

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

REVELYST SALES LLC
Petitioner

v.

BRAINGUARD TECHNOLOGIES INC.
Patent Owner

IPR2025-01033
U.S. Patent No. 9,516,909

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 9,516,909
CHALLENGING CLAIMS 1-2, 4-5, 8-13, 15-16, and 19-20
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 1-2, 4-5, 8-13, 15-16, and 19-20 of U.S. Patent No. 9,516,909 (the “’909 Patent”) (Ex.1001[USP909]) pursuant to 35 U.S.C. §§311-19 and 37 C.F.R. §42.1 *et seq.*

The ’909 Patent is directed to helmets with layers that can slide relative to each other to increase protection upon impact. The safety issues the ’909 Patent seeks to address, including related to rotational acceleration, were known long before the patent. So too were the proffered solutions, which were 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 ’909 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 obvious. For instance, Madey’s disclosure of helmets with multiple layers separated by a shear mechanism that allows relative sliding and absorption of energy, and a chin-strap on an inner layer, anticipates most Challenged Claims. Other references render all Challenged Claims obvious.

This Petition, supported by the declaration of Dr. Stefan Duma (Ex.1002), demonstrates a reasonable likelihood Petitioner will prevail with respect to cancellation of at least one Challenged Claim. *See* 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 that 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 ’909 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. 9,516,909

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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”) at the time of the earliest claimed priority date of the ’909 Patent (Jul. 21, 2011) or at the proper priority date (Jul. 20, 2012) would have had either at least the equivalent of a Bachelor’s degree

in mechanical engineering or a related subject, or a medical degree with training in neuroscience or a related subject. A POSA also would have a general understanding of brain injury biomechanics and how helmets protect against varying types of brain injuries. A POSA would also have two or more years of experience in the field of design or development of helmets. Less work experience may be compensated by a higher level of education and vice versa. Ex.1002, ¶¶32-36.

Petitioner's positions regarding the prior art and the '909 Patent claims are supported by the declaration of Dr. Stefan Duma, an expert in helmet-safety design with almost 30 years of experience. Ex.1002, ¶¶1-11.

IV. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies under 37 C.F.R. §42.104(a) that the '909 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 in this Petition.

V. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Petitioner requests review and cancellation of '909 Patent claims 1-2, 4-5, 8-13, 15-16, and 19-20.

A. Prior Art

As Section VII.C discusses, the priority date of the '909 Patent is July 20, 2012 and not July 21, 2011 as claimed. Petitioner relies on Exhibits including:

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of U.S. Patent No. 9,516,909

- 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 No. 61/462,914 (filed February 9, 2011) (“*Weber Provisional*”)(Ex.1014[WeberProv]), as §102(e) prior art.
- U.S. Patent No. 6,996,856 to Puchalski (“Puchalski”) (Ex.1011[Puchalski]), published February 14, 2006, as §102(a), (b) 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. 61/333,817 (filed May 12, 2010) (*Halldin Provisional*”) (Ex.1015[HalldinProv]), as §102(e) prior art as of July 21, 2011, and §102(a) prior art as of July 20, 2012.
- 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 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.
- Japanese Patent Application No. JP2006/16740 to Dotsuko (“Dotsuko”) (Ex.1041[Dotsuko] (English translation of Ex.1042[Dotsuko-Original-Japanese])), which published on January 19, 2006, 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	§103	1-2, 8-13, 19-20	Weber combined with Puchalski
2	§103	1-2, 5, 8-9, 11-13, 16, 19-20	Von Holst combined with Halldin and Puchalski
3	§103	1-2, 4-5, 8-9, 11-13, 15-16, 19-20	Kleiven combined with Puchalski

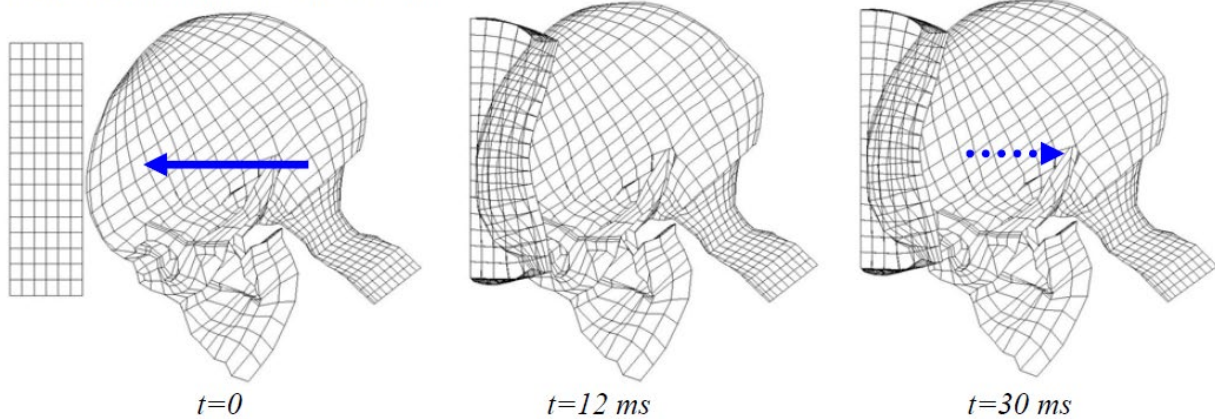
4	§102	1-2, 4-5, 8-10, 12-13, 15-16, 19- 20	Madey
5	§103	1-2, 5, 8-9, 12- 13, 16, 19-20	Dotsuko combined with Puchalski

VI. TECHNOLOGY BACKGROUND

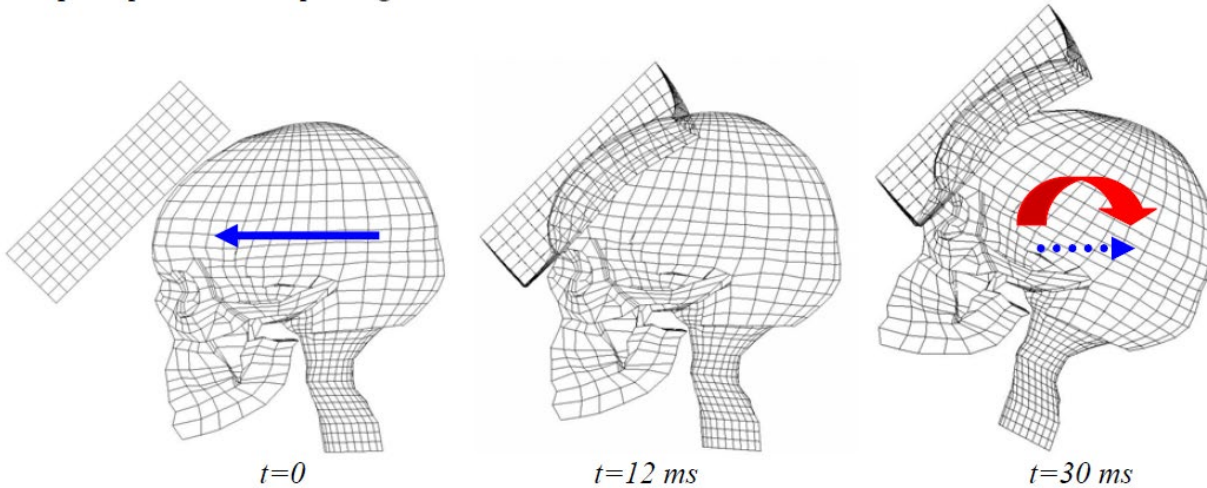
A. Rotational Motion from Impact

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.”

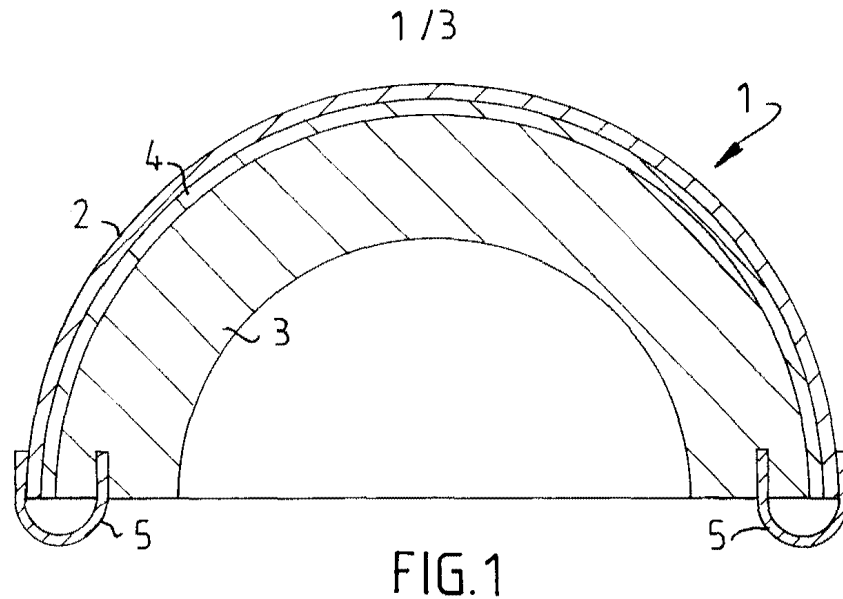
Ex.1031[Bosch], 55. “Shearing” results from “shear forces,” or forces from parallel translation in different or opposing directions. Ex.1002, ¶¶37-38.

