pp.4, 5, 6: helmet layers including inner comfort liner contacting wearer’s head
[0037]	pp.4, 5: engagement between liners and allowance of movement to reduce force and acceleration from outer shell
[0038]	p.5: multiple layers with omni-directional control using components with or without air gaps
[0039]	p.5: outer liner fixed to inside of helmet shell
[0040]	

[0041]	p.5: “inner and outer liners” and their engagement using isolation dampers; Figure 2 embodiment
[0042]	pp.4, 3: outer liner affixed to outer shell
[0043]	pp.5-6: “inner and outer liners” and their engagement using isolation dampers, Figure 2 embodiment, and flex bumpers and their properties
[0044]	p.5: “inner liner” and engagement by head through “comfort liner”; “restraint” “managed by the chin-strap or neck security device commonplace on all helmets” p.6: stops to prevent over-rotation.
[0045]	pp.4-6: intermediate liners and their materials and comfort liner
[0046]	p.6: “flex bumpers” ⁶ (isolation dampers) and their makeup and properties, including absorbing energy
[0047]	pp.6, 5: lugs and the control of the relative movement of the inner and outer layer through “various means of suspension, dampening, and motion controlling components”
[0048]	p.6: lugs and “flex bumpers” (isolation dampers), their properties, and use in multiple layers
[0049]	pp. 3-4: air-filled bladders and managing forces, air gaps and relative movement of layers

⁶ Weber Provisional uses “flex bumpers” and “isolation dampers” interchangeably.

Ex.1014[WeberProv], 3. Ex.1002, ¶98, n.5.

[0050]	pp.5, 7: relative movement of layers and use of “flex bumpers” (isolation dampers) in such movement
[0056]	pp.4, 6: properties and operation of liners and layers (including of “flex bumpers” (isolation dampers)) to allow relative movement and absorb energy
[0062]	p.6: materials for “flex bumpers” (isolation dampers)

Ex.1002 ¶98.

And at least *Weber* claim 1 has written-description support from *Weber Provisional* (Ex.1014[WeberProv]).

<i>Weber</i>	<i>Weber Provisional</i>
1. A helmet, comprising:	p.4 describes a helmet with outer liner affixed to outer shell.
an outer shell;	
an outer liner disposed within and coupled to the outer shell; and	
an inner liner disposed within and coupled to the outer liner with at least one isolation damper for omnidirectional movement of the inner liner relative to the outer liner and the outer shell.	pp.4, 5, 7 describes “inner...liners” engaged with outer liner, “flex bumpers” (isolation dampers), and relative omnidirectional movement.

Ex.1002, ¶99.

2. Claim 1

a) 1[preamble]⁷: “A helmet comprising:”

Weber discloses “helmets.” Ex.1004[Weber], [0002], Fig. 4. Ex.1002, ¶100.

b) 1[a]: “a first shell layer;”

Weber discloses 1[a]. Weber’s “outer shell” and “outer liner” (made of, e.g., EPS) “affixed directly to the inside surface of the outer shell,” Ex.1004[Weber], [0039], [0042], Figs. 2, 4, is a “first shell layer.”⁸ Ex.1004[Weber], [0036], [0038], [0045]; Ex.1001[USP561], 10:11-13, 11:3-10. Weber equates “layers” and “liners.” *See, e.g.*, Ex.1004[Weber], [0036], [0038]. Ex.1002, ¶101.

⁷ Petitioner takes no position herein on whether any preamble is limiting. In all cases, the prior art teaches it. Ex.1002, ¶¶94–343.

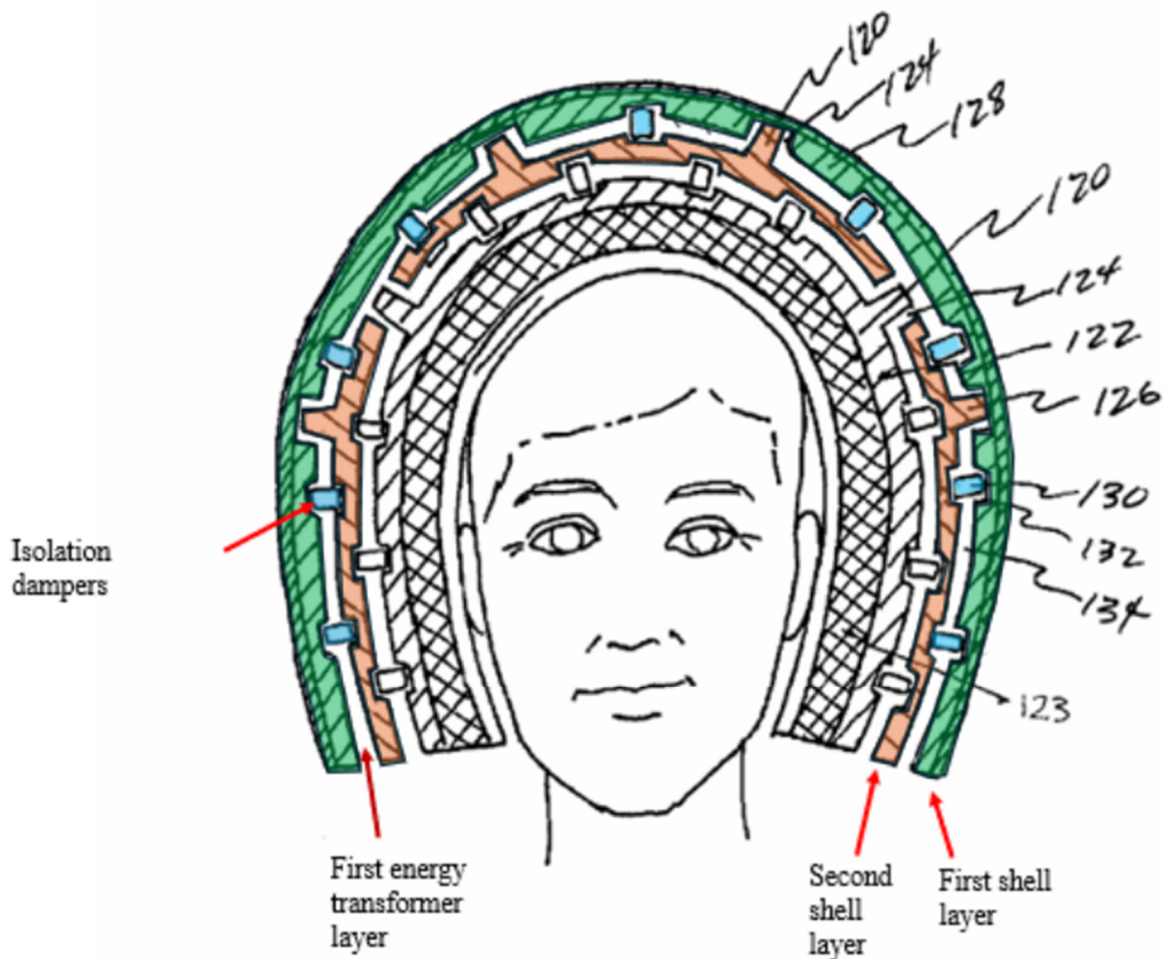
⁸ The ’561 Patent does not define “shell,” but states outer, middle, and inner “shells” “may vary in weight and strength,” “may” have certain characteristics, and may be constructed using a non-limiting set of materials including “plastics, resins, metal, composites,” and others denoted with “etc.” Ex.1001[USP561], 11:3-10, 10:11-13. Weber’s outer “liner” discloses to a POSA a first “shell layer” because, for example, it spans the entirety of the helmet and is made of EPS (a plastic constructed from a plastic resin). Ex.1004[Weber], [0036]; Ex.1049[Epssole]; *see* Ex.1031[Bosch], 2 (standard for different materials at outer/inner layers). Ex.1002, ¶101.

c) 1[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,”

Weber discloses 1[b]. Weber’s “one or more additional layers or liners” “inserted between an inner liner and outer liner” and made of, e.g., EPS, are a “second shell layer.” Ex.1004[Weber], [0045]; *see* n.8, Ex.1002, ¶¶103-104.

Weber further discloses a “first energy transformer layer,” i.e., a layer between the outer and intermediate liners including **isolation dampers** and air gaps. Ex.1004[Weber], [0045-46], Fig. 4. This layer is created by the aggregate distribution of dampers with surrounding air gaps. *Id.*, [0038], [0045-46], Fig. 4. Ex.1002, ¶¶105-106.

The ’561 Patent explains “a connection between two entities does not necessarily mean a direct, unimpeded connection...” Ex.1001[USP561], 2:19-22. It explains “connections” may be “indirect” (i.e., “through” an energy and impact transformer) or layers may be “loosely connected.” *See, e.g.*, Ex.1001[USP561], 8:42-47, 10:37-42. Weber’s **second shell layer** and **first shell layer** are connected through the layer including **dampers** and air gaps. Ex.1002, ¶107.



Ex.1004[Weber], Fig. 4; *id.*, [0037], [0046]. Ex.1002, ¶105.

As Weber explains and Dr. Duma confirms, this layer of dampers and air transforms energy from impact force to movement and heat. *E.g.*, Ex.1004[Weber], [0034] (“[O]mnidirectional impact energy management systems...significantly reduce both rotational and linear forces generated from impacts....”); *see* Ex.1001[USP561], 6:42-44 (fluids, gels absorptive/dissipative materials). Isolation dampers 130, disposed between “*outer liner*[...]...128 and/or the *intermediate liner*

126,” “**dissipate**” impact energy. Ex.1004[Weber], [0045]. Isolation dampers 130 “flex, bend, and/or compress to **absorb** the energy of impacts to the helmet...and thereby enable...**intermediate liner**]...126 **to move relative to...outer liner 128.**” Ex.1004[Weber], [0046]. Weber’s air gaps also facilitate relative movement between outer and inner liners. Ex.1004[Weber], [0049], [0046]. Ex.1002, ¶¶106-109.

d) 1[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Weber discloses 1[c]. Weber discloses isolation dampers “**dissipate**” and/or “**absorb the energy of impacts** to the helmet.” Ex.1004[Weber], [0044-46]. Weber’s air gaps also facilitate relative movement between the outer and other liners. Ex.1004[Weber], [0049], [0046]. Weber recognizes, consistent with the ’561 Patent, Ex.1001[USP561], 9:9-12, Fig. 5, relative sliding allowed by isolation dampers absorbs energy from forces imparted onto the first shell layer, Ex.1004[Weber], [0037] (relative movement/displacement “reduce[s] the transfer of forces and resulting accelerations originating from the hard outer shell of the helmet”); *id.* [0046], [0004]. See Section X.A.2.c). Ex.1002, ¶110.

e) 1[d]: “wherein the first energy transformer layer includes a first absorptive/dissipative material to allow the first shell layer to slide relative to the second shell layer;”

Weber discloses 1[d]. Weber's isolation dampers are made of materials that absorb and/or dissipate energy. Weber discloses isolation dampers made of "elastomeric materials, including MCU (micro-cellular urethane)," that "flex, bend, and/or compress to absorb the energy of impacts." Ex.1004[Weber], [0062], [0046], [0050], [0043]. Ex.1002, ¶111.

Weber's isolation dampers "thereby enable the inner and intermediate liners 122 and 126 *to move relative to each other* and/or the outer liner 128." Ex.1004[Weber], [0046], [0040], [0043], [0050].⁹ Dr. Duma explains this mechanical deformation dissipates energy, and the lateral/rotational movement of Weber's outer and inner liners allowed by isolation dampers 130 is relative sliding as 1[d] requires. Ex.1002, ¶¶112, 115.

In addition, Dr. Duma explains air gaps also allow fluid (e.g., air) to absorb and dissipate energy from impact through compression, displacement, and fluid

⁹ In conjunction, Weber discloses inner liner "later[ally] or rotational[ly] displace[d]" "relative to the outer liner," as "controlled" by lugs engaged with corresponding recesses. Ex.1004[Weber], [0047]. Such lugs also allow rotational movement between "intermediate 126 and the inner and outer liners 122 and 128," which have "isolation dampers 130" between them "to further dissipate the energy of impacts." *Id.* [0045]. Ex.1002, ¶¶77, 112.

flow, which generates heat. Ex.1004[Weber], [0049]. As the specification also recognizes, fluids are absorptive/dissipative materials. Ex.1001[USP561], 6:35-37. Air is a type of fluid. Ex.1002, ¶¶114-115.

f) 1[e]: “an third shell layer connected to the second shell layer through a second energy transformer layer,”

Weber discloses 1[e]. Weber describes “one or more additional layers or liners” “between an *inner liner* and outer liner.” Ex.1004[Weber], [0045]. Weber also describes isolation dampers and air gaps disposed in a layer between the inner and intermediate liners. *See* Ex.1004[Weber], [0045]; Section VIII.A. Figure 4 shows *inner* (third shell layer) and *intermediate* (second shell layer) liners connected through a layer of the aggregate distribution of *isolation dampers* with surrounding air gaps. Ex.1004[Weber], [0038], [0045-46], Fig. 4. Ex.1002, ¶116.

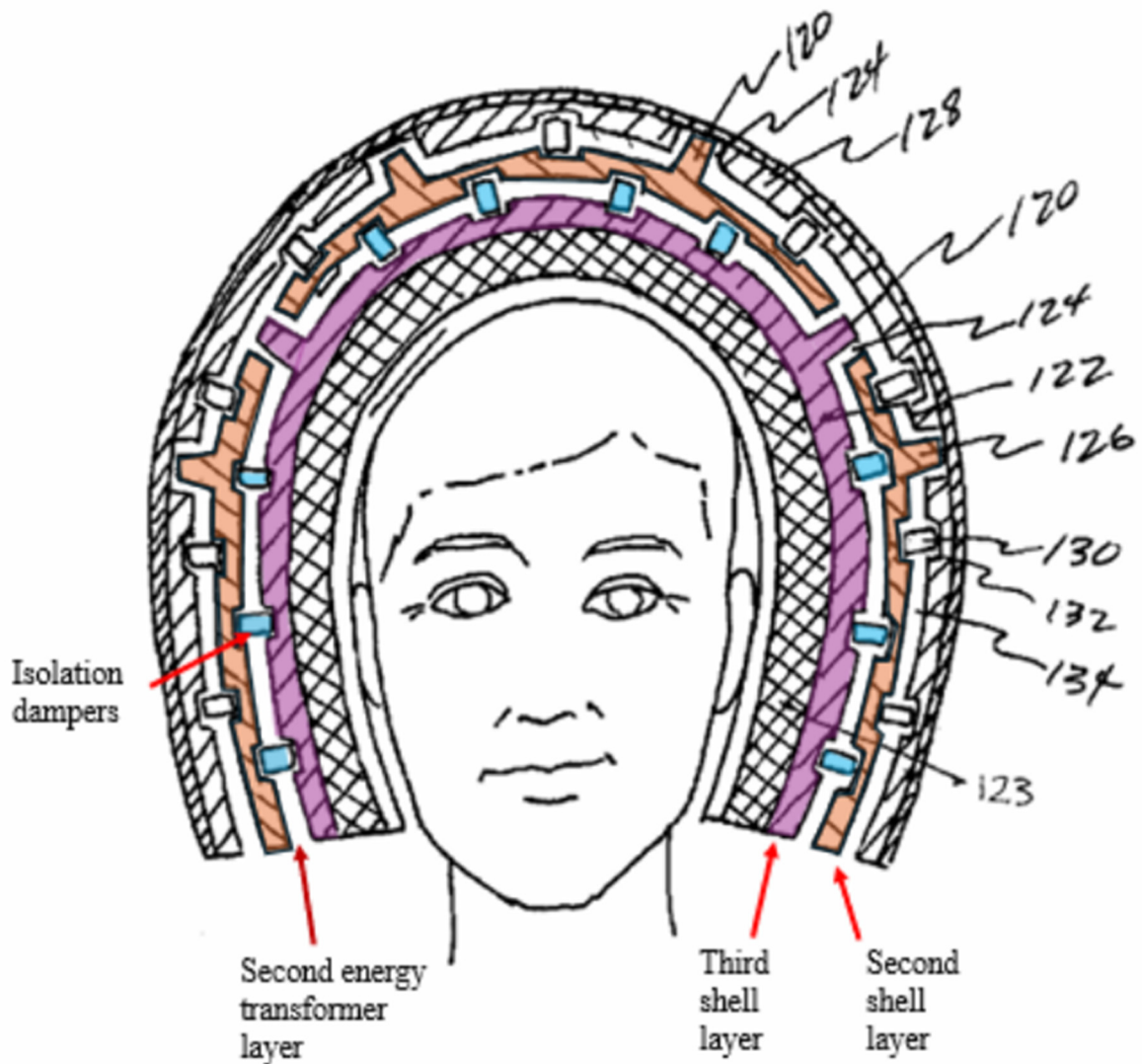


Fig. 4

Ex.1004[Weber], Fig. 4. Weber's inner liner made of, e.g., EPS, is a "third shell layer." See n.8. Ex.1002, ¶116.

g) 1[f]: "the second energy transformer layer including a second absorptive/dissipative material,"

Weber's dampers and air in a second energy transformer layer disclose 1[f] for the same reasons as 1[d]. Section X.A.2.e). Ex.1004[Weber], [0046], [0048], [0062], Fig. 4. Ex.1002, ¶117.

h) 1[g]: “the second energy transformer layer operable to absorb energy from forces imparted onto the second shell through the first shell and the first energy transformer layer.”