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:



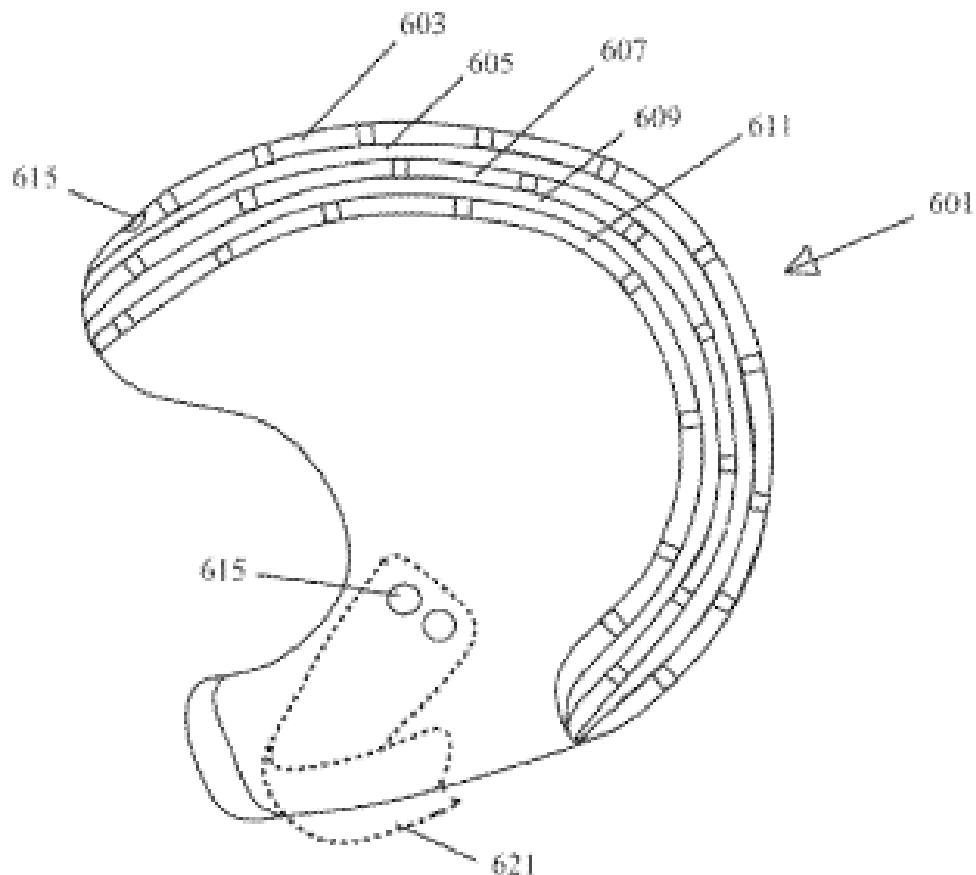
Ex.1005[VonHolst], 4:10-17, Fig. 1. Von Holst taught this arrangement reduces “injurious forces” when the outer shell is “displaced relative to the inner shell” to absorb rotational energy. *Id.*, 2:34-38, 8:12-18; Ex.1032[Mills-2006], 173-174 (“low friction layers” to reduce “rotational acceleration”). 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. OVERVIEW OF THE '909 Patent

A. Specification

The '909 Patent is directed to preventing damage from “rotational” and other forces. Ex.1001[USP909], 2:63-3:2. 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[USP909], 3:9-16, 6:52-55. Figure 6 depicts three layers (603, 607, 611) joined by “energy and impact transformer” layers (605, 609):



Ex.1001[USP909], 10:17-25, FIG. 6. The layers are connected (directly or indirectly) through transformer layers, Ex.1001[USP909], 10:56-58, which “transform” energy—*e.g.*, impact or rotational force—via sliding into *e.g.*, heat or rotational energy. *Id.*, *e.g.*, 9:22-39, 6:35-45, FIG. 5 (shell 501 “mov[ing] and/or

slid[ing]”¹ relative to 503). The Patent identifies several materials—in various combinations—that may make up a transformer layer. Ex.1001[USP909], Abstract, 2:51-57, 6:46-7:67, 9:44-10:16, 11:20-22, 9:7-11 (fluid or gel alone or with mechanical spacers). The ’909 Patent specification does not reference “shear mechanism” or “shear layer.” Ex.1002, ¶¶49-52.

The ’909 Patent further discusses typical prior-art helmet components like lining layers, Ex.1001[USP909], 8:24-27, 10:21-23, and chin-straps. *Id.*, 10:23-25, 10:38-40. Ex.1002, ¶53.

B. Prosecution History

The ’909 Patent issued from U.S. Patent Application No. 15/050,357. Its prosecution was abbreviated, with only one office action with double patenting rejections, and allowance after terminal disclaimers. Ex.1003[Knight-909-FH], 61-66, 78-80, 87-91.

With the ’909 Patent prosecution pending, Applicant prosecuted U.S. Application No. 13/554,563, claiming priority to the same provisional. Ex.1012[Knight-162], Cover. A different examiner rejected similar claims *five*

¹ The ’909 Patent uses “move relative to” and “slide relative to” synonymously.

Ex.1001[USP909], Abstract, 2:47:51, 8:66-9:6, 9:22-30, 9:31-39. Ex.1002, ¶52, n.2.

times before allowing significantly narrower claims. *See generally* Ex.1013[Knight-162-FH]. Ex.1002, ¶¶54-56.

C. Priority Date

For this IPR, the '909 Patent is entitled at most to a priority date of July 20, 2012.²

The '909 Patent claims priority to U.S. Provisional Application No. 61/510,401 (“’401 Provisional”), filed July 21, 2011 (Ex.1029[401Prov]). Patent Owner cannot, however, prove the '401 Provisional provides written-description support for each claim, *i.e.*, “reasonably convey[s] to [POSAs] the inventor had possession of the [later-claimed] subject matter as of the filing date.” *Parus Holdings, Inc. v. Google LLC*, 70 F.4th 1365, 1373 (Fed. Cir. 2023) (quoting *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc)).

Every Challenged Claim recites “a chin-strap” attached to an inner layer. But the '401 Provisional *nowhere mentions a chin-strap*, much less one “attached” to the inner shell/layer as claimed. The specification thus does not convey to a POSA that the inventor possessed a chin-strap attached to a helmet inner layer. Indeed, the '401 Provisional only refers to gear designed for the head in discussing (1) “Related Art” and (2) a “Coconut and Fiber Element”

² Petitioner reserves the right to assert a different date in District Court.

embodiment that does not refer to sliding layers. Ex.1029[401Prov], 5-6, 11;
Ex.1002, ¶¶57-59.

The earliest application discussing a chin-strap was U.S. Application No. 13/554,471, filed July 20, 2012. Ex.1048[Knight-384], [0049]. Although Petitioner does not concede the '471 application adequately supports the claims, for this IPR, it provides the earliest potential priority date. Ex.1002, ¶59.

VIII. PRIOR ART PATENTS AND PUBLICATIONS

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, ¶¶65-66.

Weber describes outer, intermediate, and inner liners separated by components that allow relative movement between them. For example, Weber describes isolation dampers that allow “controlled internal omnidirectional relative displacement...including relative rotation and translation...” Ex.1004[Weber], [0010]. Figure 4’s 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 the intermediate and inner/outer liners.

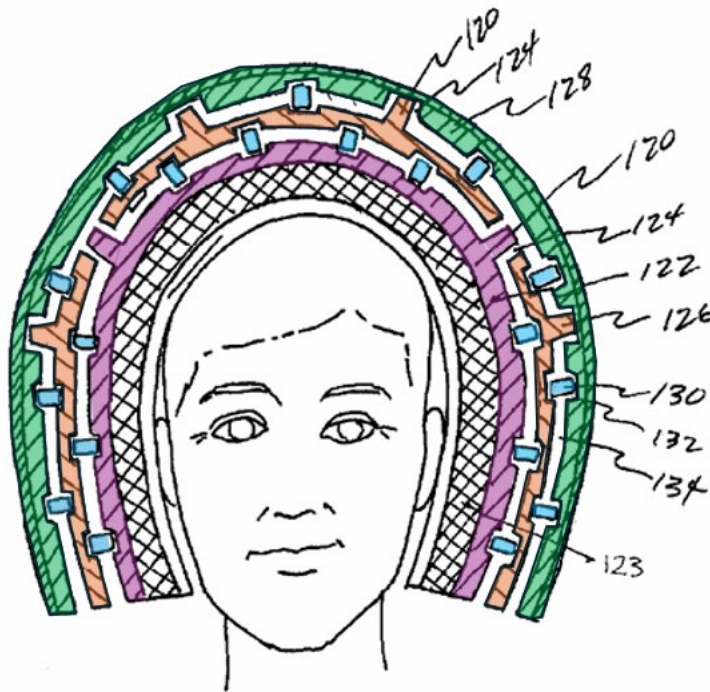


Fig. 4

Ex.1004[Weber], Fig. 4³, [0045-46]. Ex.1002, ¶¶67-68.