Weber discloses 1[g] for the same reasons as 1[c]. Section X.A.2.d). Weber discloses its helmet has “controlled, omnidirectional relative movement” that reduces forces “originating from the hard outer shell of the helmet ***to the head and brain of a wearer.***” Ex.1004[Weber], [0037]; *id.* [0008]. Thus, it discloses some forces originating from the outer (first) shell pass through the first layer of dampers/air at least to the intermediate liner (second shell layer). Weber also discloses additional inner isolation dampers/air in the layer between intermediate and inner liners allows relative movement to further absorb energy, like their operation in the layer between the outer and intermediate liners. Ex.1004[Weber], [0056] (isolation dampers control “impact force” and “how it is transferred from one liner to another liner”). Weber further confirms isolation dampers and surrounding air gaps are disposed in a layer “between, e.g., the ***inner*** and outer liners 122 and 128 ***and/or the intermediate liner 126 to further dissipate the energy of impacts.***” Ex.1004[Weber], [0045]. *See* Section X.A.2.d). Ex.1002, ¶118.

Therefore, Weber anticipates claim 1. Ex.1002, ¶119.

3. **Claim 7**

a) “The helmet of claim 1, wherein mechanical forces¹⁰ include impact forces.”

Weber discloses claim 1. Section X.A.2. Weber discloses claim 7’s additional limitation and anticipates it. Weber discloses, e.g., isolation dampers 130 “absorb the *energy of impacts* to the helmet.” Ex.1004[Weber], [0046]; *id.*, [0009], [0056]. See Sections X.A.2.d)-X.A.2.e). Ex.1002, ¶¶120-121.

4. **Claim 8**

a) “The helmet of claim 1, wherein mechanical forces include rotational and shear forces.”

Weber discloses claim 1. Section X.A.2. Weber discloses claim 8’s additional limitation and anticipates it. Weber’s helmets “significantly reduce the likelihood of both translational and *rotational*” injury, and “engagement between the inner and outer liners enables a controlled, omnidirectional *relative movement* between the two liners to reduce the transfer of *forces* and resulting accelerations originating from the hard outer shell of the helmet to the head and brain of a wearer.” Ex.1004[Weber], [0002], [0037], [0045-46] (isolation dampers between inner/intermediate and intermediate/outer liners “further dissipate” and “absorb the

¹⁰ For this IPR only, Petitioner treats “mechanical forces” in claims 7, 8, 16, and 17 as referring to “forces” in claims 1 and 10. Ex.1002, ¶120, n.11.

energy of impacts”); [0038] (air gaps). Weber recognizes impact forces its helmets address include “*rotational* and linear *forces*” and “*shear forces*.” Ex.1004[Weber], [0006], [0009]. Thus, Weber’s helmet is operable to absorb energy from rotational acceleration and shearing upon impact. Ex.1002, ¶¶122-123.

5. Claim 9

a) “The helmet of claim 1, wherein a lining layer is connected to the third shell layer, wherein the lining layer is configured to conform to a human head.”

Weber discloses claim 1. Section X.A.2. Weber discloses claim 9’s additional limitation and anticipates it. Weber discloses its “inner liner” (third shell layer) coupled at its inner surface to “a ‘**comfort**’ **liner 123** configured to closely surround the head.” Ex.1004[Weber], [0045]; *id.*, [0036], [0050]. Figure 4 shows this:

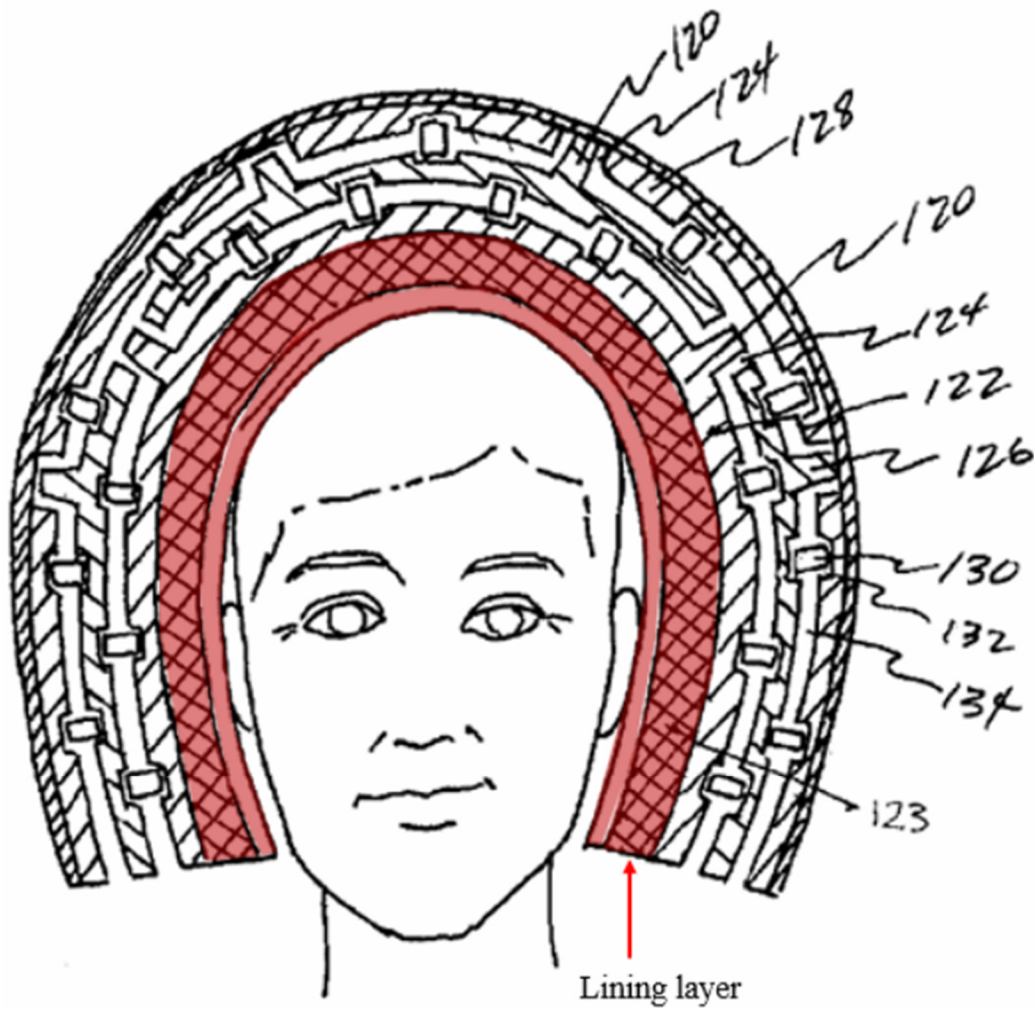


Fig. 4

Ex.1004[Weber], Fig. 4. Ex.1002, ¶124.

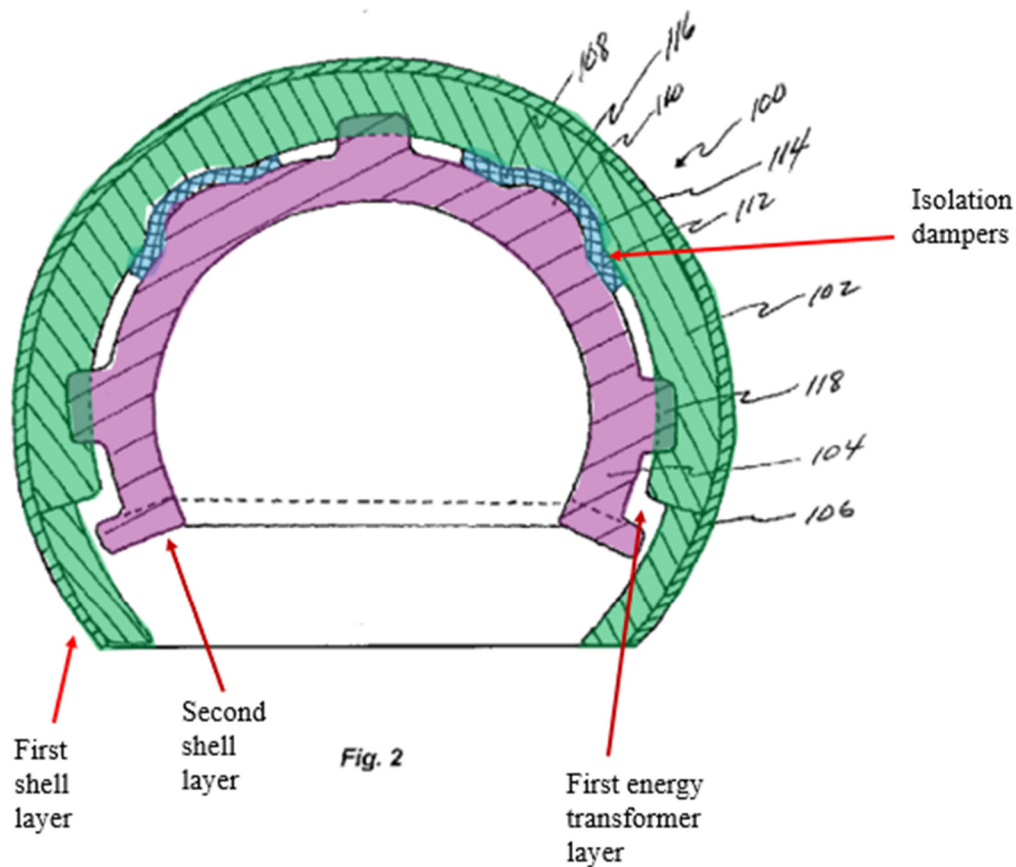
6. Claim 10

a) 10[preamble]: “A helmet comprising:”

Weber discloses “protective helmets.” Ex.1004[Weber], [0002]. Section X.A.2.a). Ex.1002, ¶125.

b) 10[a]: “a first shell layer;”

Weber discloses 10[a]. Weber discloses “outer liner 102” “attached directly to” “relatively hard helmet outer shell 106.” Ex.1004[Weber], [0039], Fig. 2. Weber’s **outer liner 102** affixed to an **outer shell** is a “first shell layer.” Section X.A.2.b). Ex.1002, ¶126.



Ex.1004[Weber], Fig. 2, [0039-40]; Ex.1002, ¶126.

c) 10[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,”

Weber discloses 10[b]. Weber discloses a second shell layer (**inner liner 104**). Weber states “outer liner 102 [is] disposed circumferentially around a similarly shaped **inner liner 104**.” Ex.1004[Weber], [0042]. Ex.1002, ¶127.

Weber further discloses a first energy transformer layer composed of **isolation dampers 108** and air gaps between first and second shell layers (liners 102 and 104), such that liners 102 and 104 are connected through it. Dampers 108 are “resilient, e.g., elastomeric, structures.” Ex.1004[Weber] [0040]. Weber states “isolation dampers 108 are disposed between the inner and outer liners 104 and 102,” Ex.1004[Weber], [0041], and “inner and outer liners 104 and 102 are coupled to each other” through the layer of isolation dampers. Ex.1004[Weber], [0040]. Section X.A.2.c). Ex.1002, ¶¶128-129.

As Section X.A.2.d) discusses, a layer of dampers and air gaps transforms energy. Ex.1002, ¶129.

d) 10[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Weber discloses 10[c]. Weber discloses isolation dampers “dissipate” or “**absorb the energy of impacts** to the helmet.” Ex.1004[Weber], [0044-46]; *id.*, [0037] (“shock absorbing and dampening components”), [0040] (“plurality of resilient...elastomeric, structures”). As Dr. Duma explains, Weber discloses its air gaps facilitate relative movement between outer and inner liners. Ex.1004[Weber],

[0049], [0046]. Weber further recognizes, consistent with the '561 Patent, Ex.1001[USP561], 9:9-12, Fig. 5, that relative sliding allowed by isolation dampers absorbs energy from forces imparted onto the first shell layer, Ex.1004[Weber], [0037] (relative movement/displacement “reduce[s] the transfer of forces and resulting accelerations originating from the hard outer shell of the helmet”); *id.* [0046] (dampers “absorb the energy of impacts”). Sections X.A.2.c), X.A.2.d). Ex.1002, ¶130.

e) 10[d]: “wherein the first energy transformer layer includes an absorptive/dissipative material to allow the first shell layer to slide relative to the second shell layer;”

Weber discloses 10[d]. As Section X.A.2.e) discusses, Weber’s isolation dampers and air gaps are made of material that absorbs and/or dissipates energy and allow relative sliding of layers. Ex.1002, ¶¶131-133.

f) 10[e]: “a lining layer connected to the second shell layer, wherein the lining layer is configured to conform to a human head.”

Weber discloses 10[e]. Weber’s inner liners, including Figure 2 inner liner/second shell layer 104, are “disposed in contact with the wearer’s head, either directly or via a...‘comfort liner.’” Ex.1004[Weber], [0036]; *id.*, [0044], [0050]. This “comfort liner” is connected to the second shell layer and configured to conform to a human head. Section X.A.5. Ex.1002, ¶134.

Thus, Weber anticipates claim 10. Ex.1002, ¶135.

7. Claim 16

a) “The helmet of claim 10, wherein mechanical forces include impact forces.”

Weber discloses claim 10. Section X.A.6. Weber discloses claim 16’s additional limitation for the reasons discussed for 10[c] and claim 7 and anticipates it. *See* Sections X.A.6.d), X.A.3. Ex.1002, ¶¶136-137.

8. Claim 17

a) “The helmet of claim 10, wherein mechanical forces include rotational and shear forces.”

Weber discloses claim 10. Section X.A.6. Weber discloses claim 17’s additional limitation for the reasons discussed for 10[c] and claim 8 and anticipates it. *See* Sections X.A.6.d), X.A.4. Ex.1002, ¶¶138-139.

9. Claim 18

Weber discloses claim 18 for the same reasons as claim 1. Section X.A.1. Ex.1002, ¶140. Further:

a) 18[preamble]: “Protective gear comprising:”

Weber discloses the preamble. Section X.A.2.a). The ’561 Patent specifies “helmets” are “protective gear.” Ex.1001[USP561], 1:23. Ex.1002, ¶141.

b) 18[a]: “a first shell layer;”

Weber discloses 18[a] for the same reasons as 1[a]. Section X.A.2.b). Ex.1002, ¶142.

c) 18[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

Weber discloses 18[b] for the same reasons as 1[b]. Section X.A.2.c).

Ex.1002, ¶143.

d) 18[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Weber discloses 18[c] for the same reasons as 1[c]. Section X.A.2.d).

Ex.1002, ¶144.

e) 18[d]: “wherein the first energy transformer layer includes first absorptive/dissipative means to allow the first shell layer to slide relative to the second shell layer;”

Weber discloses 18[d]. Weber discloses isolation dampers, i.e., “elastomeric materials,” Ex.1004[Weber], [0062], which are a structure within the claimed “means.” See Section IX (including “dampers”). As Sections X.A.2.d)-X.A.2.e) discuss, Weber’s isolation dampers also perform the claimed function of absorbing and/or dissipating energy and allowing the first shell layer to slide relative to the second shell layer. As also discussed there, Weber’s isolation dampers “flex, bend, and/or compress to absorb the energy of impacts to the helmet...and thereby enable...intermediate liner[]...126 to move relative to...outer liner 128.” Ex.1004[Weber], [0046], [0050]. As also discussed there, Weber’s air gaps are absorptive/dissipative materials that facilitate relative movement between the outer and other liners and are a structure within the claimed “means” to perform the

function of allowing the first shell layer to slide relative to the second shell layer.

See Section IX (including “fluids”). Ex.1002, ¶145.

f) 18[e]: “an third shell layer connected to the second shell layer through a second energy transformer layer,”

Weber discloses 18[e] for the same reasons as 1[e]. Section X.A.2.f).
Ex.1002, ¶146.

g) 18[f]: “the second energy transformer layer including a second absorptive/dissipative means,”

Weber discloses element 18[f] for the same reasons as 1[f] and 18[d]. Sections X.A.2.g), X.A.2.e). Weber’s inner isolation dampers, i.e., “elastomeric materials,” Ex.1004[Weber], [0062], and air gaps, Ex.1004[Weber], [0049], [0046], are structures within the claimed “means.” See Section IX (including “dampers” and “fluids”). Weber’s dampers and air gaps perform the claimed function of absorbing and/or dissipating energy. Ex.1004[Weber], [0045] (“isolation dampers...***further dissipate the energy of impacts***”); Ex.1001[USP561], 6:35-37 (fluids absorptive/dissipative materials). Ex.1002, ¶147.

h) 18[g]: “the second energy transformer layer operable to absorb energy from forces imparted onto the second shell through the first shell and the first energy transformer layer.”

Weber discloses 18[g] for the same reasons as 1[g]. Section X.A.2.h).
Ex.1002, ¶148.

Thus, Weber anticipates claim 18. Ex.1002, ¶149.

10. Claim 19

a) “The protective gear of claim 18, wherein a lining layer is connected to the third shell layer, wherein the lining layer is configured to conform to a human head.”

Weber discloses claim 18. Section X.A.9. Weber discloses claim 19 for the same reasons as claim 9 and anticipates it. Section X.A.5. Ex.1002, ¶¶150-151.

B. Ground 2: Claim 20 is Obvious over Weber Combined with Piper

1. Claim 20

a) “The protective gear of claim 18, wherein the lining layer comprises foam.”¹¹

Weber discloses claims 18 and 19. Section X.A.9-X.A.10. Weber combined with Piper discloses claim 20’s additional limitation. Piper discloses a “**comfort liner 212** next to the head 200 of the wearer” that is, e.g., “lower density, open-cell *foam* material that easily conforms to the head.” Ex.1009[Piper], [0109]; Ex.1002, ¶152.

¹¹ Claim 18 does not recite “lining layer,” but claim 19, which depends from claim 18, does. Solely for this IPR, and for all grounds, Petitioner addresses claim 20 as if dependent on claim 19. Ex.1002, n.14.

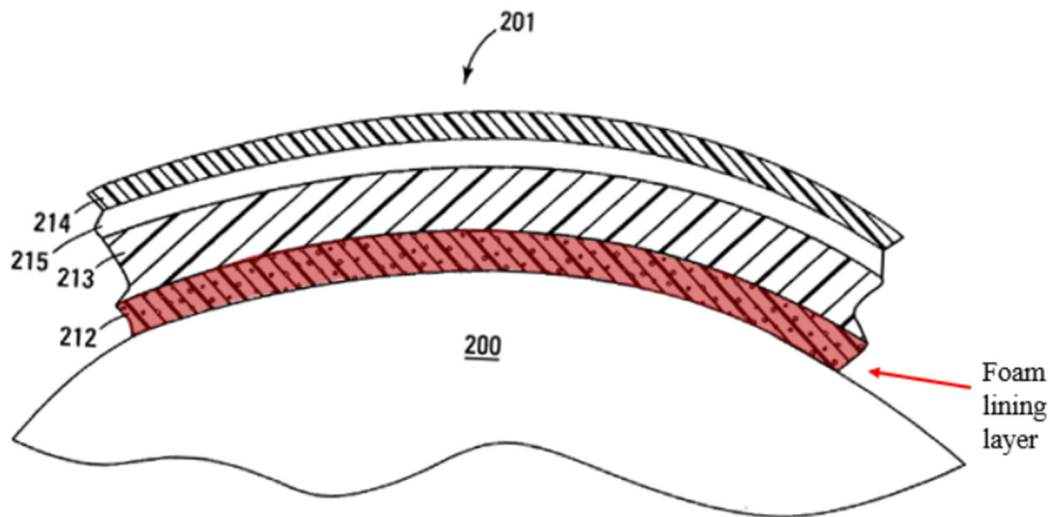


Fig. 3

Ex.1009[Piper] Fig. 3. Ex.1002, ¶152.

A POSA would have been motivated to combine Weber and Piper with a reasonable expectation of success. Weber and Piper are analogous to the challenged claims: they are in the same field (helmet design) and directed to the same problem (rotational impact)—with similar solutions (improving helmet safety with sliding layers). *E.g.*, Ex.1009[Piper], [0002]; Ex.1004[Weber], [0002], [0004]. While Weber discloses “‘comfort’ liner 123 configured to closely surround the head of the wearer,” Ex.1004[Weber], [0044-0045], it does not explicitly identify the material for such comfort liner. Piper provides those details (e.g., “lower density, open-cell foam material”) and the liner’s characteristics (“provides sweat and heat management characteristics”). Ex.1009[Piper], [0109]. A POSA would have been

motivated to incorporate Piper’s more-specific comfort liner 212 in Weber’s helmet to not only provide comfort and improve fit, but achieve heat and sweat management. This heat-reducing characteristic would enhance helmet safety by reducing risks of heat stress and lowering the temptation to remove or omit a helmet due to heat. Indeed, foam comfort liners were standard in many helmets. Ex.1025[Newman], 47 (“[C]ycling helmets have typically used small polyester *foam* pads” as “comfort padding”). A POSA would have found it obvious to combine these elements as a matter of routine implementation, as it is a straightforward and predictable combination of known elements according to known methods to yield predictable results, and Weber’s general comfort liner is ready for improvement through incorporation of Piper’s liner. This known technique of using a foam comfort liner would improve Weber’s helmet in a similar way to Piper. Ex.1002, ¶¶153-156.

A POSA would have reasonably expected success using Piper’s comfort liner in Weber’s design. Weber generally teaches a “comfort liner” and a POSA would have, as a matter of routine implementation, been able to configure Piper’s comfort liner to fit into Weber’s design. Ex.1002, ¶157.

Thus, Weber combined with Piper renders claim 20 obvious. Ex.1002, ¶158.

C. Ground 3: Von Holst Anticipates Claims 1, 6-10, 12, and 16-20

Von Holst discloses Claims 1, 6-10, 12, and 16-20 arranged as in each Challenged Claim for the reasons below. Ex.1002, ¶¶159-214.

1. Claim 1

a) 1[preamble]: “A helmet comprising:”

Von Holst discloses a “protective helmet” in Figures 1-2 and “variants” of the Figure-1 helmet in Figure 3:

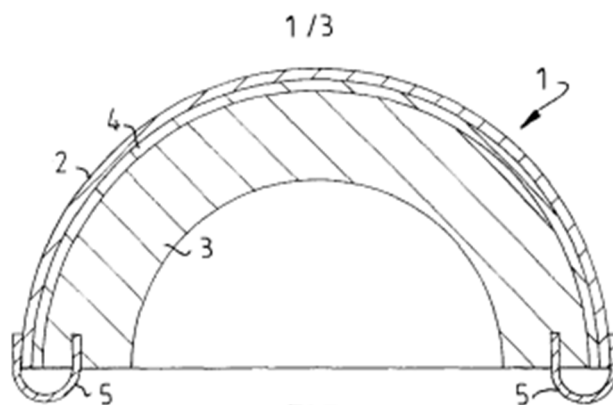


FIG. 1

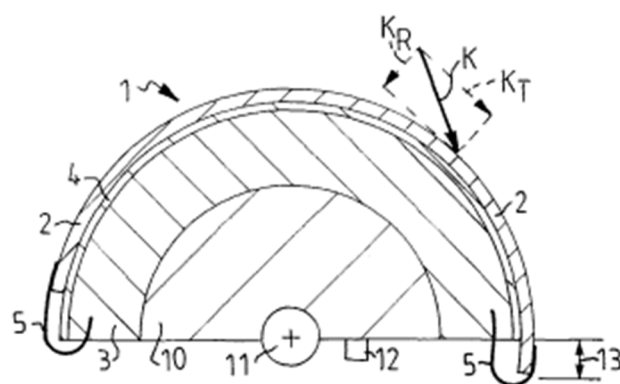


FIG. 2

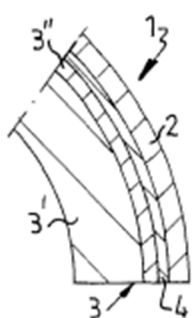


FIG. 3a

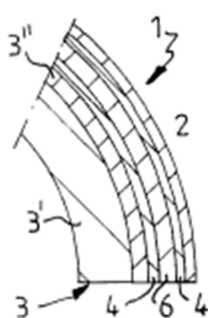


FIG. 3b

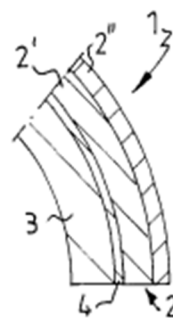


FIG. 3c

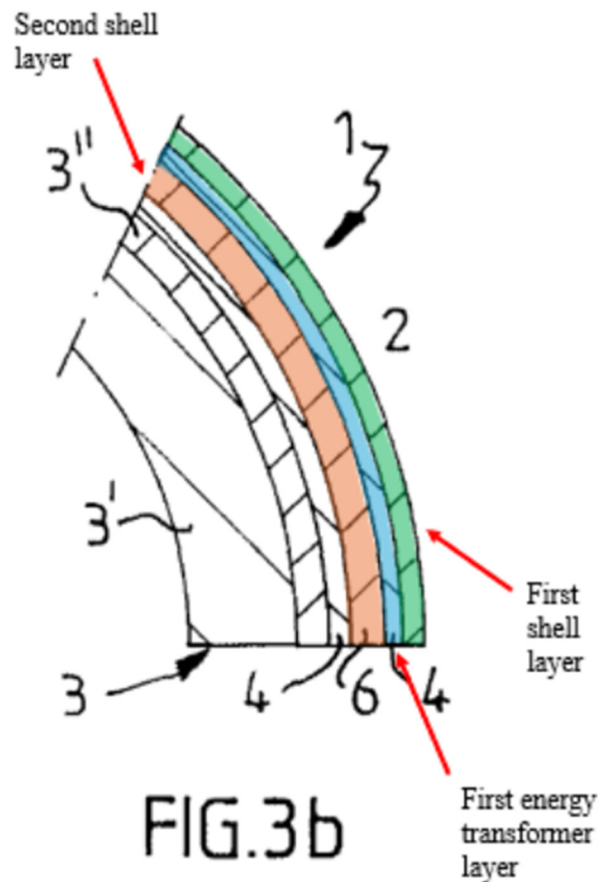
Ex.1005[VonHolst], 3:22-30, 4:10-14, Figs. 1-3, cls. 1-10. Ex.1002, ¶160.

b) 1[a]: “a first shell layer;”

Von Holst discloses 1[a]. Von Holst discloses a helmet “constructed from an **outer shell 2**” (first shell layer). Ex.1005[VonHolst], 4:10-12, Figs. 1-3, cl. 1. Ex.1002, ¶161.

c) 1[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

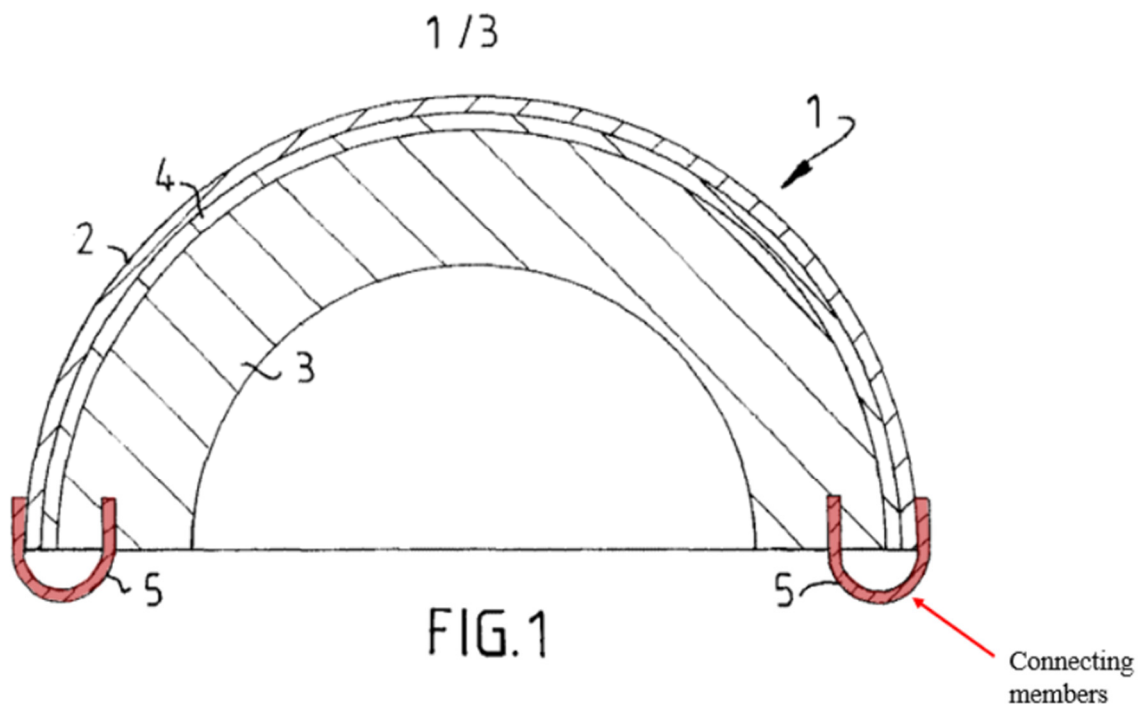
Von Holst discloses 1[b]. Von Holst discloses a helmet with “two sliding layers 4, between which there is an intermediate shell 6.” Ex.1005[VonHolst], 6:4-6. **Outer sliding layer 4, intermediate shell 6, and outer shell 2** are shown below:



Ex.1005[VonHolst], Fig. 3b; *id.* cls. 1, 4. Ex.1002, ¶162.

Von Holst's **intermediate shell 6** (second shell layer) and **outer shell 2** (first shell layer) are connected through **outer sliding layer 4**, between them. See Ex.1001[USP561], 2:14-23, 10:27-37; Ex.1002, ¶163.

Von Holst additionally includes “**connecting members**” that “absorb[] energy.” Ex.1005[VonHolst], 4:17-21; *id.*, 5:36-39 (Figure 3 “variant” of Figure 1 includes connecting members). As Figure 1 shows (as applicable to Figure 3), the “connecting members” connect outer and inner shell layers and layers in between.



Ex.1005[VonHolst], Fig. 1. Ex.1002, ¶¶164-165.

d) 1[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Von Holst discloses 1[c]. Von Holst's sliding layers 4 (energy transformer layers) absorb energy from forces imparted on the outer (first) shell layer through relative sliding. Ex.1005[VonHolst], Abstract, 4:15-17, 5:31-34, 6:35-7:10, Figs. 3-6, cls. 1, 4. These layers further absorb energy as friction between the outer layer and sliding layer, which can be made of "oil, Teflon, microspheres, air, rubber etc." Ex.1005[VonHolst], 4:32-34, 6:8-10; 7:38-8:2 (describing friction between layers). Outer sliding layer 4 is a first energy transformer layer. Ex.1002, ¶¶166-168.

e) 1[d]: "wherein the first energy transformer layer includes a first absorptive/dissipative material to allow the first shell layer to slide relative to the second shell layer;"

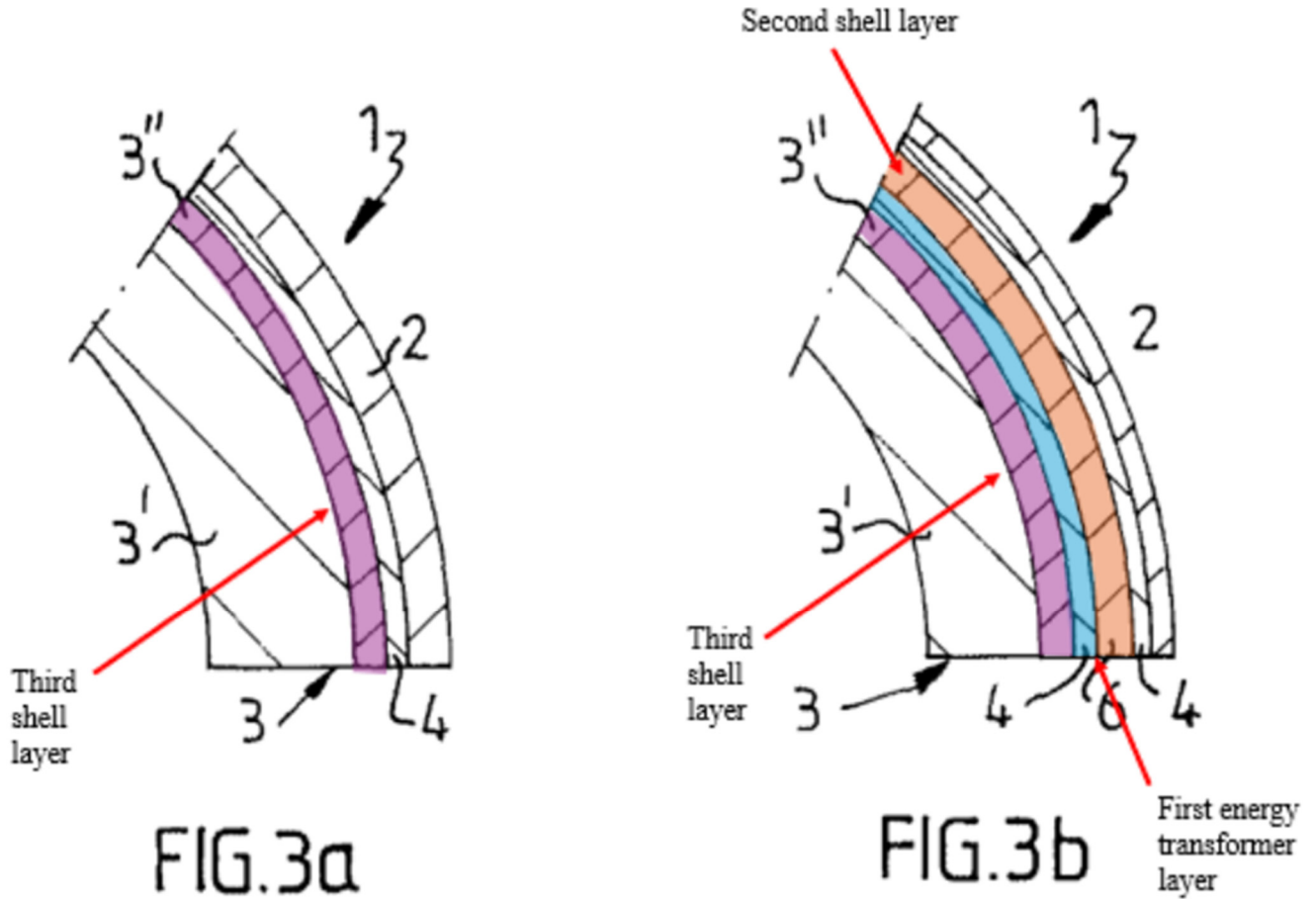
Von Holst discloses 1[d]. Von Holst's inner and outer sliding layers (energy transformer layers) are made of, e.g., "oil, Teflon, microspheres, air, rubber etc.," Ex.1005[VonHolst], 4:32-36, which are materials that absorb and/or dissipate energy via sliding and through the creation of heat from friction. See Ex.1001[USP561], 6:42-44. For example, Von Holst discloses "a significant improvement (lower force) of roughly 25% is obtained with an embodiment according to the invention" using "an oil film as the sliding layer." Ex.1005[VonHolst], 5:21-34; Ex.1002, ¶169.

Von Holst's sliding layers allow the first shell layer to slide relative to the second shell layer. The outer (first) shell layer slides against the outer sliding layer, and the intermediate (second) shell layer slides against the outer and inner sliding

layers, thus allowing the outer layer and intermediate layer to have “mutual displacement...by sliding.” Ex.1005[VonHolst], 8:12-14; *id.*, 6:2-10, Fig. 3b; Ex.1002, ¶170.

f) 1[e]: “an third shell layer connected to the second shell layer through a second energy transformer layer,”

Von Holst discloses 1[e]. Von Holst discloses a helmet with **intermediate shell layer 6** (second shell layer) connected to **outer layer 3"** of inner shell 3 (third shell layer) through **inner sliding layer 4**. Between outer shell 2 and inner shell 3 Von Holst describes “two sliding layers 4, between which there is an intermediate shell 6.” Ex.1005[VonHolst], 5:38-6:6. In the Figure 3a-3b variants, “inner shell 3 is constructed from a **harder, relatively thin outer layer 3"** and a softer, relatively thick inner layer 3'.” Ex.1005[VonHolst], 5:39-6:4. As shown below, intermediate and inner shells (6, 3) are connected through sliding layer 4, positioned between them. *See* Ex.1001[USP561], 2:14-23, 10:27-37. Section X.C.1.c); Ex.1002, ¶171.