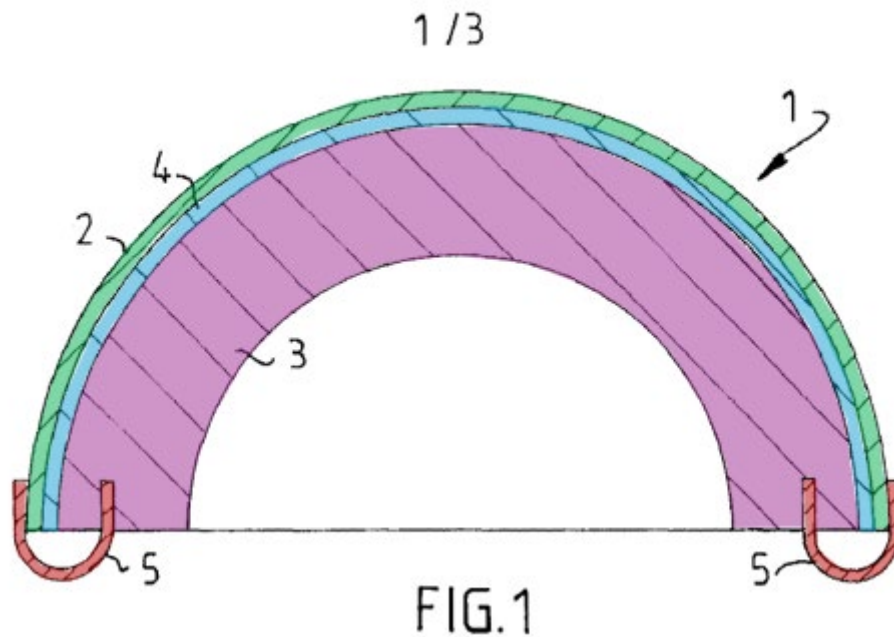
Weber’s “isolation dampers 130” “disposed between” liners “dissipate” impact energy, *id.*, *e.g.*, “enabl[ing] the inner and intermediate liners 122 and 126 to move relative to each other and/or the outer liner 128.” *Id.*, [0045-46]. Ex.1002, ¶68.

B. WO01/45526 (“Von Holst”)

³ All annotations and emphasis added unless stated.

Von Holst's helmets have 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, ¶69-70.

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



Ex.1005[VonHolst], Fig. 1. Ex.1002, ¶71.

Von Holst's Figure 3b helmet is a five-layer variant of Figure 1 with **intermediate shell 6** between “**two sliding layers 4**....” Ex.1005[VonHolst], 6:2-6. Ex.1002, ¶¶72-73.

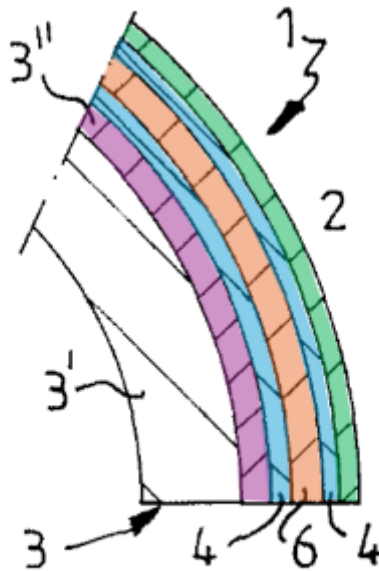


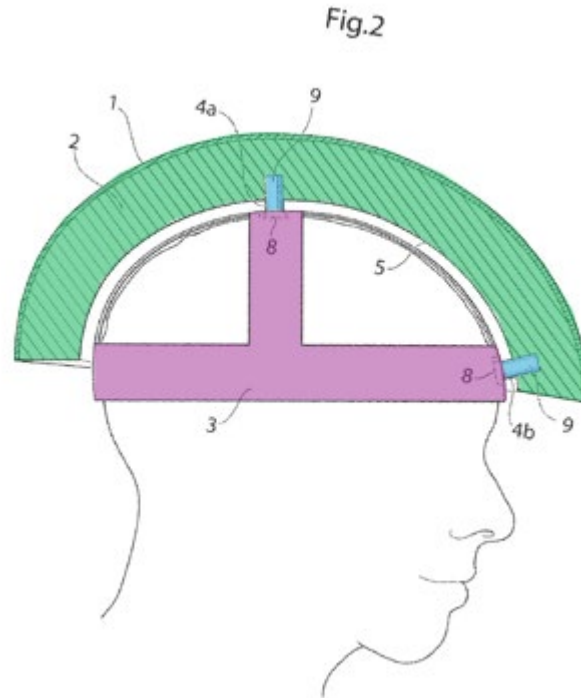
FIG.3b

Ex.1005[VonHolst], Fig. 3b.

C. WO2011/139224 (“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” device 3.
Ex.1006[Halldin], [0046-47].



Ex.1006[Halldin], Fig. 2. Ex.1002, ¶¶74-75.

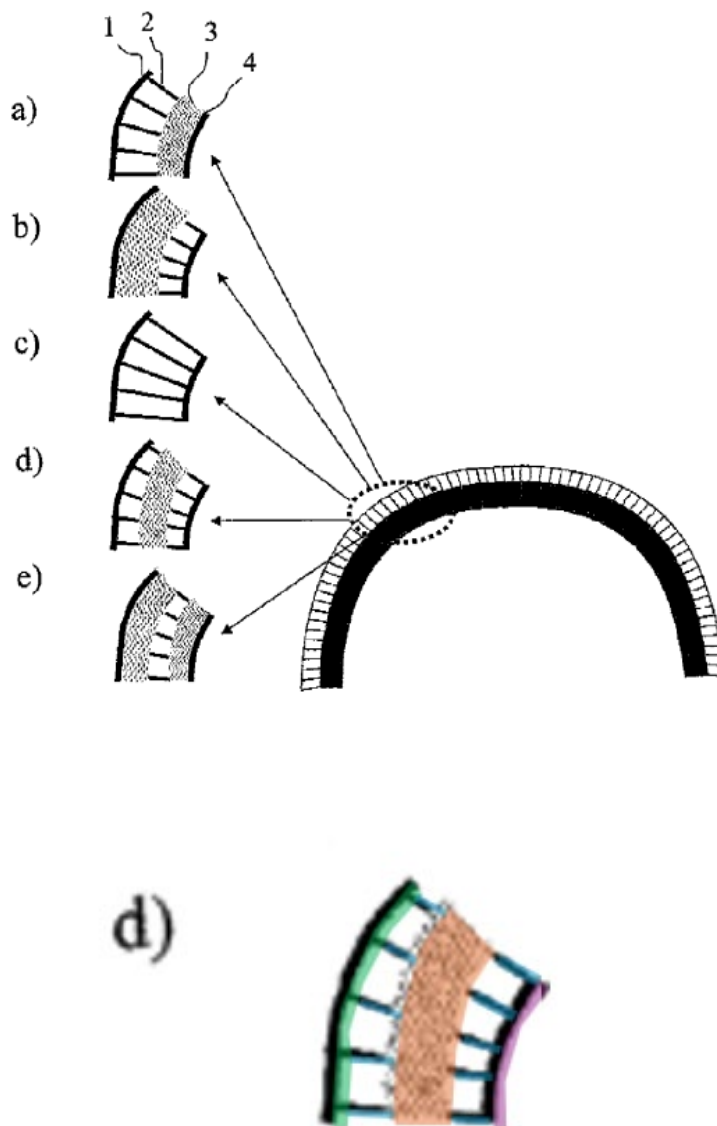
D. US2013/0122256 (“Kleiven”)

Kleiven recognizes “[a]ngular or rotational motion” from 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], [0048-0049], [0062]. Ex.1002, ¶¶76-77.

Figures 1 and 2 disclose **outer shell 1**, **inner shell 4**, **spike/beam layers 2**, and **energy absorbing foam layer 3**. Ex.1007[Kleiven], [0031], Figs. 1-2. 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].