Ex.1005[VonHolst], Figs. 3a-b. Ex.1002, ¶171.

g) 1[f]: “the second energy transformer layer including a second absorptive/dissipative material,”

Von Holst discloses 1[f] for the same reasons as 1[d]. Section X.C.1.e).

Ex.1005[VonHolst], 4:32-36, 5:21-34. Ex.1002, ¶172.

h) 1[g]: “the second energy transformer layer operable to absorb energy from forces imparted onto the second shell through the first shell and the first energy transformer layer.”

Von Holst discloses 1[g] for the same reasons as 1[d] and 1[f]. Sections X.C.1.e), X.C.1.g). Ex.1005[VonHolst], 4:32-36, 5:21-34. At least some force

imparted onto an outer shell would travel through outer sliding layer 4 (first energy transformer layer), to intermediate shell layer 6 (second shell layer). Inner sliding layer 4 would work like outer sliding layer 4 to absorb and/or dissipate energy from such force through relative sliding using absorptive/dissipative materials. Ex.1005[VonHolst], 4:32-36, 5:21-34. Inner sliding layer 4 (second energy transformer layer) is operable to absorb energy from forces imparted onto the second shell (intermediate shell layer 6) through the outer sliding layer 4 (first energy transformer layer). Ex.1002, ¶173.

Thus, Von Holst anticipates claim 1. Ex.1002, ¶164.

2. Claim 6

a) “The helmet of claim 1, wherein the first absorptive/dissipative material and the second absorptive/dissipative material are different.”

Von Holst discloses claim 1. Section X.C.1.a). Von Holst discloses claim 6’s additional limitation and anticipates it. Von Holst discloses “two sliding layers 4” “embodied differently and made of different materials,” including “lower friction in the outer sliding layer than in the inner.” Ex.1005[VonHolst], 6:6-10. Ex.1002, ¶175.

3. Claim 7

a) “The helmet of claim 1, wherein mechanical forces include impact forces.”

Von Holst discloses claim 1. Section X.C.1. Von Holst discloses claim 7's additional limitation and anticipates it. Von Holst's helmets' sliding layers allow relative displacement upon "oblique **impact** against the protective helmet." Ex.1005[VonHolst], cl. 1. "In this way, impact **energy from** an oblique **impact** against the helmet can be absorbed during displacement between the outer shell and the inner shell." Ex.1005[VonHolst], Abstract, 5:11-13. Sections X.C.1.d), X.C.1.g). Ex.1002, ¶¶176-177.

4. Claim 8

a) ***"The helmet of claim 1, wherein mechanical forces include rotational and shear forces."***

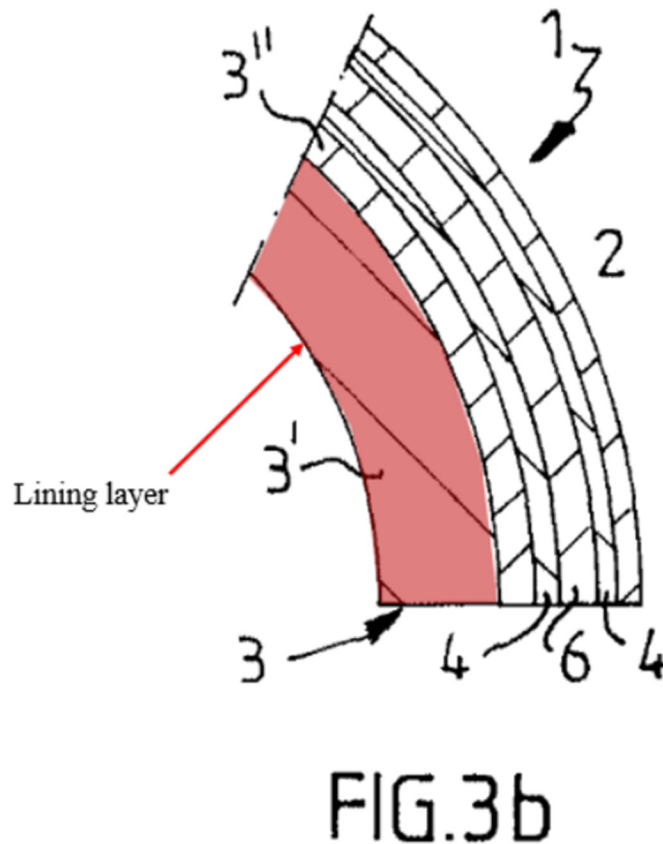
Von Holst discloses claim 1. Section X.C.1. Von Holst discloses claim 8's additional limitation and anticipates it. Von Holst's helmets cause "**reduction in the rotational acceleration....**" Ex.1005[VonHolst], 6:30-33, 7:1-5. As Dr. Duma explains, reducing rotational acceleration reduces shear. Ex.1002, ¶¶178-180.

5. Claim 9

a) ***"The helmet of claim 1, wherein a lining layer is connected to the third shell layer, wherein the lining layer is configured to conform to a human head."***

Von Holst discloses claim 1. Section X.C.1. Von Holst discloses claim 9's additional limitation and anticipates it. Von Holst discloses in Figures 3a-3b "inner shell 3 is constructed from a harder, relatively thin outer layer 3" and a softer,

relatively thick **inner layer 3'**.” Ex.1005[VonHolst], 5:39-6:4, cl. 6. It
“*contact[s]...the head of the wearer,*” Ex.1005[VonHolst], 9:13-15, and includes
softer **inner layer 3'** (lining layer) made of “polyurethane *foam* or [expanded]
polystyrene.” Ex.1005[VonHolst], 4:26-29.



Ex.1005[VonHolst], Fig. 3b. Ex.1002, ¶¶181-182.

6. **Claim 10**

a) *10[preamble]: “A helmet comprising:”*

Von Holst discloses “protective helmet[s].” Ex.1005[VonHolst], 4:10-14.

Ex.1002, ¶183.

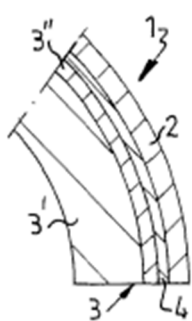
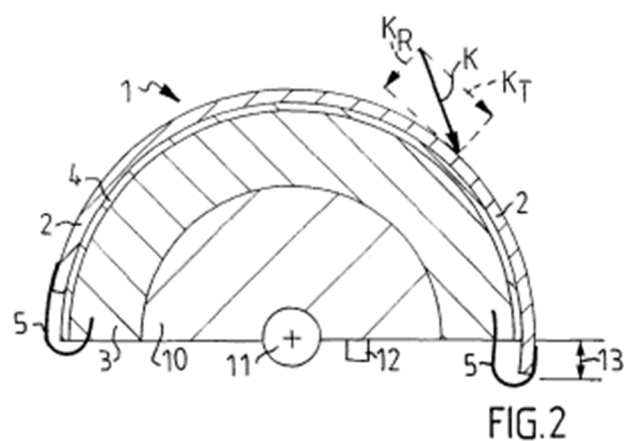
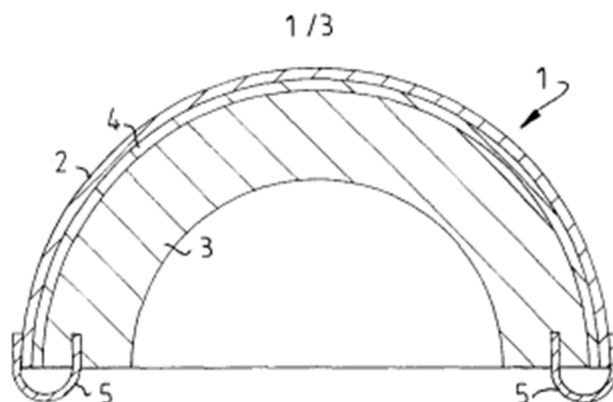


FIG. 3a

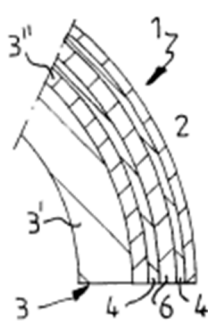


FIG. 3b

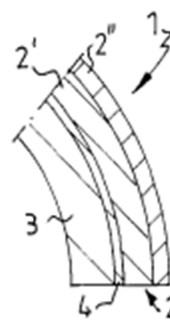


FIG. 3c

Ex.1005[VonHolst], Figs. 1-3. Section X.C.1.a). Ex.1002, ¶183.

b) 10[a]: “a first shell layer;”

Von Holst discloses 10[a]. In, e.g., Figure 3a, Von Holst discloses a helmet “constructed from an *outer shell 2*,” which is a first shell layer. Ex.1005[VonHolst], 4:10-12, 5:36-6:2. Section X.C.1.b). Ex.1002, ¶184.

c) 10[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

Von Holst discloses 10[b]. Von Holst discloses a second shell layer, **outer layer 3** of inner shell 3. Ex.1005[VonHolst], 4:15; Ex.1002, ¶185.

Von Holst discloses second shell layer 3" connected to first shell layer 2 through first energy transformer layer 4. Von Holst discloses that “sliding layer 4...makes possible displacement between the outer shell 2 and the inner shell 3.” Ex.1005[VonHolst], 4:14-17, 5:38-6:2. The **sliding layer 4, outer layer 3** of inner shell 3, and **outer shell 2** are depicted below:

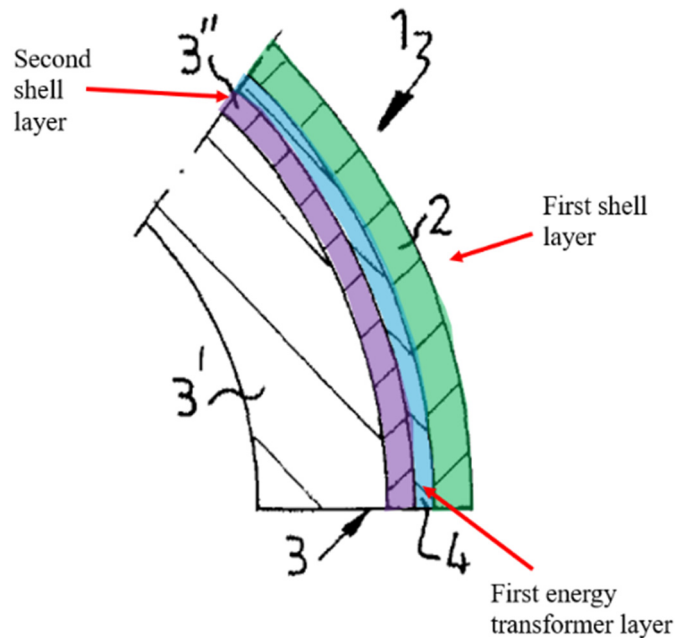
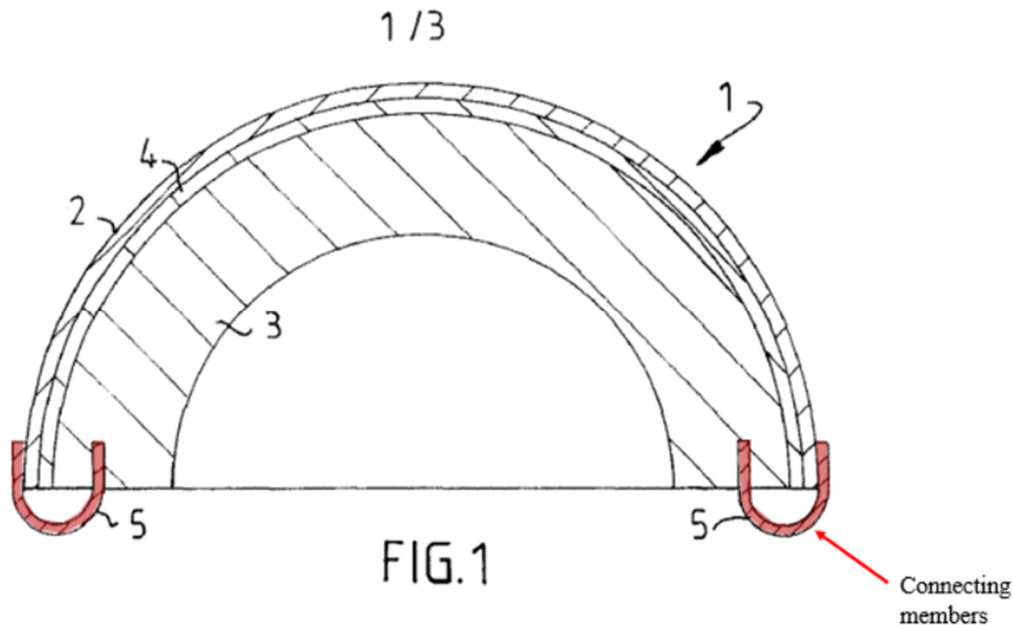


FIG.3a

Ex.1005[VonHolst], Fig. 3a. Ex.1002, ¶186.

Von Holst’s **outer layer 3**” of inner shell 3 (second shell layer) and **outer shell 2** (first shell layer) are connected through **sliding layer 4** of, e.g., oil (first energy transformer layer), positioned between them. *See* Ex.1001[USP561], 2:16-25, 10:37-47. Section X.C.1.c). Ex.1002, ¶187.

Von Holst additionally includes “**connecting members**” that “absorb[] energy.” Ex.1005[VonHolst], 4:17-21; *id.*, 5:36-39. As Figure 1 shows, this “connecting member” connects outer and inner shell layers and the sliding layer in between.



Ex.1005[VonHolst], Fig. 1. Ex.1002, ¶188.

d) 10[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Von Holst discloses 10[c]. Von Holst’s sliding layer 4 absorbs energy from mechanical forces through relative sliding. Ex.1005[VonHolst], Abstract, 4:15-17, 5:31-34, 6:35-7:10, Figs. 1, 3a, 4-6, cls. 1, 4. This layer further absorbs energy as friction between the outer layer and sliding layer, which can be made of “oil, Teflon, microspheres, air, rubber etc.” Ex.1005[VonHolst], 4:32-34, 6:8-10; 7:38-8:2 (describing friction between layers). Thus, sliding layer 4 (first energy transformer layer) absorbs energy from mechanical forces imparted onto the outer layer. *Id.*, 5:31-34, 6:35-7:10, Figs. 1, 3-6, cls. 1, 4. Section X.C.1.c)-X.C.1.d). Ex.1002, ¶189.

e) 10[d]: “wherein the first energy transformer layer includes an absorptive/dissipative material to allow the first shell layer to slide relative to the second shell layer;”

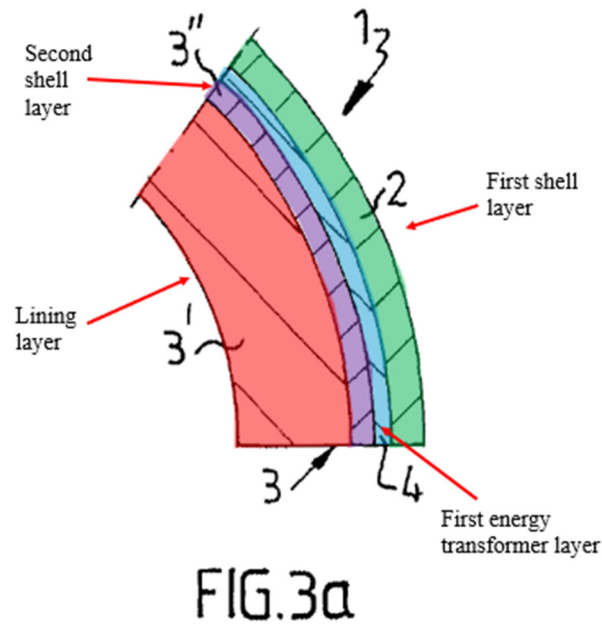
Von Holst discloses 10[d] for the reasons as 1[d] above. Section X.C.1.e). Von Holst’s sliding layer 4 is made of, e.g., “*oil*, Teflon, microspheres, *air*, rubber etc.,” Ex.1005[VonHolst], 4:32-36, which absorb and/or dissipate energy via sliding and through the creation of heat from friction. Ex.1001[USP561], 6:44 (“absorptive/dissipative material such as *fluids*”). For example, Von Holst discloses that “significant improvement (lower force) of roughly 25% is obtained with an embodiment” using “oil film as the sliding layer.” Ex.1005[VonHolst], 5:21-34.¹² Ex.1002, ¶190.

Sliding layer 4 also allows outer shell 2 (first shell layer) to slide relative to **outer layer 3** of inner shell 3 (second shell layer). Ex.1005[Von Holst], 4:14-17; *id.*, 8:12-14 (“sliding layer...facilitates mutual displacement [between layers]...by sliding”). Section X.C.1.e). Ex.1002, ¶191.

f) 10[e]: “a lining layer connected to the second shell layer, wherein the lining layer is configured to conform to a human head.”

¹² Further, connecting members 5, e.g., made of “deformable strips of plastic or metal,” Ex.1005[VonHolst], 4:38-39, deform to absorb energy. Ex.1002, ¶190, n.18.

Von Holst discloses 10[e] for the same reasons as claim 9. Section X.C.5. Further, Von Holst discloses “[i]n Fig. 3a, the inner shell 3 is constructed from a harder, relatively thin outer layer 3" [second shell layer] and a softer, relatively thick **inner layer 3'** [lining layer].”



Ex.1005[VonHolst], 5:36-6:2, Fig. 3a. “[I]nner shell 3...is intended for contact with the head of the wearer.” Ex.1005[VonHolst], 4:12-13, 9:13-15. Von Holst’s inner shell 3, with softer inner layer 3', is “made of...polyurethane foam or expanded polystyrene.” Ex.1005[VonHolst], 4:26-29. Thus, the inner shell’s inner layer 3' is configured to conform to a human wearer’s head. Section X.C.5. Ex.1002, ¶¶192-193.

Thus, Von Holst anticipates claim 10. Ex.1002, ¶194.

7. Claim 12

a) “The helmet of claim 10, wherein the absorptive/dissipative material comprises a fluid.”

Von Holst discloses claim 10. Section X.C.6. Von Holst discloses claim 12’s additional limitation and anticipates it. Von Holst’s sliding layer 4 comprises fluids (e.g., air/oil). Ex.1005[VonHolst], 4:32-34. Ex.1002, ¶¶195-196.

8. Claim 16

a) “The helmet of claim 10, wherein mechanical forces include impact forces.”

Von Holst discloses claim 10. Section X.C.6. Von Holst discloses claim 16’s additional limitation for the same reasons as claims 7 and 10 (i.e., forces imparted onto the first shell layer and addressed by Von Holst’s Figure 1 and 3 helmets include mechanical forces) and anticipates it. *Id.*, Section X.C.3; Ex.1002, ¶¶197-198.

9. Claim 17

a) “The helmet of claim 10, wherein mechanical forces include rotational and shear forces.”

Von Holst discloses claim 10. Section X.C.6. Von Holst discloses claim 17’s additional limitation for the same reasons as claims 8 and 10 (i.e., forces imparted onto the first shell layer and addressed by Von Holst’s Figure 1 and 3 helmets include rotational and shear forces) and anticipates it. *Id.*, Section X.C.4; Ex.1002, ¶¶199-200.

10. Claim 18

Von Holst discloses claim 18 for the same reasons as claim 1. Section X.C.1;
Ex.1002, ¶201. Further:

a) 18[preamble]: “Protective gear comprising:”

Von Holst discloses 18[preamble] for the same reasons as 1[preamble].
Section X.C.1.a). “Helmets” are “protective gear.” Ex.1001[USP561], 1:23;
Ex.1002, ¶202.

b) 18[a]: “a first shell layer;”

Von Holst discloses 18[a] for the same reasons as 1[a]. Section X.C.1.b).
Ex.1002, ¶203.

c) 18[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

Von Holst discloses 18[b] for the same reasons as 1[b]. Section X.C.1.c).
Ex.1002, ¶204.

d) 18[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Von Holst discloses 18[c] for the same reasons as 1[c]. Section X.C.1.d).
Ex.1002, ¶205.

e) 18[d]: “wherein the first energy transformer layer includes first absorptive/dissipative means to allow the first shell layer to slide relative to the second shell layer;”

Von Holst discloses 18[d]. Von Holst discloses sliding layers including “oil” and “air,” Ex.1005[VonHolst], 4:32-34, which are structures within the claimed “means.” Section IX (“fluids”). Von Holst’s sliding layers also perform the claimed function of absorbing and/or dissipating energy and allowing the outer shell 2 (first shell layer) and intermediate shell 6 (second shell layer) to slide against the outer sliding layer 4 (first energy transformer layer) and relative to each other thereby producing “mutual displacement...by sliding.” Ex.1005[VonHolst], 8:12-14; *id.*, 6:2-10, Fig. 3b. See 1[b], 1[c]. Sections X.C.1.c)-X.C.1.d). Ex.1002, ¶206.

f) 18[e]: “an third shell layer connected to the second shell layer through a second energy transformer layer,”

Von Holst discloses 18[e] for the same reasons as 1[e]. Section X.C.1.f). Ex.1002, ¶207.

g) 18[f]: “the second energy transformer layer including a second absorptive/dissipative means,”

Von Holst discloses 18[f] for the same reasons as 1[d], 1[f], and 18[d]. Sections X.C.1.e), X.C.1.g), X.C.10.e). Ex.1002, ¶208.

h) 18[g]: “the second energy transformer layer operable to absorb energy from forces imparted onto the second shell through the first shell and the first energy transformer layer.”

Von Holst discloses 18[g] for the same reasons as 1[g]. Section X.C.1.h). Ex.1002, ¶209.

Thus, Von Holst anticipates claim 18. Ex.1002, ¶210.

11. Claim 19

a) “The protective gear of claim 18, wherein a lining layer is connected to the third shell layer, wherein the lining layer is configured to conform to a human head.”

Von Holst discloses claim 18. Section X.C.10. Von Holst discloses claim 19’s additional limitation for the same reasons as claim 9 and anticipates it. Section X.C.5. Ex.1002, ¶¶211-212.

12. Claim 20

a) “The protective gear of claim 18, wherein the lining layer comprises foam.”

Von Holst discloses claims 18 and 19. Sections X.C.10-X.C.11. Von Holst discloses claim 20’s additional limitation and anticipates it. Von Holst discloses inner shell 3 with softer **inner layer 3'** “made of...polyurethane *foam*.” Ex.1005[VonHolst], 4:26-29; Ex.1002, ¶¶213-214.

D. Ground 4: Claims 1, 6-10, 12, and 16-20 are Obvious over Von Holst Combined with Halldin

1. Dynamic Drinkware Analysis: Halldin

The relied-upon subject matter in *Halldin* has 35 U.S.C. §112, first paragraph, support from *Halldin Provisional* (Ex.1015[HalldinProv]).

<i>Halldin</i>	<i>Halldin Provisional</i>
Fig. 1	Fig. 1
Fig. 2	Fig. 2
Fig. 3	Fig. 3
Fig. 4	Fig. 4
Fig. 11	Fig. 11

Petition for *Inter Partes Review*
of U.S. Patent No. 9,060,561

[Title]	[0001]
[0001]	[0001]
[0005]	[0005]
[0012]	[0011]
[0013]	[0012]
[0042]	[0040]
[0043]	[0041]
[0044]	[0041]
[0046]	[0042]
[0047]	[0043]
[0048]	[0044]
[0050]	[0046]
[0052]	[0048]
[0057]	[0053]
[0059]	[0055]
[0062]	[0058]
[0064]	[0060]
[0065]	[0060]
[0066]	[0061]

Ex.1002, ¶¶215-216.

At least *Halldin* claim 7 has written-description support from *Halldin Provisional* (Ex.1015[HalldinProv]).

<i>Halldin</i>	<i>Halldin Provisional</i>
1. A helmet; comprising an energy absorbing layer (2) and an attachment device (3) provided for attachment of the helmet to a wearer's head, wherein a sliding facilitator (5) is being provided inside of the energy absorbing layer (2) and the sliding facilitator (5) is fixated to the attachment device (3) and/ of the inside of the energy	Claims 1, 2, and 3 [0001], [0003], [0004], [0009], [0010]

absorbing layer (2) for providing slidability between the energy absorbing layer (2) and the attachment device (3).	
7. A method of manufacturing a helmet comprising a sliding facilitator, the method comprising the steps of:	Claim 9 [0008], [0011], [0014], [0041]
providing an energy absorbing layer in a mould, and	Claim 9 [0008], [0011], [0014], [0041]
providing a sliding facilitator in relation to the energy absorbing layer.	Claim 9 [0008], [0011], [0014], [0041]

Ex.1002, ¶217.

2. Claim 1

a) 1[preamble]: “A helmet comprising:”

Von Holst discloses the preamble. Section X.C.1.a). Halldin does also.

Ex.1006[Halldin], [Title] (“Helmet...”). Ex.1002, ¶218.

b) 1[a]: “a first shell layer;”

Von Holst discloses 1[a]. Section X.C.1.b). Halldin does also.

Ex.1006[Halldin], [0012] (“outer shell”), [0001], [0013], [0042-0043], Fig. 1, cls. 1-

2. Ex.1002, ¶219.

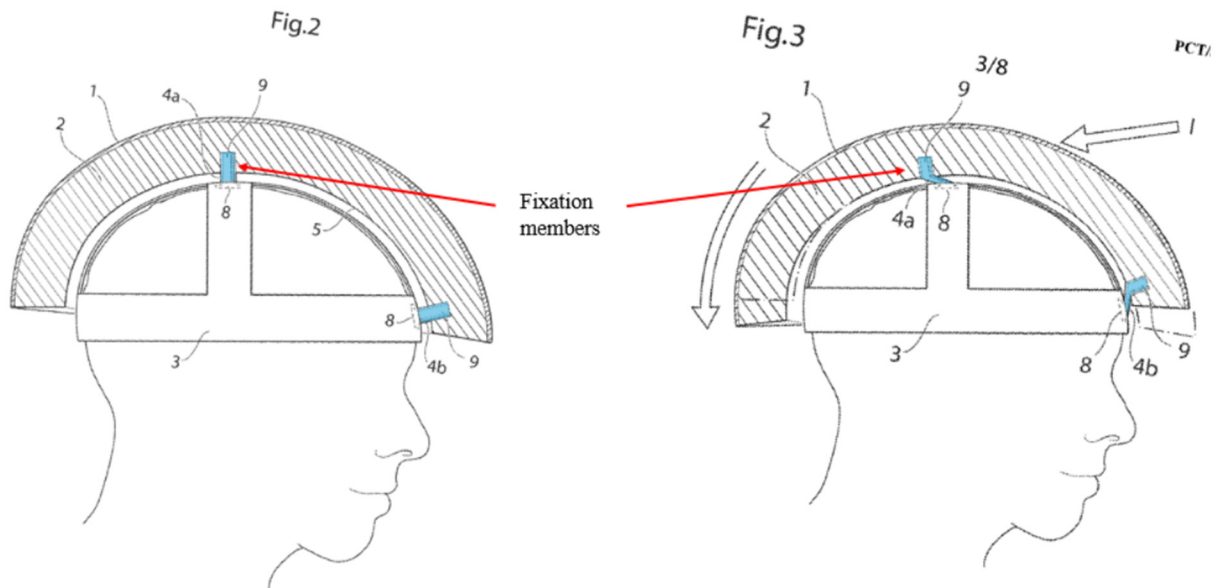
c) 1[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

Von Holst discloses 1[b]. Section X.C.1.c). If PO argues Von Holst does not disclose connection through a first energy transformer layer, it would have been

obvious to incorporate Halldin's fixation members to "connect" Von Holst's middle (second) and outer (first) shell layers. Ex.1002, ¶¶220-229.

Halldin teaches helmets with an outer shell connected to an attachment device by "fixation members." Ex.1006[Halldin], [0013]. Halldin teaches multiple fixation members, including members 4a-4d that "absorb energy by deforming in an elastic, semi-elastic or plastic way." Ex.1006[Halldin], [0043], Fig. 3. Ex.1002, ¶221.

Halldin's **fixation members** (e.g., 4a and 4b) connect helmet layers while allowing relative sliding between them and energy absorption. Ex.1006[Halldin], [0047] (fixation members allow "energy absorbing layer 2 to slide in relation to the attachment device 3" and "[t]he fixation absorbs the rotational forces by deforming elastically or semi-elastically"), Figs. 2-3:



Ex.1006[Halldin], Figs. 2, 3; Ex.1002, ¶222.

A POSA would have been motivated to modify Von Holst to incorporate Halldin's fixation members. Von Holst and Halldin are analogous to the challenged claims: both are directed to the same field (helmet safety design), and address the same problem of rotational impact with the same solution of sliding mechanisms. They also share a common inventor. While Von Holst describes layers connected through transformer layers and a connecting member, Halldin teaches additional ways to connect layers while maintaining desired sliding to address impact forces. A POSA would have been motivated to include Halldin's fixation connections, which connect layers and also "absorb energy" by "deforming," Ex.1006[Halldin], [0043], thereby supplementing energy absorption from sliding layers 4. Ex.1002, ¶¶223-224.

A POSA would also have been motivated to use Halldin's internal connections (i.e., members 4a-d) to replace or supplement peripheral connecting member 5. Halldin teaches peripheral and internal fixation were known, available alternatives that could be used individually or together. *E.g.*, Ex.1006[Halldin], [0057], Fig. 11; *id.*, [0064] (combination of "master" and "additional fixation members"). A POSA would have been motivated to improve Von Holst with internal fixation connections to increase connection throughout the helmet and provide additional mechanisms to absorb energy. A POSA would have found it

obvious to combine these elements as a matter of routine implementation, as their combination is a straightforward and predictable combination of known elements according to known methods to yield predictable results, and Von Holst's helmet with sliding layers was ready for improvement through incorporating a layer of internal fixation members that additionally absorb energy. The known technique of using fixation members from Halldin to create a connecting layer and absorb energy would have improved Von Holst's helmet in a similar way to Halldin. Ex.1002, ¶¶225-228.

A POSA would have a reasonable expectation of success modifying Von Holst as described. Halldin's helmet is readily applicable to Von Holst. Like Von Holst's sliding layers, Halldin describes "sliding facilitator 5 [Fig. 2] [that] may be a low friction material," "provided on outside of the attachment device 3 facing the energy absorbing layer 2" or "on the inside of the energy absorbing layer 2." Ex.1006[Halldin], [0044]. Halldin's fixation members are not exclusive to its embodiments, and a POSA would have readily adapted them to other designs, e.g., Von Holst's helmets, as a matter of routine implementation: "the attachment device 3 could be...any other design functioning as an attachment device for mounting on a wearer's head." Ex.1006[Halldin], [0050]. For example, Halldin teaches fixation members fixated to the outer energy absorbing layer via an "adhesive."

Ex.1006[Halldin], [0052]. Thus, a POSA would have reasonably expected to be able to implement Halldin's fixation members to connect Von Holst's intermediate (second) shell layer to the outer (first) shell layer. Ex.1002, ¶229.

d) 1[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Von Holst discloses 1[c]. Section X.C.1.d). Halldin discloses 1[c] also, teaching “energy absorbing layer” with “fixation members” to absorb energy. Ex.1006[Halldin], [0013] (“***absorbed rotational energy***” reduces “rotational acceleration affecting the brain....”); *id.* [0043]. Ex.1002, ¶230.

e) 1[d]: “wherein the first energy transformer layer includes a first absorptive/dissipative material to allow the first shell layer to slide relative to the second shell layer;”

Von Holst discloses 1[d]. Section X.C.1.e). Halldin discloses fixation members made of elastic, semi-elastic, or plastic material that “absorb energy and forces by deforming in an elastic, semi-elastic or plastic way.” Ex.1006[Halldin], [0013]; *id.*, [0043], [0046]. Dr. Duma explains this mechanical deformation dissipates energy. Halldin's fixation members therefore absorb and/or dissipate energy and allow displacement and relative sliding of outer and inner layers. *Id.*, [0013], [0043], [0047-48], Fig. 4. Ex.1002, ¶231.

f) 1[e]: “an third shell layer connected to the second shell layer through a second energy transformer layer,”

Von Holst discloses 1[e]. Section X.C.1.f). If PO argues Von Holst does not disclose “second energy transformer layer” connecting third and second shell layers, a POSA would have been motivated to modify Von Holst to connect inner (third) and middle (second) shell layers using Halldin’s fixation members for the same reasons as 1[b]. A POSA would have reasonably expected to be able to implement a second layer of Halldin’s fixation members. Multi-layered helmets, including with multiple connections across multiple layers, were well-known, including Weber’s connection points through multiple layers. Section X.C.1.c); Ex.1007[Kleiven] [0031], Figs. 1d, 2d; Ex.1018[Ferrara-2007], [0086], [0097-98], Fig. 19; Ex.1017[Nichols], 3:32-4:6, Figs. 6-8; Ex.1019[Hawkins], [0050], Figs. 4-7, 16; Ex.1002, ¶232.

g) 1[f]: “the second energy transformer layer including a second absorptive/dissipative material,”

Von Holst discloses 1[f]. Section X.C.1.g). Halldin also discloses a layer including fixation members that absorb and/or dissipate energy and allow displacement and relative sliding of outer and inner layers. Ex.1006[Halldin] [0013], [0043], [0047-48], Fig. 4. Section X.A.2.f). A POSA would have been motivated to and reasonably expected to be able to implement a second layer of Halldin’s fixation members. Section X.A.2.f). Ex.1002, ¶233.

h) 1[g]: “the second energy transformer layer operable to absorb energy from forces imparted onto the second shell through the first shell and the first energy transformer layer.”

Von Holst and Halldin teach 1[g] for the same reasons as 1[c]. Sections X.C.1.h), X.C.1.d). As Section X.C.1.h) discusses, the second energy transformer layer (Von Holst’s inner sliding layer 4 with Halldin’s fixation members) would absorb energy not fully absorbed when arriving at the middle shell layer. Ex.1002, ¶¶234-235.

Thus, Von Holst combined with Halldin renders claim 1 obvious. Ex.1002, ¶236.

3. Claim 6

a) “The helmet of claim 1, wherein the first absorptive/dissipative material and the second absorptive/dissipative material are different.”

Von Holst combined with Halldin teaches claim 1. Section X.D.2. Von Holst teaches claim 6’s additional limitation and renders it obvious. Section X.C.2. Ex.1002, ¶¶237-238.

4. Claim 7

a) “The helmet of claim 1, wherein mechanical forces include impact forces.”

Von Holst combined with Halldin teaches claim 1. Section X.D.2. The combination teaches claim 7’s additional limitation and renders it obvious. Sections

X.C.1.d), X.C.1.h), X.D.2.e), X.D.2.h), X.C.3; Ex.1006[Halldin], [0005], [0065-66].
Ex.1002, ¶¶239-240.

5. Claim 8

a) “The helmet of claim 1, wherein mechanical forces include rotational and shear forces.”