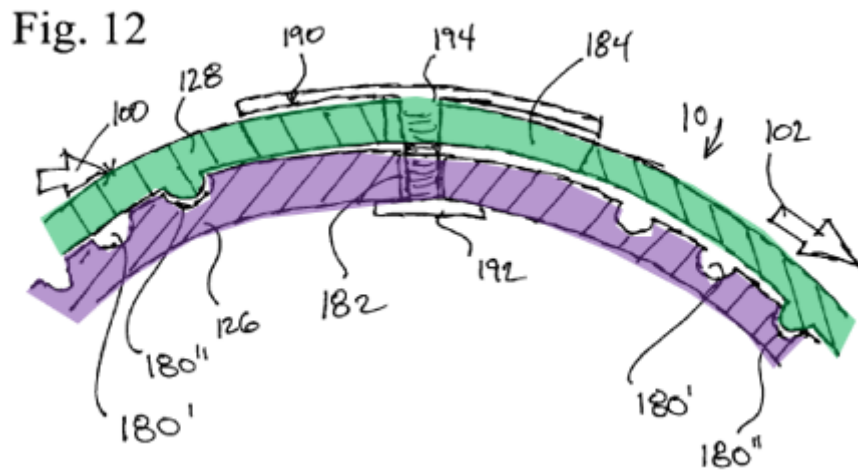
Fig. 2.



Ex.1007[Kleiven], Fig. 2, 2(d). Ex.1002, ¶¶78-79.

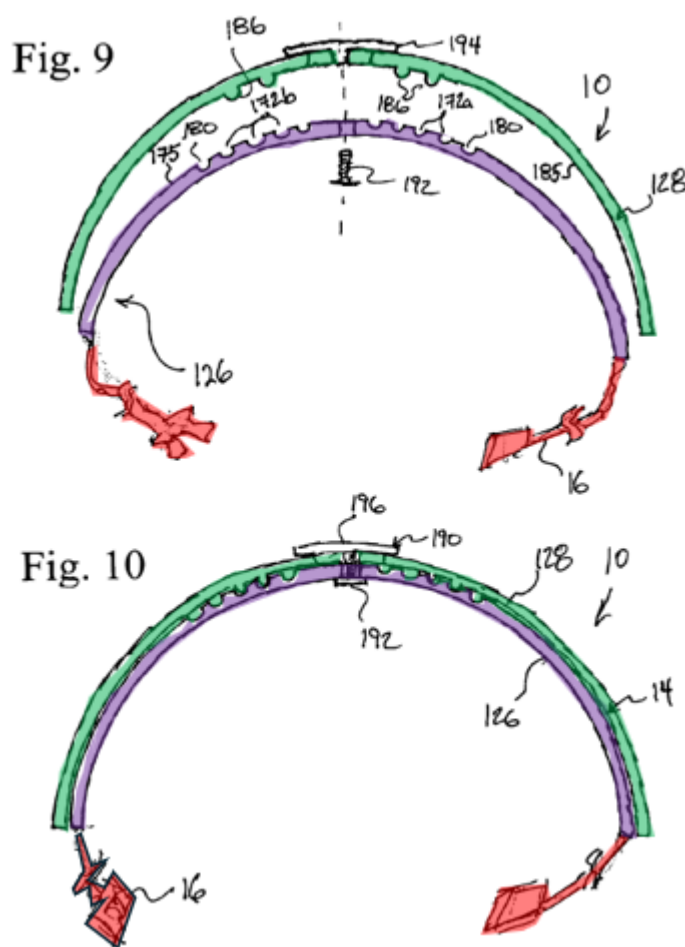
E. US6,996,856 (“Puchalski”)

Puchalski's helmets have a “**inner dome-shaped panel 126**” and “**outer dome-shaped panel 128**.” Ex.1011[Puchalski] 11:36-39. Upon impact to “the outer panel 128, the impact force results in the *sliding movement* of the outer panel 128 relative to the inner panel 126”:



Ex.1011[Puchalski], 12:55-58, Fig. 12. Ex.1002, ¶¶80-81.

Puchalski discloses **chin-straps 16** “most preferably...secured to the peripheral edge of the **inner panel 126**....” Ex.1011[Puchalski] 12:1-3, as Figures 9-10 show:

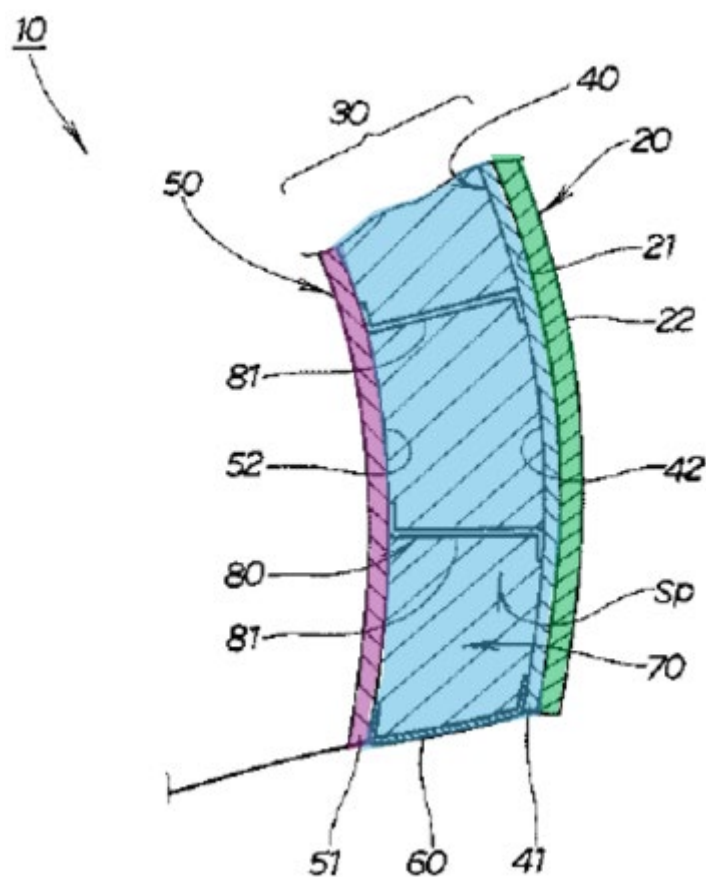


Ex.1011[Puchalski], Figs. 9-10. Ex.1002, ¶82.

F. JP2006/016740 (“Dotsuko”)

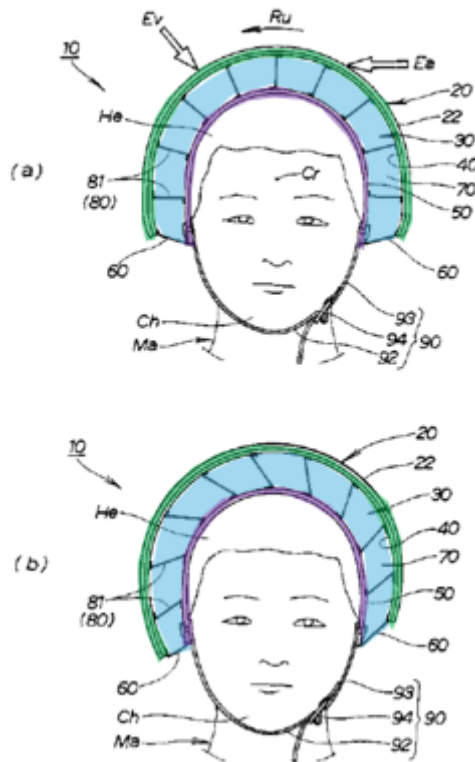
Dotsuko’s helmet has **inner liner 50** connected to **outer liner 40 and outer shell 20** with a **layer of space Sp** between with elastic straps and an elastic body.

Ex.1041[Dotsuko], [0013], [0017].



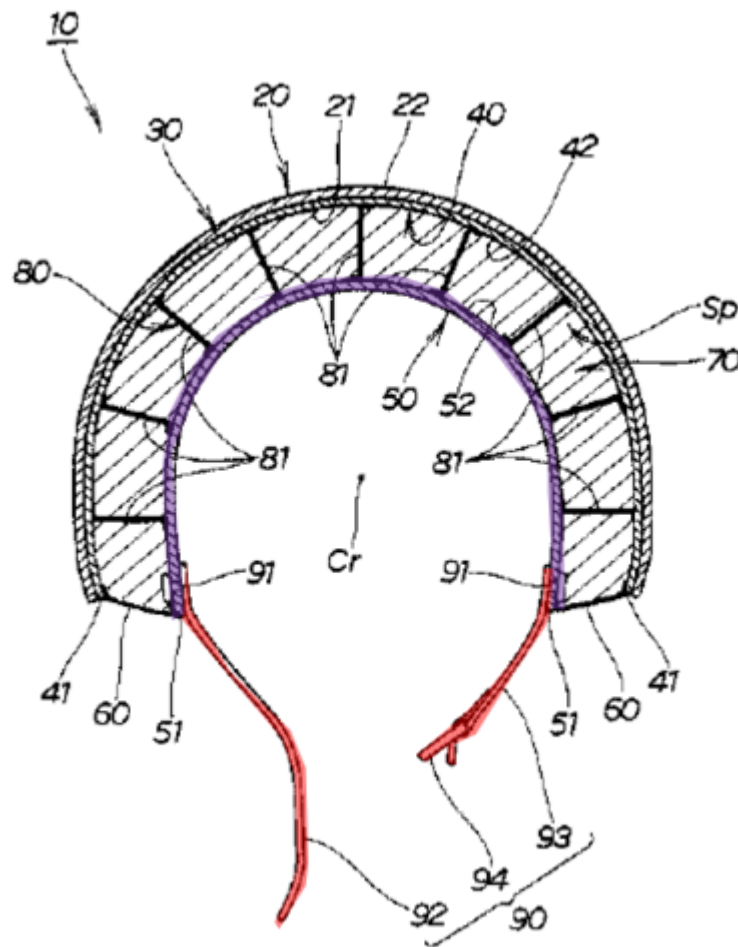
Ex.1041[Dotsuko], Fig. 2. Dotsuko's elastic body can "deform" and the straps allow "relative rotation of the shell 20 and the outer liner 40 with respect to the inner liner 50...." Ex.1041[Dotsuko], [0016], [0017].