Von Holst combined with Halldin teaches claim 1. Section X.D.2. The combination teaches claim 8’s additional limitation and renders it obvious. Section X.C.4; Ex.1006[Halldin], [0005], [0065-66]. Ex.1002, ¶¶241-242.

6. Claim 9

a) “The helmet of claim 1, wherein a lining layer is connected to the third shell layer, wherein the lining layer is configured to conform to a human head.”

Von Holst combined with Halldin teaches claim 1. Section X.D.2. The combination teaches claim 9’s additional limitation and renders it obvious. Section X.C.5. Ex.1002, ¶¶243-244.

7. Claim 10

a) 10[preamble]: “A helmet comprising:”

Von Holst discloses the preamble. Section X.C.6.a). Halldin does also. Ex.1006[Halldin], [Title] (“Helmet...”). Ex.1002, ¶245.

b) 10[a]: “a first shell layer;”

Von Holst discloses 10[a]. Section X.C.6.b). Halldin does also. Ex.1006[Halldin], [0012] (“outer shell”), [0001], [0013], [0042-0043], Fig. 1, cls. 1-2. Ex.1002, ¶246.

c) 10[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

Von Holst discloses 10[b]. Section X.C.6.c). If PO argues Von Holst does not disclose a “first energy transformer layer” that “connect[s]” the second shell layer to the first, Von Holst’s sliding intermediate layer incorporating Halldin’s fixation members teaches this element. See Section X.D.2.c). Ex.1002, ¶247.

d) 10[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Von Holst discloses 10[c]. Section X.C.6.d). Halldin also discloses 10[c]. Section X.D.2.d). Ex.1002, ¶248.

e) 10[d]: “wherein the first energy transformer layer includes an absorptive/dissipative material to allow the first shell layer to slide relative to the second shell layer;”

Von Holst discloses 10[d]. Section X.C.6.e). Halldin also discloses 10[d]. Section X.D.2.e). Ex.1002, ¶249.

f) 10[e]: “a lining layer connected to the second shell layer, wherein the lining layer is configured to conform to a human head.”

Von Holst discloses 10[e]. Section X.C.6.f). Ex.1002, ¶250.

Thus, Von Holst combined with Halldin renders claim 10 obvious. Ex.1002, ¶251.

8. Claim 12

a) “The helmet of claim 10, wherein the absorptive/dissipative material comprises a fluid.”

Von Holst combined with Halldin teaches claim 10. Section X.D.7. Von Holst teaches claim 12’s additional limitation and renders it obvious. Section X.C.7. Ex.1002, ¶¶252-253.

9. Claim 16

a) “The helmet of claim 10, wherein mechanical forces include impact forces.”

Von Holst combined with Halldin teaches claim 10. Section X.D.7. The combination teaches claim 16’s additional limitation and renders it obvious. Section X.D.4. Ex.1002, ¶¶254-255.

10. Claim 17

a) “The helmet of claim 10, wherein mechanical forces include rotational and shear forces.”

Von Holst combined with Halldin teaches claim 10. Section X.D.7. The combination teaches claim 17’s additional limitation and renders it obvious. Section X.D.5. Ex.1002, ¶¶256-257.

11. Claim 18

Von Holst combined with Halldin discloses claim 18 for the same reasons as claim 1. Section X.D.2. Ex.1002, ¶258. Further:

a) 18[preamble]: “Protective gear comprising:”

Von Holst combined with Halldin discloses 18[preamble] for the same reasons as 1[preamble]. Section X.D.2.a). Ex.1002, ¶259.

b) 18[a]: “a first shell layer;”

Von Holst combined with Halldin discloses 18[a] for the same reasons as 1[a]. Section X.D.2.b). Ex.1002, ¶260.

c) 18[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

Von Holst combined with Halldin discloses 18[b] for the same reasons as 1[b]. Section X.D.2.c). Ex.1002, ¶261.

d) 18[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Von Holst combined with Halldin discloses 18[c] for the same reasons as 1[c]. Section X.D.2.d). Ex.1002, ¶262.

e) 18[d]: “wherein the first energy transformer layer includes first absorptive/dissipative means to allow the first shell layer to slide relative to the second shell layer;”

Von Holst discloses 18[d]. Section X.D.2.e). Halldin also discloses a layer including “elastic” fixation members that are a structure within the claimed “means.” Ex.1006[Halldin], [0013], [0043], [0046], [0062]; Section IX (“elastomeric truss”).

Halldin's fixation members perform the claimed function of absorbing and/or dissipating energy by deforming and allowing displacement and sliding of outer and inner layers relative to one another. Halldin [0013], [0043], [0047-48], Fig. 4; Section X.D.2.e). Ex.1002, ¶263.

f) 18[e]: “an third shell layer connected to the second shell layer through a second energy transformer layer,”

Von Holst discloses 18[e]. Section X.C.10.f). Von Holst combined with Halldin discloses 18[e] for the same reasons as 1[e]. Section X.D.2.f). Ex.1002, ¶264.

g) 18[f]: “the second energy transformer layer including a second absorptive/dissipative means,”

Von Holst discloses 18[f]. Section X.C.10.g). Von Holst combined with Halldin discloses 18[f] for the same reasons as 1[d], 1[f], and 18[d]. Sections X.D.2.e), X.D.2.g), X.D.11.e). Ex.1002, ¶265.

h) 18[g]: “the second energy transformer layer operable to absorb energy from forces imparted onto the second shell through the first shell and the first energy transformer layer.”

Von Holst discloses 18[g]. Section X.C.10.h). Von Holst combined with Halldin discloses 18[g] for the same reasons as 1[g]. Section X.D.2.h). Ex.1002, ¶266.

Thus, Von Holst combined with Halldin renders claim 18 obvious. Ex.1002, ¶267.

12. Claim 19

a) “The protective gear of claim 18, wherein a lining layer is connected to the third shell layer, wherein the lining layer is configured to conform to a human head.”

Von Holst combined with Halldin teaches claim 18. Section X.D.11. The combination discloses claim 19’s additional limitation and renders it obvious. Section X.C.11. Ex.1002, ¶¶268-269.

13. Claim 20

a) “The protective gear of claim 18, wherein the lining layer comprises foam.”

Von Holst combined with Halldin discloses claims 18 and 19. Sections X.D.11-X.D.12. The combination discloses claim 20’s additional limitation and renders it obvious. Section X.C.12. Ex.1002, ¶¶270-271.

E. Ground 5: Kleiven Anticipates Claims 1, 7-8, and 18

Kleiven discloses Claims 1, 7-8, and 18 arranged as in each Challenged Claim for the reasons below. Ex.1002, ¶¶272-302.

1. Claim 1

a) 1[preamble]: “A helmet comprising:”

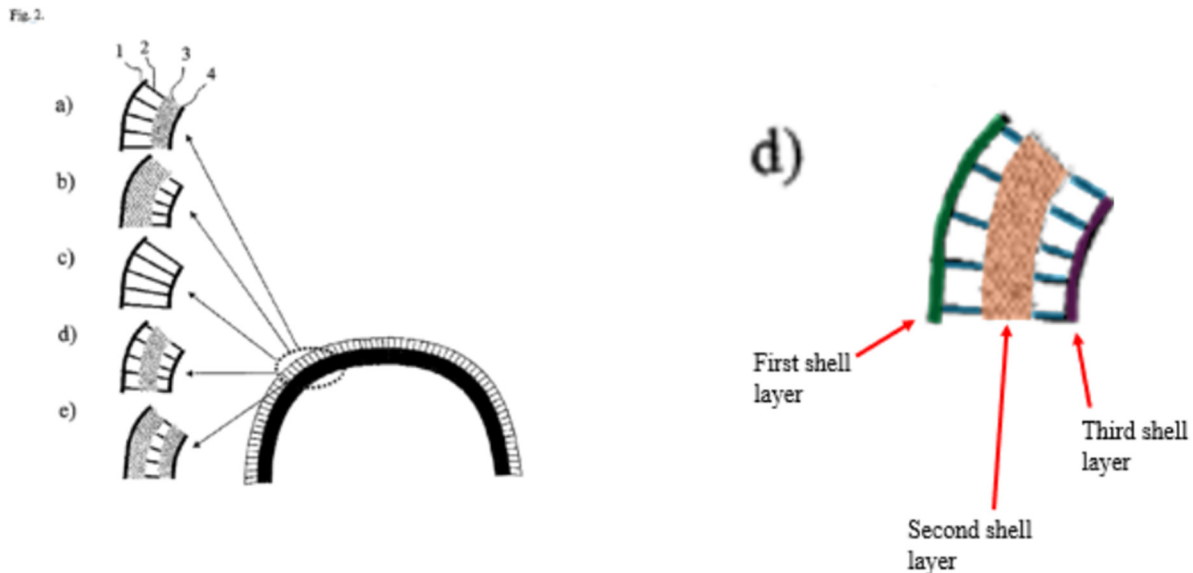
Kleiven discloses “a *helmet*.” Ex.1007[Kleiven], [0031]. Ex.1002, ¶273.

b) 1[a]: “a first shell layer;”

Kleiven discloses 1[a]. Kleiven Figure 2 includes, as a “layer[,],” “outer...shell” 1. Ex.1007[Kleiven], [0031], Fig. 2. Ex.1002, ¶274.

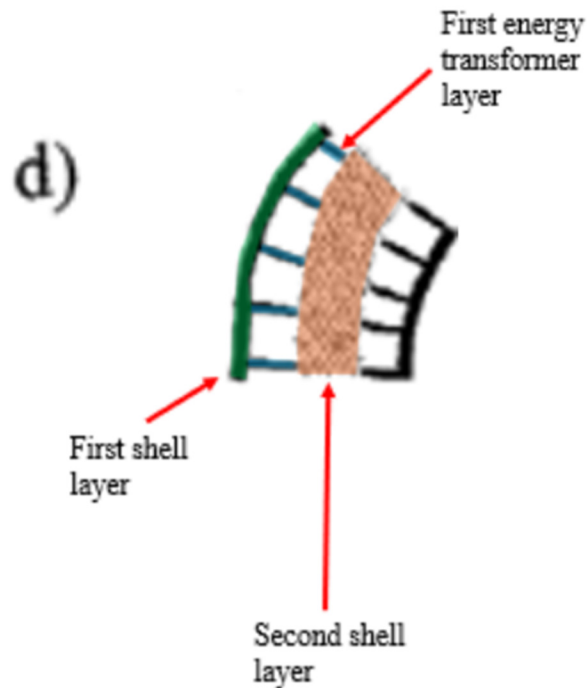
c) 1[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

Kleiven discloses 1[b]. Kleiven’s Figure 2(d) discloses “**layer of standard energy absorbing foam 3**” (second shell layer) between **two spike/beam layers 2** with air pockets. Outer spike/beam layer 2 (first energy transformer layer) is between **outer shell 1** (first shell layer) and **energy absorbing foam 3**.



Ex.1007[Kleiven], [0031], [0039-41], Fig. 2; *id.*, [0020], [0048]. Kleiven’s energy absorbing foam made of, e.g., “expanded polystyrene and expanded polypropylene,” Ex.1007[Kleiven], [0048], is a second shell layer. *See* n.8. Ex.1002, ¶275.

Outer spike/beam layer 2 with air compartments (first energy transformer layer) connects foam layer 3 and outer shell 1.



Ex.1007[Kleiven], [0031], [0039-41], Fig. 2(d). Ex.1002, ¶¶275-280.

The spikes are “flexible, plasticizing, yielding or frangible in order to absorb/reduce the force of an impact,” and allow “[o]ne or several intermediate layers [to] move relative to each other or to the inner or outer layer.” Ex.1007[Kleiven], [0048], [0020], [0062], [0002]. Similarly, the ’561 Patent describes “outer and inner energy and impact transformer layers” as “flexibly connect[ing] the shell layers to absorb impact forces, rotational forces, shear forces, etc., and allow[ing] the various shell layers to move and slide relative to the other shell layers.” Ex.1001[USP561], 2:31-35. Kleiven also discloses fluid

compartments between spikes/beams filled with fluid (e.g., air) that also allow the outer protective shell to slide relative to the inner protective shell and transform energy through translational movement via fluid flow. Ex.1007[Kleiven], [0039-41] (“fluid/air layer *shears*”), [0047], [0065], Figs.10-12. Ex.1002, ¶¶275-280.

d) 1[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Kleiven discloses 1[c]. Kleiven’s spike layer with fluid/air (first energy transformer layer) is designed “to *absorb/reduce the force of an impact* towards the material.” Ex.1007[Kleiven], [0048], Fig. 2. Kleiven’s design “enables the spikes to give way more easily after a *tangential/rotational impact* and thereby efficiently *reduce the negative effects of such an impact* on [e.g.] the brain. The spikes or beams are so constructed and connected to the shells that they permit *displacement of the outer shell relative to the inner shell* in the event of an oblique impact...through *shearing and bending* of the spikes/beams, during *simultaneous absorption of rotational energy in the material*, it is possible to *reduce* the *injurious forces*.” Ex.1007[Kleiven], [0062]; *id.* [0002], [0020-27], [0064], Fig. 9. The “fluid/air layer” surrounding the spikes further “*shears* with little resistance...[and] *distributes* the pressure....” *Id.*, [0039-40]. As Dr. Duma explains, air absorbs and dissipates impact energy through compression, displacement, and fluid flow, which

generates heat. See Ex.1001[USP561], 6:38-44 (fluid/gel absorptive/dissipative materials). Ex.1002, ¶281.

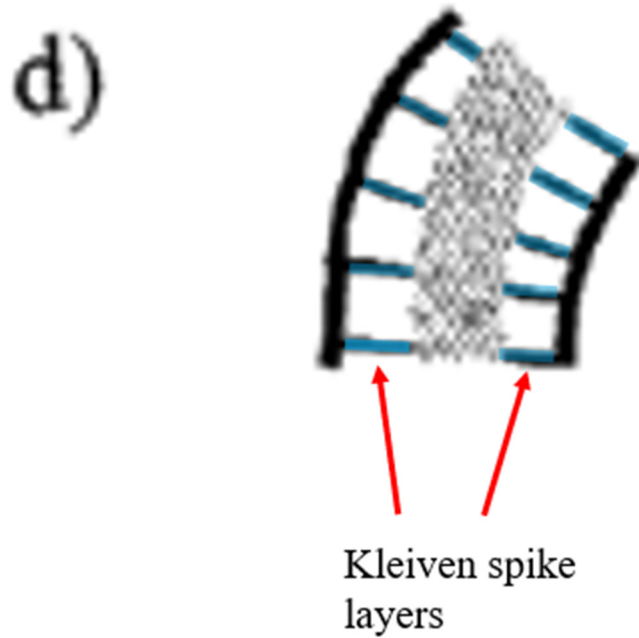
e) 1[d]: “wherein the first energy transformer layer includes a first absorptive/dissipative material to allow the first shell layer to slide relative to the second shell layer;”

Kleiven discloses 1[d]. Kleiven’s outer spike/beam layer with fluid/air (first energy transformer layer) includes absorptive/dissipative material because spikes/beams are “flexible polymer materials such as plastics, rubber or fibers” and are “flexible plasticizing, yielding or frangible *in order to absorb/reduce the force of an impact.*” Ex.1007[Kleiven], [0020], [0048], Fig. 2; *id.*, [0011]. The fluid/air also “shears with little resistance...[and] distributes the pressure in the radial direction.” *Id.*, [0039-40]. Ex.1002, ¶282.

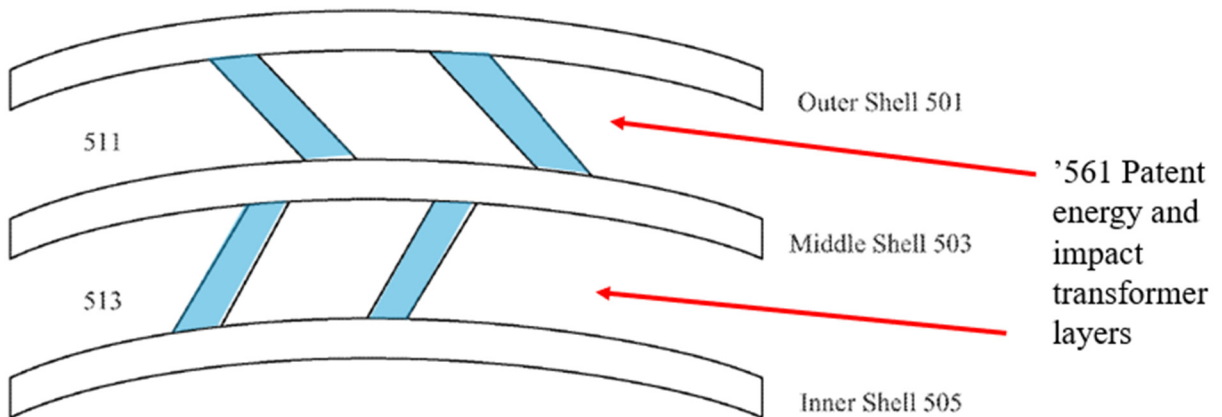
Moreover, Kleiven’s spikes/beams with air allow the first shell layer to slide relative to the second shell layer. Kleiven’s spikes allow a middle shell (second shell), i.e., “[o]ne or several intermediate layers,” to “*move relative* to each other or *to the inner or outer layer.*” Ex.1007[Kleiven], [0048]. And surrounding fluid/air layer “shears” to allow relative movement of surrounding layers. *Id.*, [0039-40], Figs. 10-11. See Section X.E.1.d); Ex.1002, ¶283.

Kleiven’s **spikes/beam** layer is similar to the ’561 Patent’s “mechanical transformer layer,” a “shear truss-like structure connecting” layers that “dampen[] any force or impact” and allows layers to “slide relative” to each other.