[Fig. 4]



Ex.1041[Dotsuko], Fig. 4. Ex.1002, ¶¶83-84.

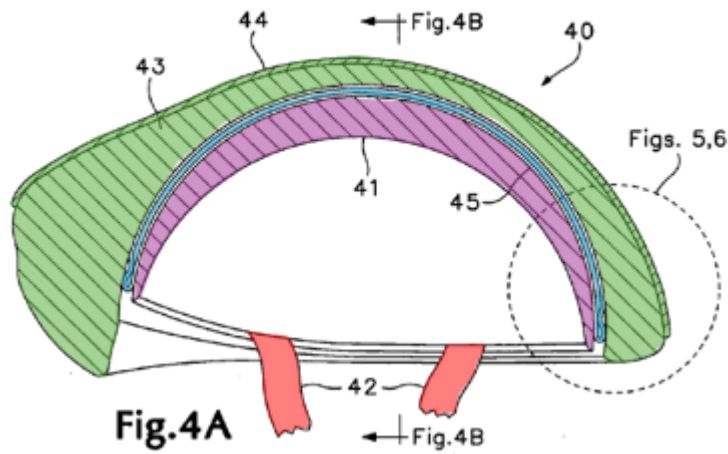
Dotusko further discloses a **chin-strap 90** attached to the sides “of the **inner liner 50**....” Ex.1041[Dotsuko], [0018].



Ex.1041[Dotsuko], Fig. 3. With its chin-strap, upon impact, “inner liner 50[] remains in place while the shell 20 alone relatively rotates...thereby absorbing the impact energy E_a .” Ex.1041[Dotsuko], [0022]. Ex.1002, ¶85.

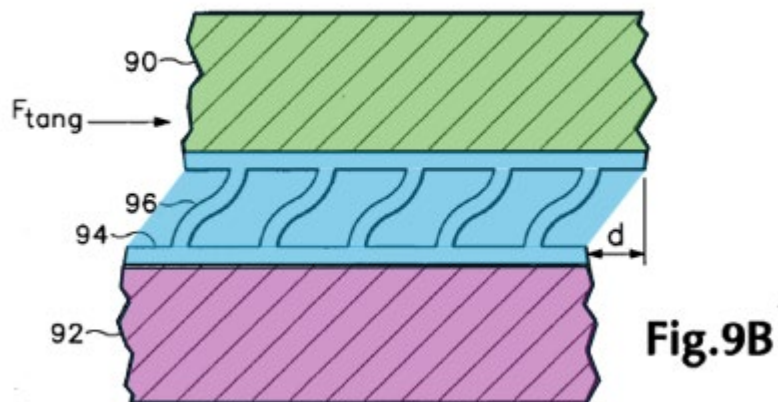
G. US2004/0117896 (“Madey”)

Madey’s helmets have **outer helmet layer 43/44**, **inner helmet layer 41**, and **interface layer 45**, which allows “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.1047[Madey], Fig. 4A. Ex.1002, ¶¶86-87.

In Figure 9B “**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, deflecting and absorbing it. Ex.1047[Madey], [0037].



Ex.1047[Madey], Fig. 9B. Ex.1002, ¶¶87-88.

IX. CLAIM CONSTRUCTION

All claim terms should be given their plain and customary meaning as understood by a POSA. For example, the plain meaning of “shear mechanism allowing the outer protective [shell/layer] to slide relative to the inner protective [shell/layer]” is something that shears and allows the outer protective shell/layer to slide relative to the inner protective shell/layer. Claim 9 confirms the claimed shear mechanism can be a shear layer, which is a layer that shears. Ex.1001[USP909], cl. 9. Ex.1002, ¶¶60-64.

Petitioner reserves the right to propose or respond to claim constructions in parallel litigation and respond to any claim construction PO advances here. Ex.1002, ¶64.

X. SPECIFIC GROUNDS FOR UNPATENTABILITY

Under 37 C.F.R. § 42.104(b)(4)-(5), and as Dr. Duma confirms (Ex.1002, ¶¶89-345), the prior art anticipates and/or renders obvious the Challenged Claims.

A. Ground 1: Claims 1-2, 8-13, and 19-20 are Obvious Over Weber Combined with Puchalski

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, and 2) at least one claim has written description in the provisional. *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 describes helmets to <i>e.g.</i> “reduce...rotational brain injury [and] shearing of brain matter...” and “force applied to the helmet...result[ing] in...rotational brain injury...”
[0006]	
[0008]	p.4: helmets to <i>e.g.</i> “absorb and dissipate as much energy as possible, in the shortest amount of time possible” including “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]	pp. 3-4 describes helmet system reducing rotational and linear forces on the brain
[0036]	pp. 4-6: helmet layers and materials including an inner comfort liner in contact with wearer’s head
[0037]	p. 4-5: engagement between liners and allowance of movement to reduce force and acceleration from outer shell

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of U.S. Patent No. 9,516,909

[0038]	p. 5: multiple layers with omni-directional control using components with or without air gaps and layer materials
[0039]	p. 5: outer liner fixed to inside of helmet shell
[0040]	p. 5: “inner and outer liners” and their engagement using isolation dampers; Figure 2 embodiment
[0041]	
[0042]	pp.4-5: outer liner affixed to outer shell
[0043]	<i>See</i> [0040-0041]; pp.5,6: 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.” p.6: stops to prevent over-rotation.
[0045]	pp. 4-6: intermediate liners and their materials and comfort liner
[0046]	p. 6: “flex bumpers” (isolation dampers) and their makeup and properties, including absorbing energy
[0047]	p. 6, 5: lugs and recesses and relative movement of layers
[0048]	p. 6: lugs and “flex bumpers” (isolation dampers), their properties, and use in multiple layers
[0049]	pp. 5-6: “flex bumpers” (isolation dampers) create space between surfaces and air gaps for relative displacement
[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 “flex bumpers” (isolation dampers)) to allow relative movement and absorb energy

[0062]	p. 6: materials for “flex bumpers” (isolation dampers)
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Ex.1002, ¶¶91-92.

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: 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.	p. 4: helmet with outer liner affixed to outer shell. pp. 4-5, 7: “inner...liners” engaged with outer liner, “flex bumpers” (isolation dampers), and relative omnidirectional movement

Ex.1002, ¶93.

2. Claim 1

a) 1[preamble]⁴: “A helmet comprising:”

Weber discloses “helmets.” Ex.1004[Weber], [0002], Fig. 4. Ex.1002, ¶¶94-95.

b) 1[a]: “an outer protective shell;”

⁴ Petitioner takes no position herein whether any preamble is limiting. In all cases, the prior art teaches it. Ex.1002, ¶¶89-347.

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], [0042], [0045], Figs. 2, 4, is an outer protective shell.⁵ Ex.1004[Weber], [0036], [0038], [0045]; Ex.1001[USP909], 10:30-33, 10:22-30. Weber equates “layers” and “liners.” Ex.1004[Weber], [0036]. Ex.1002, ¶¶96-97.

c) 1[b]: “an inner protective shell;”

Weber discloses 1[b]. Weber’s “inner liner 122” made of, *e.g.*, EPS, is an inner protective shell, like Weber’s outer liner. Ex.1004[Weber], [0036], [0038], [0046], Figs. 2, 4; *see n.5*. Ex.1002, ¶98.

d) 1[c]: “a first energy transformer layer associated with a shear mechanism, the first energy transformer layer residing between the outer protective shell and the inner protective

⁵ The ’909 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[USP909], 11:22-30, 10:30-33. Weber’s outer “liner” discloses to a POSA an outer “protective shell” because it, for example, spans the entirety of the helmet and is made of EPS (a plastic constructed from a plastic resin). Ex.1004[Weber], [0036], [0038]; Ex.1049[Epsol]; *see also* Ex.1031[Bosch], 2 (standard for materials at outer and inner layers). Ex.1002, ¶96.

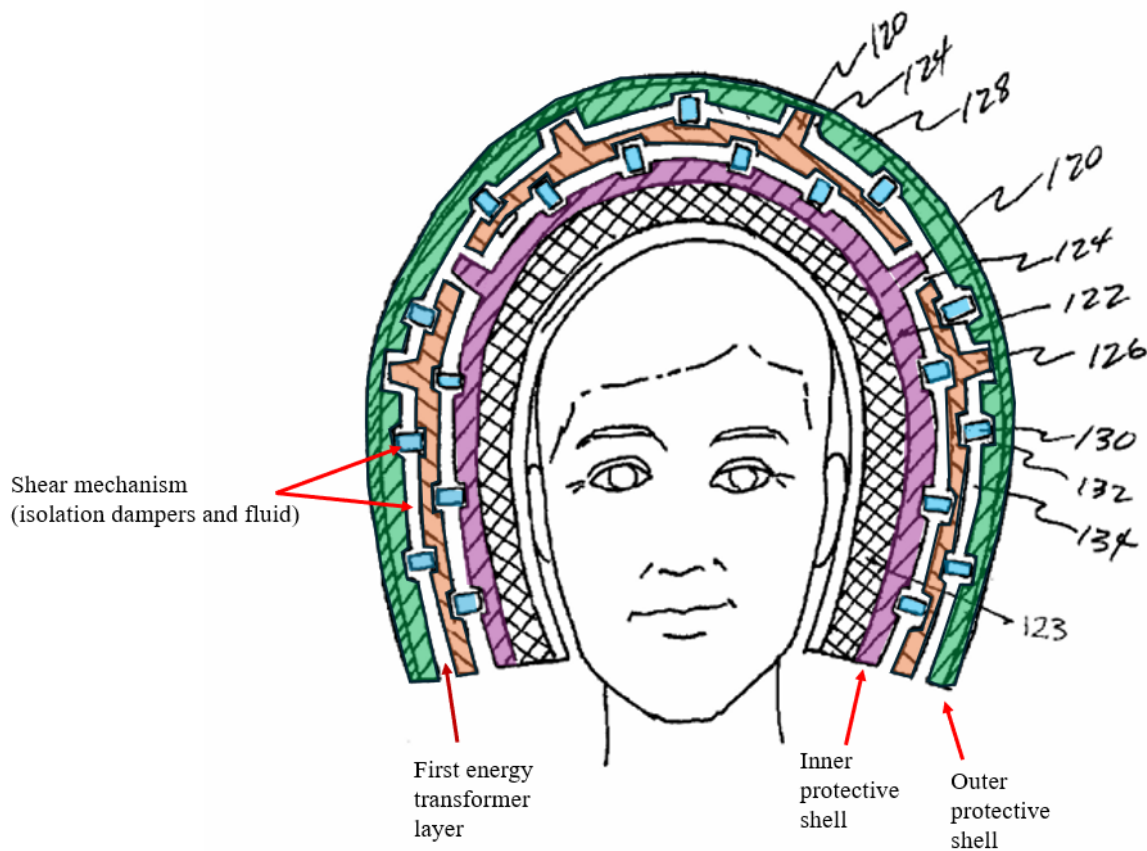
shell, wherein the shear mechanism allows the outer protective shell to slide relative to the inner protective shell;”

Weber discloses 1[c].⁶ Weber discloses components between its outer and inner liners that shear and allow them to slide relative to each other and to transform energy from impact. This layer of components includes dampers and surrounding fluid (*i.e.*, air). Thus, as exemplified below, Weber discloses the claimed shear mechanism and energy transformer layer. Ex.1002, ¶¶99-108, 110.

Weber discloses 1[c] is as much, if not more detail, as the '909 Patent, which does not identify a “shear mechanism,” nor explain how it differs from an “energy transformer layer.” For example, to a POSA, Weber discloses at least a first energy transformer layer, as Figures 2-4 show, located between **outer liner 128** and **inner liner 122** and including outer layer of **dampers 130** and air gap 134 (Figure 4), or single layer of **dampers 108** and air gap 134 (Figure 2). *Id.*, [0045]-[0046], [0039-41]. As Weber explains and Dr. Duma confirms, this layer of space filled with fluid (air) and dampers transforms energy including absorbing and dissipating energy from impact force through compression, displacement, and fluid flow, which results in generation of heat. *E.g.*, Ex.1004[Weber], [0034] (“[O]mnidirectional impact energy management systems...significantly reduce both rotational and linear forces

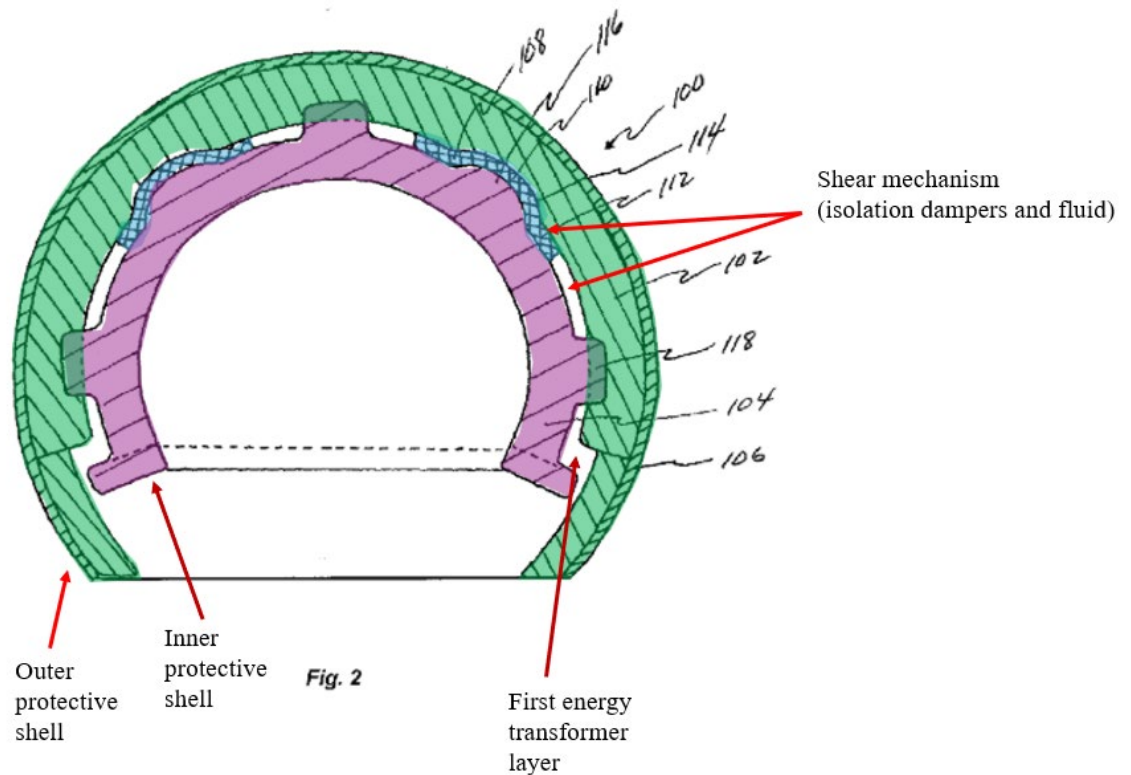
⁶ The '909 patent does not describe “energy transformer layer,” but for this IPR, it is encompassed in an energy and impact transformer layer. Ex.1002, ¶99. n.8.

generated from impacts.”); see Ex.1001[USP909], 6:57-63 (fluids, gels absorptive/dissipative materials).⁷ Ex.1002, ¶¶100-104.



Ex.1004[Weber], Fig. 4. Ex.1002, ¶104.

⁷ Weber also states the layer of space “can be completely or partially filled with any suitable material in any form, including without limitation, a liquid, gel, foam, or gas cushion.” Ex.1004[Weber], [0049]. This transforms energy for the same reasons as the air gap. Ex.1002, ¶104.



Ex.1004[Weber], Fig. 2. Ex.1002, ¶104.

Weber also, for example, discloses its layer filled with dampers and fluid (*e.g.*, air) (first energy transformer layer) is associated with a shear mechanism, which in Weber are at least the components that shear and allow the outer liner (protective shell) to slide relative to the inner liner (protective shell). The shear mechanism includes **isolation dampers 108/130** and fluid (*e.g.*, air). *Id.* Ex.1002, ¶105.

For example, Weber’s isolation dampers “couple an inner liner [*e.g.*] 138 with an outer layer [*e.g.*] 142 and maintain a predetermined gap therebetween....” Ex.1004[Weber], [0049]. They “flex, bend, and/or compress to absorb the energy of impacts..., and 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].⁸ Lateral/rotational movement of Weber’s outer and inner liners is relative sliding that is allowed by, *e.g.*, isolation dampers 130. Ex.1002, ¶¶106, 108.

As another example, Weber states the space can be an air gap that facilitates relative movement between the outer and inner liners. Ex.1004[Weber], [0049], [0046]. Dr. Duma explains this space allows the (*e.g.*) fluid to transform energy through translational movement and fluid flow, generating heat.⁹ Ex.1002, ¶¶107-108.

⁸Weber also discloses lugs engaged with recesses “control[]” “lateral or rotational displacement” of the inner liner “relative to the outer liner.” Ex.1004[Weber], [0047]; [0045] (isolation dampers “further” dissipate energy). Ex.1002, ¶106, n.10.