Ex.1001[USP561], 6:27-44; *id.*, Fig. 5, 9:22-30 (“elastomeric trusses”). The **spikes/beam** layers in Kleiven’s Figure 2(d) have similar structure as ’561 Patent **energy and impact transformer layers 511 and 513**.



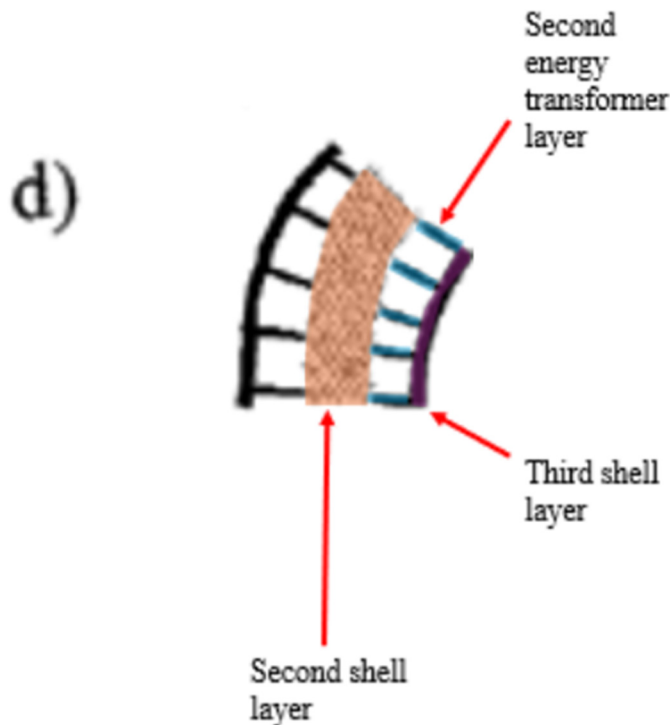
Ex.1007[Kleiven], Fig. 2(d).



Ex.1001[USP561], Fig. 5. Like Kleiven's spike layer surrounded by fluid/air, the '561 Patent's trusses are also surrounded by fluid. *Id.*, 9:14-16, 9:28-30. Thus, Kleiven's spike/beam layer allows the first shell layer to slide relative to the second shell layer similarly to '561 Patent Figure 5. Ex.1002, ¶284.

f) 1[e]: "an third shell layer connected to the second shell layer through a second energy transformer layer,"

Kleiven discloses 1[e]. Kleiven's Figure 2(d), discloses **inner shell layer 4** (third shell layer), **energy absorbing foam 3** layer (second shell layer), and **inner spike/beam layer 2** with air pockets (second energy transformer layer).



Ex.1007[Kleiven], [0031], Fig. 2(d). Ex.1002, ¶285.

Inner shell 4 is connected to middle energy absorbing foam 3 through inner spike/beam layer 2 and its air compartments in the same way middle shell 3 is connected to outer shell 1 through outer layer 2 in 1[b]. Ex.1002, ¶286.

g) 1[f]: “the second energy transformer layer including a second absorptive/dissipative material,”

Kleiven discloses 1[f]. Kleiven Figure 2(d)’s inner spike/beam layer 2 with air (second energy transformer layer) includes absorptive/dissipative material in the same way outer spike/beam layer with air does, as 1[d] discusses. Ex.1002, ¶287.

h) 1[g]: “the second energy transformer layer operable to absorb energy from forces imparted onto the second shell through the first shell and the first energy transformer layer.”

Kleiven discloses 1[g]. Kleiven Figure 2(d)’s inner spike layer 2 with air (second transformer layer) absorbs energy from forces imparted on middle (second) shell 3 through outer (first) shell 1 and outer spike layer 2 (first transformer layer) in the same way outer spike layer 2 absorbs energy imparted onto outer shell 1 in 1[c]. Kleiven recognizes some forces originating from the outer shell pass through the first spike/beam layer to be further absorbed by the inner spike/beam layer in Figure 2(d). Ex.1007[Kleiven], [0038] (describing brain strain “reduced” with spike design), Fig. 9. Indeed, the spike layers’ purpose is “to absorb/reduce the force of an impact.” Ex.1007[Kleiven], [0048]. Ex.1002, ¶288.

2. Claim 7

a) “The helmet of claim 1, wherein mechanical forces include impact forces.”

Kleiven discloses claim 1. Section X.E.1. Kleiven discloses claim 7’s additional limitation and anticipates it. Kleiven’s helmet “reduc[es] the *force* transmitted to the outer surface of the body in a *collision/impact* situation.” Ex.1007[Kleiven], [0020]; *id.*, [0061], [0032] (“*impact* sequence”), Fig. 3. Ex.1002, ¶¶289-290.

3. Claim 8

a) “The helmet of claim 1, wherein mechanical forces include rotational and shear forces.”

Kleiven discloses claim 1. Section X.E.1. Kleiven discloses claim 8’s additional limitation and anticipates it. For example, Kleiven’s spikes/beams “give way after a *tangential/rotational impact* and thereby efficiently reduce the negative effects of such an impact.” Ex.1007[Kleiven], [0020]; *id.*, [0062] (“*shearing* and bending of the spikes/beams”; “*absorption of rotational energy*”), [0039-40] (fluid/air “*shears*” and “distributes...pressure”). As Dr. Duma explains, reduction of forces from rotational impact reduces shear. Ex.1002, ¶¶291-292.

4. Claim 18

Kleiven discloses claim 18 for the same reasons as claim 1. Section X.E.1; Ex.1002, ¶293. Further:

a) 18[preamble]: “Protective gear comprising:”

Kleiven discloses 18[preamble] for the same reasons as 1[preamble]. Section X.E.1.a). “Helmets” are “protective gear.” Ex.1001[USP561], 1:23. Ex.1002, ¶294.

b) 18[a]: “a first shell layer;”

Kleiven discloses 18[a] for the same reasons as 1[a]. Section X.E.1.b). Ex.1002, ¶295.

c) 18[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

Kleiven discloses 18[b] for the same reasons as 1[b]. Section X.E.1.c). Ex.1002, ¶296.

d) 18[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Kleiven discloses 18[c] for the same reasons as 1[c]. Section X.E.1.d). Ex.1002, ¶297.

e) 18[d]: “wherein the first energy transformer layer includes first absorptive/dissipative means to allow the first shell layer to slide relative to the second shell layer;”

Kleiven discloses 18[d]. Kleiven’s spikes/beams and surrounding fluid/air are structures within the claimed “means.” Ex.1007[Kleiven], [0031], Fig. 2(d), [0039-40], [0065]; Section IX (“elastomeric trusses”; “fluids”). These structures perform the function of absorbing and/or dissipating energy and allowing the outer shell 1 (first shell layer) to slide relative to the energy absorbing foam layer (second shell

layer). Ex.1007[Kleiven], Figs. 1(d), 2(d). See Sections X.E.1.c)-X.E.1.e).
Ex.1002, ¶298.

f) 18[e]: “an third shell layer connected to the second shell layer through a second energy transformer layer,”

Kleiven discloses 18[e] for the same reasons as 1[e]. Section X.E.1.f).
Ex.1002, ¶299.

g) 18[f]: “the second energy transformer layer including a second absorptive/dissipative means,”

Kleiven discloses 18[f] for the same reasons as 1[d], 1[f], and 18[d]. Sections X.E.1.e), X.E.1.g), X.E.4.e). Like Kleiven’s outer spikes/beams and surrounding fluid/air in an outer layer are absorptive/dissipative means that allow sliding between Kleiven’s outer and intermediate layers, as 18[d] explains, Kleiven’s inner spikes/beams and surrounding fluid/air are absorptive/dissipative means included in an inner energy transformer layer that allow sliding between Kleiven’s inner and intermediate layers. Ex.1002, ¶300.

h) 18[g]: “the second energy transformer layer operable to absorb energy from forces imparted onto the second shell through the first shell and the first energy transformer layer.”

Kleiven discloses 18[g] for the same reasons as 1[g]. Section X.E.1.h).
Ex.1002, ¶301.

Thus, Kleiven anticipates claim 18. Ex.1002, ¶302.

F. Ground 6: Claims 9-10, 16-17, and 19-20 are Obvious Over Kleiven Combined with Piper

1. Claim 9

a) “The helmet of claim 1, wherein a lining layer is connected to the third shell layer, wherein the lining layer is configured to conform to a human head.”

Kleiven discloses claim 1. Section X.E.1. Kleiven combined with Piper discloses claim 9’s additional limitation and renders it obvious. Piper discloses helmets with “**comfort liner 212**,” comprising “foam material that easily conforms to the head 200.” Ex.1009[Piper], [0109].

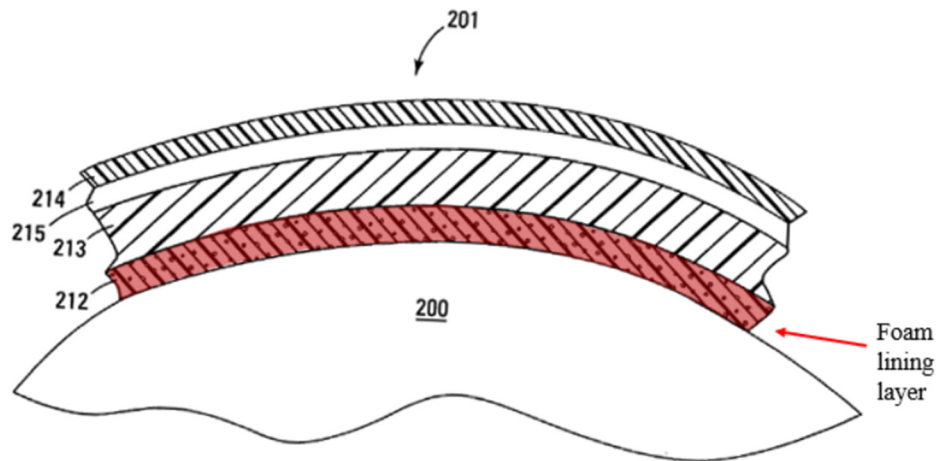


Fig. 3

Ex.1009[Piper], Fig. 3; Ex.1002, ¶303.

A POSA would have been motivated to combine Kleiven and Piper. They are analogous to the challenged claims: they are in the same field and directed to the same problem—and similar solutions—of reducing rotational impact via sliding

layers. *E.g.*, Ex.1009[Piper], [0002]; Ex.1007[Kleiven], [0002]. Kleiven recognizes interior foam improves capacity “to conform to the head.” Ex.1007[Kleiven], [0014]. Piper provides details, including materials (e.g., “lower density, open-cell foam material”) and characteristics of a foam liner (“provides sweat and heat management characteristics”). Ex.1009[Piper], [0109]. A POSA would have been motivated to incorporate Piper’s comfort liner 212 in Kleiven’s helmet to achieve comfort and fit benefits, and heat and sweat management. A POSA would have found it obvious to combine these elements as a matter of routine implementation, as it is a straightforward and predictable combination of known elements according to known methods to yield predictable results, and Kleiven’s helmet is ready for improvement through incorporation of Piper’s liner. This known technique of adding a comfort liner would improve Kleiven’s helmet in a similar way to Piper. Ex.1002, ¶¶304-310, 312.

A POSA would have reasonably expected success using Piper’s comfort liner in Kleiven’s design. Kleiven discloses headgear can be configured to conform to the head and benefits of doing so, Ex.1007[Kleiven], [0014], without further implementation details. A POSA would have, as a matter of routine implementation, easily been able to configure Piper’s comfort liner to fit into Kleiven’s design,

including because Piper's comfort liner is positioned under an inner layer like Kleiven's. Ex.1002, ¶¶311-313.

2. Claim 10

a) 10[preamble]: "A helmet comprising:"

Kleiven discloses 10[preamble] for the same reasons as 1[preamble]. Section X.E.1.a). Ex.1002, ¶314.

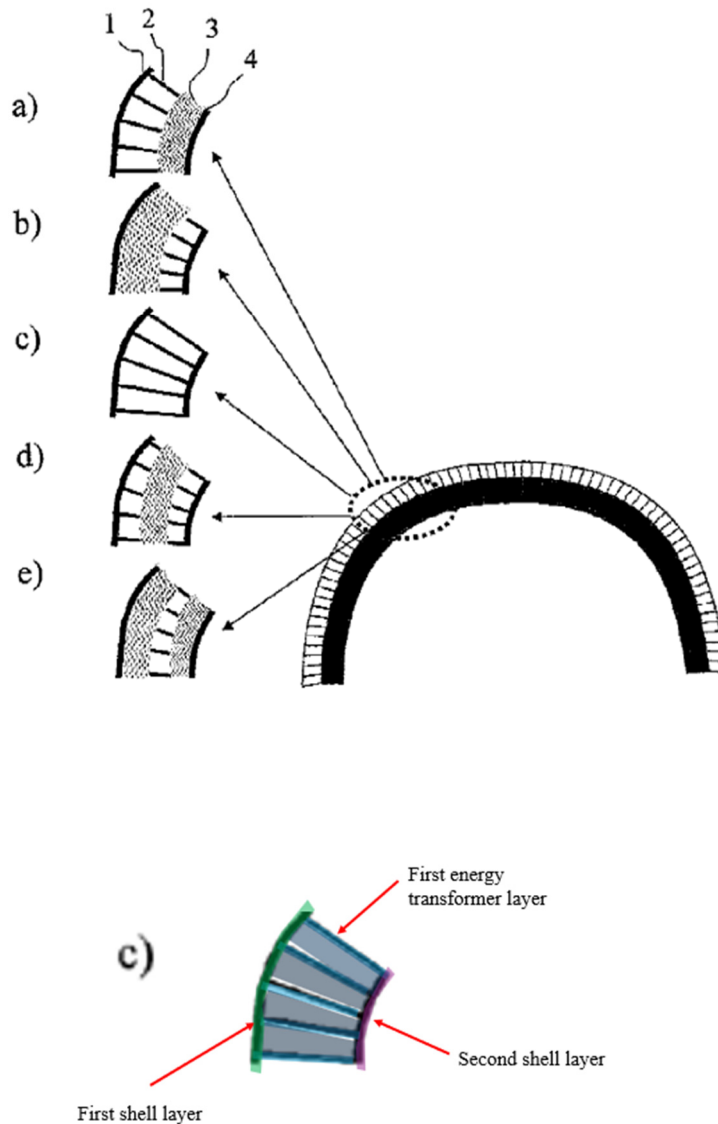
b) 10[a]: "a first shell layer;"

Kleiven discloses 10[a] for the same reasons as 1[a]. Section X.E.1.b). Ex.1002, ¶315.

c) 10[b]: "a second shell layer connected to the first shell layer through a first energy transformer layer,

Kleiven discloses 10[b]. For example, Kleiven Figure 2(c) includes spike/beam layer 2 with air compartments (first energy transformer layer) between outer shell 1 (first shell layer) and inner shell 4 (second shell layer).

Fig. 2.



Ex.1007[Kleiven], [0031], Fig. 2; *id.*, Fig. 1, [0020], [0030], [0048]. Kleiven's "spikes can be complemented by trapped fluid such as air in different compartments." Ex.1007[Kleiven], [0065], Fig. 11; *id.*, [0039-40]. Ex.1002, ¶316.

The second and first shell layers are connected through the first energy transformer layer. Spike layer 2, with surrounding fluid/air layer, is between outer shell 1 and inner shell 4. Ex.1007[Kleiven], [0031], Fig. 2, [0065], Fig. 11, [0039-40]. Section X.E.1.c). Ex.1002, ¶317.

d) 10[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

Kleiven discloses 10[c] for the same reasons as 1[c]. Section X.E.1.d). Ex.1002, ¶318.

e) 10[d]: “wherein the first energy transformer layer includes an absorptive/dissipative material to allow the first shell layer to slide relative to the second shell layer;”

Kleiven discloses 10[d] for the same reasons as 1[d]. Section X.E.1.e). Ex.1002, ¶319.

f) 10[e]: “a lining layer connected to the second shell layer, wherein the lining layer is configured to conform to a human head.”

Kleiven combined with Piper discloses 10[e]. Section X.F.1; Ex.1002, ¶320.

Thus, Kleiven combined with Piper renders claim 10 obvious. Ex.1002, ¶321.

3. Claim 16

a) “The helmet of claim 10, wherein mechanical forces include impact forces.”

Kleiven combined with Piper teaches claim 10. Section X.F.2. The combination teaches claim 16's additional limitation and renders it obvious. Section X.E.2; Ex.1002, ¶¶322-323.

4. Claim 17

a) “The helmet of claim 10, wherein mechanical forces include rotational and shear forces.”

Kleiven combined with Piper teaches claim 10. Section X.F.2. The combination teaches claim 17's additional limitation and renders it obvious. Section X.E.3; Ex.1002, ¶¶324-325.

5. Claim 19

a) “The protective gear of claim 18, wherein a lining layer is connected to the third shell layer, wherein the lining layer is configured to conform to a human head.”

Kleiven discloses claim 18. Section X.E.4. Kleiven combined with Piper teaches claim 19's additional limitation and renders it obvious. Section X.F.1; Ex.1002, ¶¶326-327.

6. Claim 20

a) “The protective gear of claim 18, wherein the lining layer comprises foam.”

Kleiven combined with Piper discloses all elements of claims 18 and 19. Sections X.E.4, X.F.5. Kleiven combined with Piper teaches claim 20's additional

limitation and renders it obvious. Section X.F.1; Ex.1009[Piper], [0109] (“comfort liner 212” comprises “foam material”); Ex.1002, ¶¶328-329.

G. Ground 7: Madey Anticipates Claims 10, 16, and 17.

Madey discloses Claims 10, 16, and 17 arranged as in each Challenged Claim for the reasons below. Ex.1002, ¶¶330-343.