⁹ Weber’s space completely or partially filled with liquid, gel, foam, or gas cushion transforms energy in the same way. Ex.1004[Weber], [0049]. Ex.1002, ¶107.

Alternatively, to the extent Patent Owner argues the claimed “shear mechanism” requires a middle shell/liner, Weber also discloses this in Figure 4.¹⁰ Weber discloses **intermediate liner 126** associated with inner and outer layers of dampers and fluid/air gaps. The components between Weber’s outer and inner liners—intermediate liner, lugs, inner/outer layers of **isolation dampers 130** and fluids—collectively shear to allow relative sliding of the inner and outer liners. Ex.1004[Weber], [0045-46], Fig. 4. Ex.1002, ¶¶109-110.

e) 1[d]: “a liner layer connected to the inner protective shell, the liner layer configured to reside between the inner protective shell and a human head;”

Weber discloses 1[d]. Weber discloses “inner liner” (inner protective shell) coupled to “**‘comfort’ liner 123** configured to closely surround the head of the wearer....” Ex.1004[Weber], [0045], *see id.*, [0036], [0050]. Figure 4 shows **comfort liner 123** between the inner protective shell and human head:

¹⁰ Petitioner disagrees this would be appropriate. ’909 patent claim 11 (dependent from claim 1) separately claims a helmet “*further comprising* a middle protective shell.” PO’s differentiation between “shear mechanism” and “middle protective shell” precludes limiting the former to the latter. Ex.1002, ¶109.

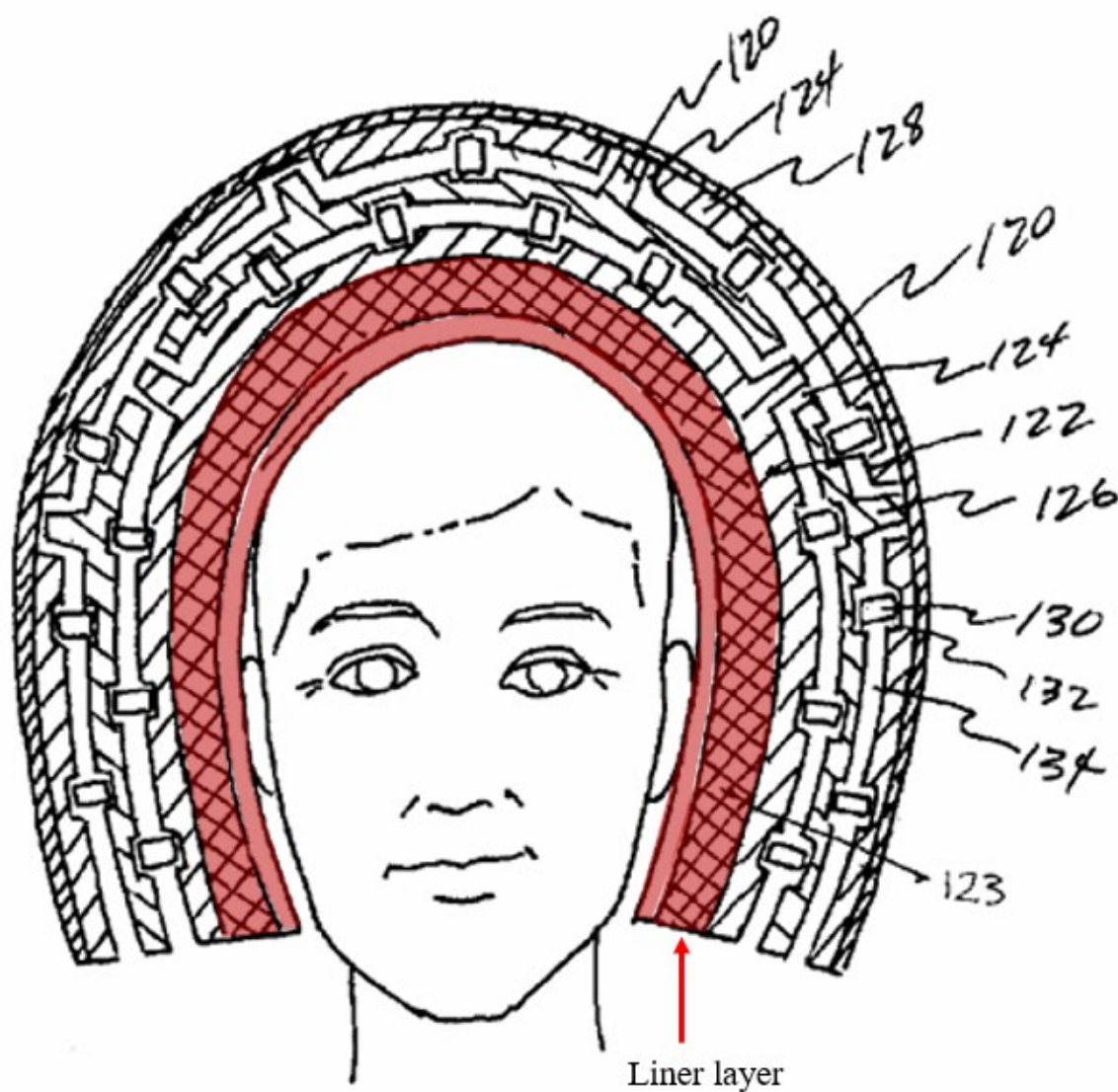


Fig. 4

Ex.1004[Weber], Fig. 4. Ex.1002, ¶111.

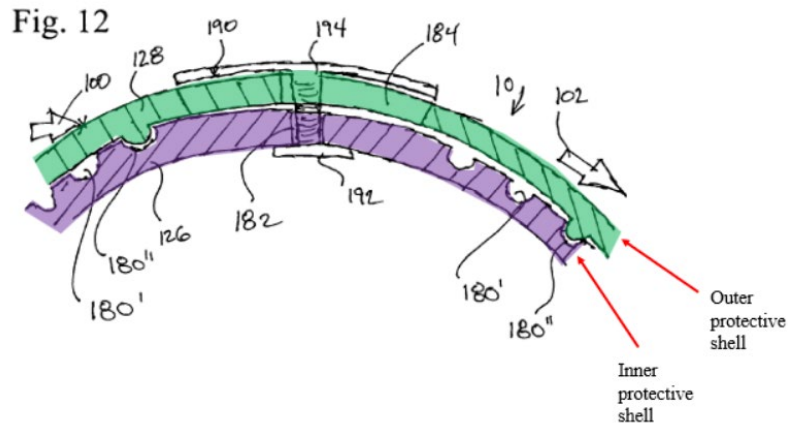
f) 1[e]: “a chin strap attached to the inner protective shell, the chin strap and the liner layer configured to secure the inner protective shell to the human head while the outer

protective shell is allowed to slide relative to the inner protective shell.”

Weber combined with Puchalski renders obvious 1[e]. A POSA would have found it obvious to use Puchalski’s chin-strap location with Weber’s chin-strap. Weber discloses “[p]roper restraint on the wearer’s head can be managed by, for example, a [conventional] chin-strap....” Ex.1004[Weber], [0038]. With its chin-strap, Weber’s comfort liner further helps secure the inner protective shell to the head while the outer protective shell moves relative to the inner protective shell. As Section X.A.2.e) discusses, Weber’s liner layer is “configured to closely surround the head,” Ex.1004[Weber], [0045], [0036], [0050], and thereby assist in securing the inner protective shell by improving fit. *Id.*; *see also* Ex.1011[Puchalski], 1:52-55 (Liner layer increases comfort, “better fit[s]” and assists with impact force absorption); *see also, e.g.*, Ex.1031[Bosch], 2 (“comfort padding liner” increases “wearing comfort” and provides “good fit”). However, Weber does not expressly disclose where it is attached to the helmet. Ex.1002, ¶¶112.