1. Claim 10

a) 10[preamble]: “A helmet comprising:”

Madey discloses “a helmet.” Ex.1047[Madey], Abstract, [0025], [0037], claim 1, Figs. 4, 9B. Ex.1002, ¶331.

b) 10[a]: “a first shell layer;”

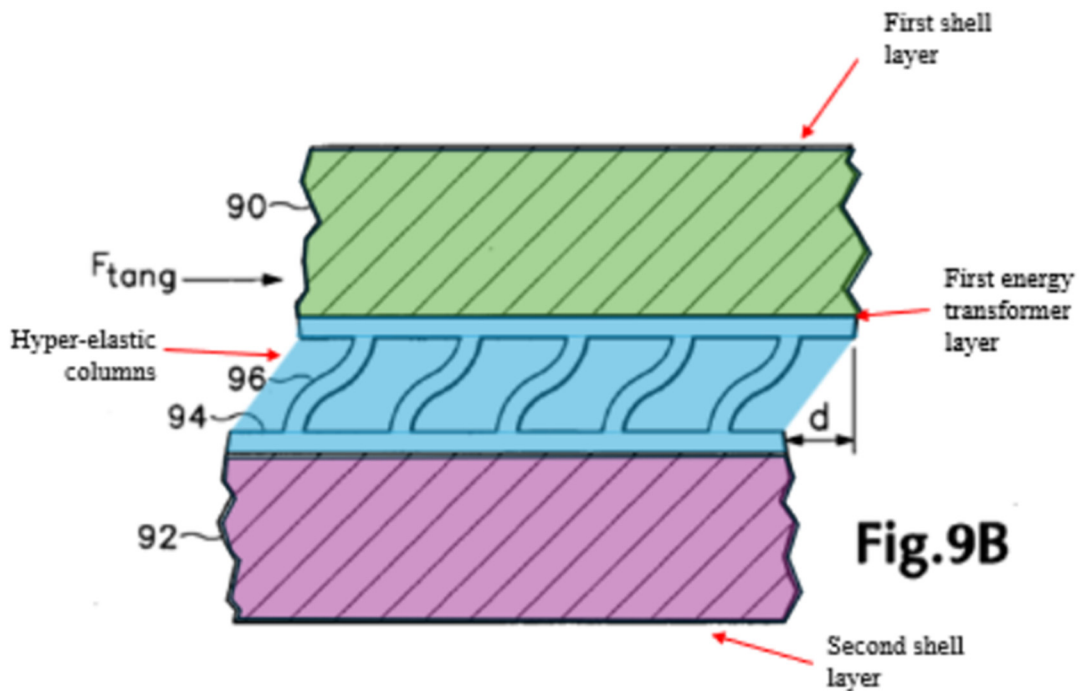
Madey discloses 10[a]. Madey discloses a helmet with “outer helmet layer” comprising “a hard shell” (first shell layer). Ex.1047[Madey], Abstract, claims 1-2, Figs. 4, 9B. Ex.1002, ¶¶332-333.

c) 10[b]: “a second shell layer connected to the first shell layer through a first energy transformer layer,

Madey discloses 10[b]. Madey’s “inner helmet layer” made of (e.g.) expanded polystyrene foam, is a second shell layer. Ex.1047[Madey], Abstract, [0025], [0037], [0050], Claim 1, Fig. 4; *see* n.8. Ex.1002, ¶334.

In the Figure 9B embodiment of Madey’s Figure 4 helmet, second and first shell layers are connected through a first energy transformer layer. Madey discloses **interface layer 94** between **outer helmet layer 90** and **inner helmet layer 92**, that

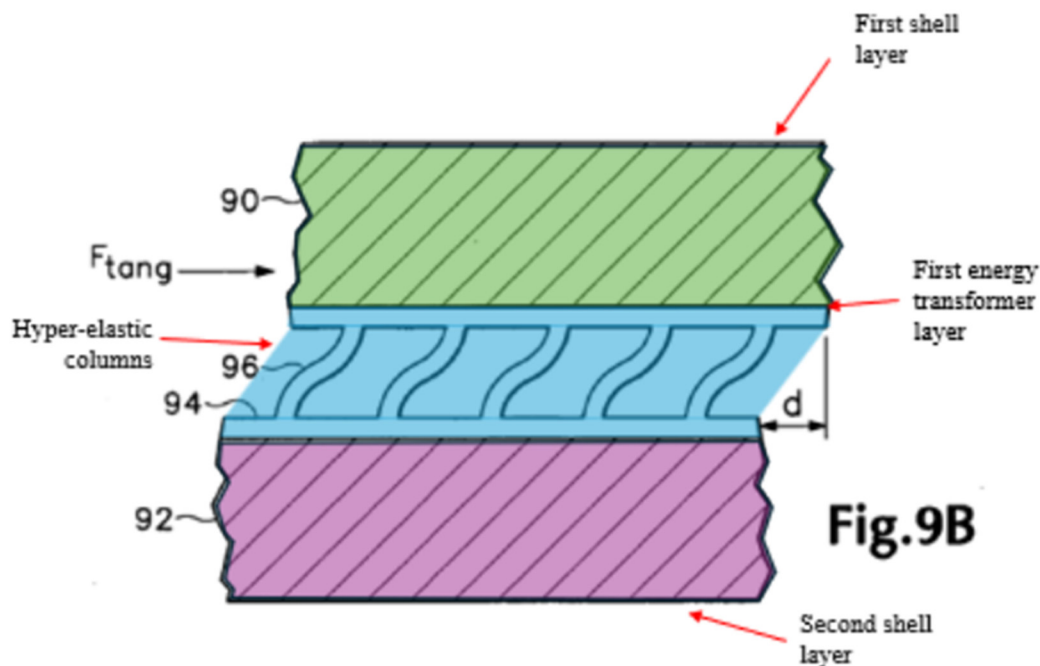
“allow[] the outer helmet layer to displace with respect to the inner helmet layer, thereby absorbing and/or diverting forces.” Ex.1047[Madey], Abstract; [0037]. In Figure 9B, **interface layer 94** includes **hyper-elastic columns 96**. As Madey explains and Dr. Duma confirms, this interface layer with hyper-elastic columns 96 transforms energy from impact force. *E.g.*, Ex.1047[Madey], [0037] (“Columns 96 buckle under an impact force to **absorb impact energy**”), Fig. 9B; Abstract (“[I]nterface layer allows the outer helmet layer to displace with respect to the inner helmet layer, thereby **absorbing and/or diverting forces....**”).



Ex.1047[Madey], Fig. 9B. Ex.1002, ¶334.

d) 10[c]: “the first energy transformer layer operable to absorb energy from forces imparted onto the first shell layer,”

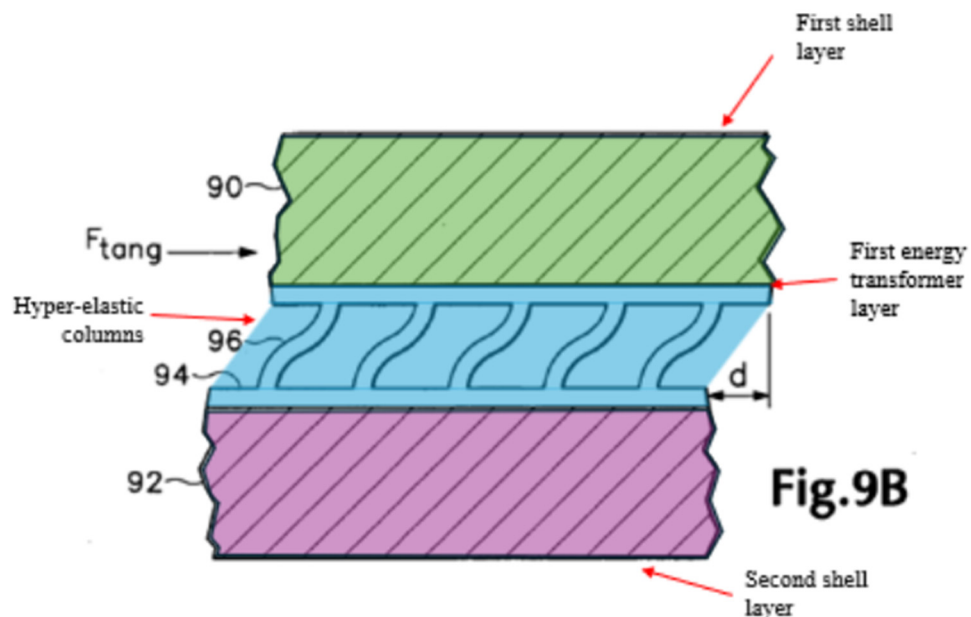
Madey discloses 10[c]. In Figure 9B, Madey's **interface layer 94** (first energy transformer layer) between **outer** and **inner** helmet layers includes hyper-elastic columns 96. Ex.1047[Madey], [0037], Fig. 9B. The hyper-elastic columns permit displacement of the outer shell relative to the inner shell upon impact to the outer, and absorb energy from such force. Ex.1047[Madey], [0037] ("Columns 96 buckle under an *impact force* to *absorb impact energy*"), Fig. 9B; Abstract ("interface layer allows the outer helmet layer to displace with respect to the inner helmet layer, thereby *absorbing and/or diverting forces*"). Ex.1002, ¶¶335-336.



e) 10[d]: “wherein the first energy transformer layer includes an absorptive/dissipative material to allow the first shell layer to slide relative to the second shell layer;”

Madey discloses 10[d]. Madey's hyper-elastic columns are made of material that "bend and stretch in response to the tangential force, thereby **deflecting** and partially **absorbing** the tangential force." Ex.1047[Madey], [0037]. Madey's hyper-elastic columns allow translational movement, and, as Dr. Duma explains, such movement absorbs and dissipates (deflects) energy. Ex.1002, ¶337.

Madey discloses hyper-elastic columns 96 that shear and allow the outer helmet layer (first shell layer) to slide relative to inner helmet layer (second shell layer). For example, Madey's hyper-elastic columns 96 "bend[] and stretch[]" in response to tangential force" and allow "relative displacement" between the outer and inner helmet layers. Ex.1047[Madey], [0037], Fig. 9B. Ex.1002, ¶337.



f) 10[e]: “a lining layer connected to the second shell layer, wherein the lining layer is configured to conform to a human head.”

Mayey discloses 10[e]. Mayey’s helmets include “helmet retention system (e.g., straps 42 and ***foam padding inserts***, not shown) to affix inner helmet layer 41 to a wearer’s head.” Ex.1047[Mayey], [0025]; [0051] (“head cushioning”). Ex.1002, ¶338.

Thus, Mayey anticipates claim 10. Ex.1002, ¶339.

2. Claim 16

a) “The helmet of claim 10, wherein mechanical forces include impact forces.”

Mayey discloses claim 10. Section X.G.1. Mayey discloses claim 16’s additional limitation and anticipates it. Mayey’s interface layer with hyper-elastic columns 96 transforms energy from impact force. *E.g.*, Ex.1047[Mayey], [0037] (“Columns 96 buckle under an ***impact force to absorb impact energy***”), Fig. 9B; Abstract (“interface layer allows the outer helmet layer to displace with respect to the inner helmet layer, thereby ***absorbing and/or diverting forces***”). Ex.1002, ¶¶340-341.

3. Claim 17

a) “The helmet of claim 10, wherein mechanical forces include rotational and shear forces.”

Madey discloses claim 10. Section X.G.1. Madey discloses claim 17's additional limitation and anticipates it. Madey's helmet "absorbs[] and/or diverts[] forces that would be transferred...to the wearer's head and neck as ***rotational acceleration.***" Ex.1047[Madey], Abstract; *see id.* [0035] ("shock-absorbing and shear-deflecting/absorbing properties"). As Dr. Duma explains, reduction of rotational acceleration reduces shear. Ex.1002, ¶¶342-343.

XI. CONCLUSION

Petitioner requests institution of *inter partes* review and cancellation of '561 Patent claims 1, 6-10, 12, and 16-20.

Respectfully Submitted,

Dated: July 9, 2025

/David L. Cavanaugh/
David Cavanaugh
Registration No. 36,476

TABLE OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 9,060,561 (USP561)
1002	Declaration of Dr. Stefan Duma
1003	Prosecution History for U.S. Patent No. 9,060,561 (Knight-561-FH)
1004	U.S. Patent Publication No. 2012/0198604 (Weber)
1005	Int'l Patent App. Pub. No. WO 2001/045526 (VonHolst)
1006	Int'l Patent App. Pub. No. WO 2011/139224 (Halldin)
1007	U.S. Patent Application Publication No. 2013/0122256 (Kleiven)
1008	Reserved
1009	U.S. Patent Application Publication No. 2004/0250340 (Piper)
1010	U.S. Patent Application Publication No. 2006/0059606 (Ferrara-2006)
1011	U.S. Patent No. 6,996,856 (Puchalski)
1012	U.S. Patent No. 10,238,162 (Knight-162)
1013	Prosecution History for U.S. Patent No. 10,238,162 (Knight-162-FH)
1014	U.S. Provisional Application No, 61/462914 (WeberProv)

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of U.S. Patent No. 9,060,561

Exhibit	Description
1015	U.S. Provisional Application No. 61/333817 (HalldinProv)
1016	U.S. Patent Application Publication No. 2008/0066217 (Depreitere)
1017	U.S. Patent No. 3,872,511 (Nichols)
1018	U.S. Patent Application No 2007/0190293 (Ferrara-2007)
1019	U.S. Patent Application No. 2007/0068755 (Hawkins)
1020	Int'l Patent App. Pub. WO 2008/046196 (Cripton)
1021	Pons-Poblet, <i>The Vierendeel Truss: Past And Present Of An Innovative Typology</i> , 15 Arquitectura Revista 193 (2019) (Pons-Poblet)
1022	Kis et al., <i>Rotational Acceleration Measurements –Evaluating Helmet Protection</i> , 31 Can. J. Neurol. Sci. 499 (2004) (Kis-2004)
1023	Int'l Patent App. Pub. No. WO 1996/014768 (Phillips)
1024	U.S. Patent Application Publication No. 2001/0032351 (Nakayama)
1025	Newman, <i>Modern Sports Helmet – Their History, Science, and Art</i> (2007) (Newman)
1026	Kleiven, <i>A Parametric Study of Energy Absorbing Foams For Head Injury Prevention</i> , Technical Paper Number 07-0385, 20 th Int'l

Exhibit	Description
	Tech. Conf. on Enhanced Safety of Vehicles (June 18-21, 2007) (Kleiven-2007)
1027	Reserved
1028	Aare, <i>A New Laboratory Rig for Evaluating Helmets Subject to Oblique Impacts</i> , 4 Traffic Injury Prevention 240 (2003) (Aare-2003)
1029	Reserved
1030	U.S. Patent No. 8,863,319 (USP319)
1031	Bosch, <i>Crash helmet testing and design specifications</i> (Jan. 1, 2006) (Ph.D. Thesis, Eindhoven University of Technology) (Bosch)
1032	Mills & Gilchrist, <i>Bicycle Helmet Design</i> , 220 Proceedings of the Institution of Mechanical Engineers Part L Journal of Materials Design and Applications 167 (2006) (Mills-2006)
1033	Smith, <i>Diffuse Axonal Injury in Head Trauma</i> , 18 J. Head Trauma Rehab. 307 (2003) (Smith-2003)
1034	Jans, <i>Bike Helmet Anatomy</i> , https://www.jans.com/anatomy-of-a-bike-helmet?srsltid=AfmBOooriodHXEC54CbWtD0foK5WSXu8-gN0vaAh1lq96kCKdGHJ68FJ (Jans)

Exhibit	Description
1035	Reserved
1036	International Polymer Solutions Inc., <i>Polycarbonate</i> , https://www.ipolymer.com/pdf/Polycarbonate.pdf (Intl-Polymer-Solutions)
1037	Universal Foam Products, Physical Properties of Expanded Polystyrene, https://univfoam.com/wp-content/uploads/2015/07/EPS-Data-Sheet.pdf (Universal-Foam-Products)
1038	Duma, <i>Analysis of Real-time Head Accelerations in Collegiate Football Players</i> , 15 Clin. J. Sports Med. 3 (2005) (Duma-2005)
1039	Ommaya, <i>Chapter 13: Biomechanics of Head Injury: Experimental Aspects</i> , in <i>The Biomechanics of Trauma</i> 245 (1985) (Ommaya-1985)
1040	Viano, <i>Injury Biomechanics Research: An Essential Element in the Prevention of Trauma</i> , 22 J. Biomechanics 403 (1989) (Viano-1989)
1041	Reserved
1042	Reserved

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Exhibit	Description
1043	Reserved
1044	Reserved
1045	Reserved
1046	Reserved
1047	U.S. Patent Application Publication No. 2004/0117896 (Madey)
1048	Reserved
1049	EPSOLE, <i>What Is EPS Material: The Complete Guide to EPS Material</i> (April 15, 2024), https://epsole.com/what-is-eps-material/ (Epsole)
1050	Reserved

CERTIFICATE UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes Review* totals 13,998, which is less than the 14,000 words allowed under 37 CFR § 42.24(a)(1)(i).

Respectfully submitted,

Dated: July 9, 2025

/Patrick E. Nyman/
Patrick Nyman
Registration No. 76,123

CERTIFICATE OF SERVICE

I hereby certify that on July 9, 2025, pursuant to an agreement between Petitioners and Patent Owner, I caused a true and correct copy of the foregoing materials:

- Petition for *Inter Partes* Review of U.S. Patent No. 9,060,561 under 35 U.S.C. § 312 and 37 C.F.R. § 42.104
- Exhibit List
- Exhibits for Petition for *Inter Partes* Review of U.S. Patent No. 9,060,561 (Exs.1001-1007, 1009-1026, 1028, 1030-1034, 1036-1040, 1047, 1049)
- Power of Attorney
- Fee Authorization
- Word Count Certification Under 37 CFR § 42.24(d)

to be served on Patent Owner (Kwan & Olynick LLP, 2001 Addison St., Suite 300, Berkeley, CA 94704, United States) via electronic mail to:

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