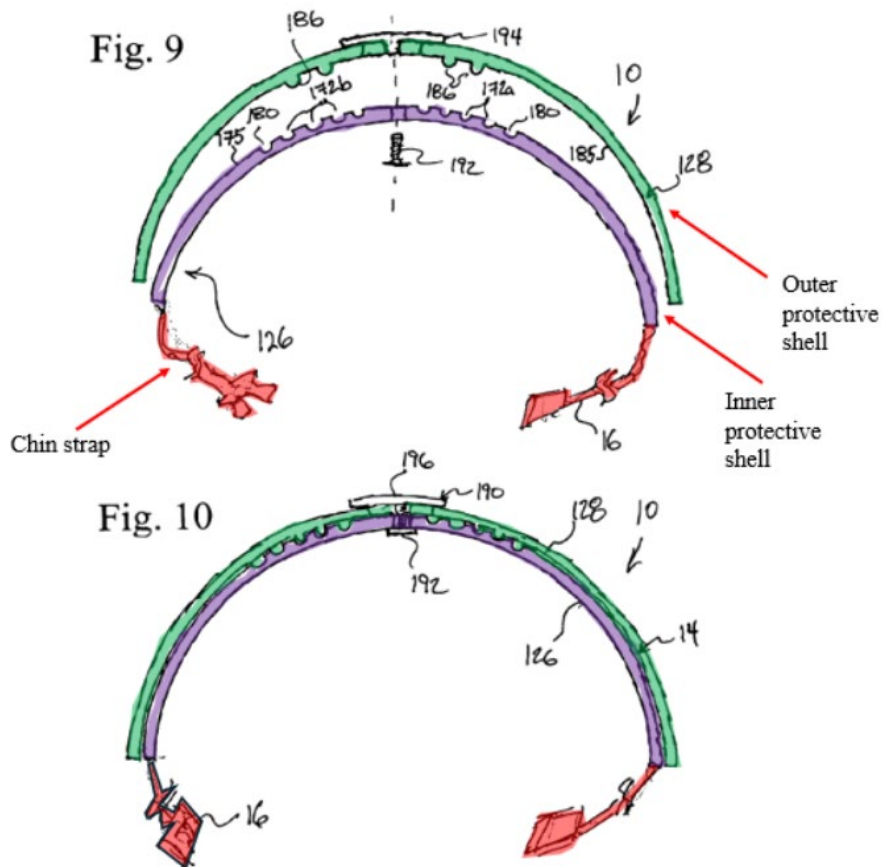
Similar to Weber, Puchalski discloses a helmet with a “two-part dome shaped shell 14” with “**separate and distinct inner dome-shaped panel 126** and an **outer dome-shaped panel 128.**” Ex.1011[Puchalski] 11:36-39. Puchalski, like Weber, states that, “upon the application of a predetermined minimum impact force (Arrow

100) on the outer panel 128, the impact force results in the sliding movement of the outer panel 128 relative to the inner panel 126”:



Ex.1011[Puchalski], 12:55-58, Fig. 12. Ex.1002, ¶113.

Puchalski discloses “[a]lthough not essential, most preferably, the helmet **chin-straps 16** are secured to the peripheral edge of the **inner panel 126**, along each of its sides.” Ex.1011[Puchalski] 12:1-3. Figs. 9-10 demonstrate this:



Ex.1011[Puchalski], Figs. 9-10. Ex.1002, ¶114.

A POSA would have been motivated to attach Weber’s chin-strap at the location of Puchalski’s chin-strap with a reasonable expectation of success. Weber and Puchalski are analogous art to the challenged claims: they are directed to the same problem of reducing rotational impact via multiple sliding layers. Both recognize chin-straps properly position helmets. Ex.1002, ¶115.

As Puchalski recognizes, the chin-strap is most preferably placed on an inner layer. Because the chin-strap is for “[p]roper restraint on the wearer’s head,” placing it on the inner layer that, along with the comfort liner, conforms to the wearer’s head

would have been an obvious design choice to ensure such attachment while allowing the outer layer to slide upon rotational impact, as Section X.A.2.d) discusses. *See also* Ex.1041[Dotsuko], [0022]; Ex.1047[Madey], [0025]. A POSA would have understood that others of the small finite set of available options may be less desirable. For example, a chin-strap attached to a layer moving relative to the layer conforming to the head could move with the outer layer, which could harm the user and/or mean the strap no longer properly secures the helmet. Placing chin-straps along the inner liners of a helmet in this preferable position ensures proper fit with the wearer's head. Ex.1002, ¶116.

Further, Weber's chin-straps have a finite number of places in which they can be attached with a limited number of solutions. They must be attached to a structural feature, and there are only up to three possible layers: the inner, intermediate, or outer layer. A POSA would have been motivated to try each of these limited options, and, as discussed, attach the chin-strap in Puchalski's preferred inner layer position to ensure a consistent, proper fit. Ex.1002, ¶117.

A POSA would have had a reasonable expectation of success in modifying Weber with Puchalski's chin-strap location. POSAs were well-equipped to modify chin-strap locations for specific helmets as a matter of routine design. For example, a POSA would have understood how to implement chin-straps into specific helmet designs to ensure proper attachment while preserving operation. This is confirmed

by Weber, which discloses a chin-strap attached to the helmet without further implementation details. POSAs recognized helmet chin-straps attached to the inner layer that conformed to the head as conventional. Ex.1041[Dotsuko], [0018], [0022]; Ex.1047[Madey], [0025]; Ex.1043[Field] 2:51-52, 5:48-51; Ex.1032[Mills-2006], 169; Ex.1044[Copeland], Fig. 3; Ex.1045[Noniyama], 2:30-31, 2:14-16; Ex.1046[Goldman], 1:19-32. And the '909 Patent identifies no design challenge with such attachment. Ex.1001[USP909], 10:17-55. Ex.1002, ¶118.

Thus, Weber combined with Puchalski renders claim 1 obvious. Ex.1002, ¶119.

3. Claim 2

a) “The helmet of claim 1, wherein the shear mechanism comprises a first absorptive/dissipative material.”

Weber combined with Puchalski render obvious claim 1. Section X.A.2. Weber also discloses the limitation of claim 2. Specifically, for example, Weber’s isolation dampers are made of absorptive/dissipative material. The fluids in Weber are also an absorptive/dissipative material. Ex.1002, ¶¶120-121.

Weber describes, *e.g.*, that isolation dampers 130/108 “disposed between, *e.g.*, the inner and outer liners 122 and 128 and/or the intermediate liner 126 to further *dissipate* the energy of impacts” and “*absorb* the energy of impacts” via mechanical deformation and are made of elastomeric material. Ex.1004[Weber], [0044-46], [0040]. Weber describes isolation dampers formed of various “elastomeric

materials, including MCU (micro-cellular urethane),” that “flex, bend, and/or compress to **absorb** the energy of impacts....” Ex.1004[Weber], [0062], [0046]. Ex.1002, ¶121.

As Section VIII.A discusses and Dr. Duma explains, Weber’s air gap can absorb and dissipate energy from impact force on the helmet through compression, displacement, and fluid flow, which results in generation of heat.¹¹ As also recognized by the specification, fluids and gels are absorptive/dissipative materials. Ex.1001[USP909], 6:60-63. Air is a type of fluid. Ex.1002, ¶122.

Thus, Weber combined with Puchalski renders claim 2 obvious. Ex.1002, ¶123.

4. Claim 8

a) “The helmet of claim 1, wherein the shear mechanism comprises a plurality of elastomeric elements.”

Weber combined with Puchalski render obvious claim 1. Section X.A.2. As discussed for claim 2 (Section X.A.3), *e.g.*, isolation dampers comprise a plurality of elastomeric elements. Ex.1004[Weber], [0062] (“elastomeric materials”), [0040], [0046]. Ex.1002, ¶124.

¹¹ Weber’s space completely or partially filled with liquid, gel, foam or gas cushion transforms and absorbs/dissipates energy in the same ways. Ex.1004[Weber], [0049]. Ex.1002, ¶122.

Thus, Weber combined with Puchalski renders claim 8 obvious. Ex.1002, ¶125.

5. Claim 9

a) “The helmet of claim 1, wherein the shear mechanism is a shear layer.”

Weber combined with Puchalski renders obvious claim 1. See Section X.A.2. As Section X.A.2.d) discusses, Weber discloses, *e.g.*, a layer with isolation dampers and, *e.g.*, air between the inner and outer liners that allows these liner layers to slide relative to one another (shear). Ex.1004[Weber], [0046], [0049], Fig. 4. Ex.1002, ¶126.

Alternatively, Weber’s intermediate layer and the aggregate distribution of the dampers, as Figure 4 shows, in conjunction with the surrounding air gaps is a shear layer. Ex.1004[Weber], [0045-46], Fig. 4. Ex.1002, ¶127.

Thus, Weber combined with Puchalski renders claim 9 obvious. Ex.1002, ¶128.

6. Claim 10

a) “The helmet of claim 9, wherein the shear layer is connected to the outer protective shell through the first energy transformer, the first energy transformer operable to absorb energy from forces imparted onto the outer protective shell, wherein the first energy transformer includes a first absorptive/dissipative material to allow the outer protective shell to slide relative to the inner protective shell.”

Weber combined with Puchalski renders obvious claim 9. Section X.A.5.

Weber discloses the additional limitations of claim 10. Ex.1002, ¶129.

The '909 Patent explains “connection between two entities does not necessarily mean a direct, unimpeded connection, as a variety of other entities may reside between the two entities.” Ex.1001[USP909], 2:32-39. It thus explains “connections” may be “indirect” (*i.e.*, “through” a transformer) or layers may be “loosely connected.” *See, e.g.*, Ex.1001[USP909], 8:60-65; 10:56-61. In this way, Weber’s layer with dampers and (*e.g.*) air is connected to the outer protective shell (*i.e.*, outer liner) through the first energy transformer (*i.e.*, space filled with air/fluid). Ex.1004[Weber] [0036], [0037], [0046], [0049], Fig. 4.

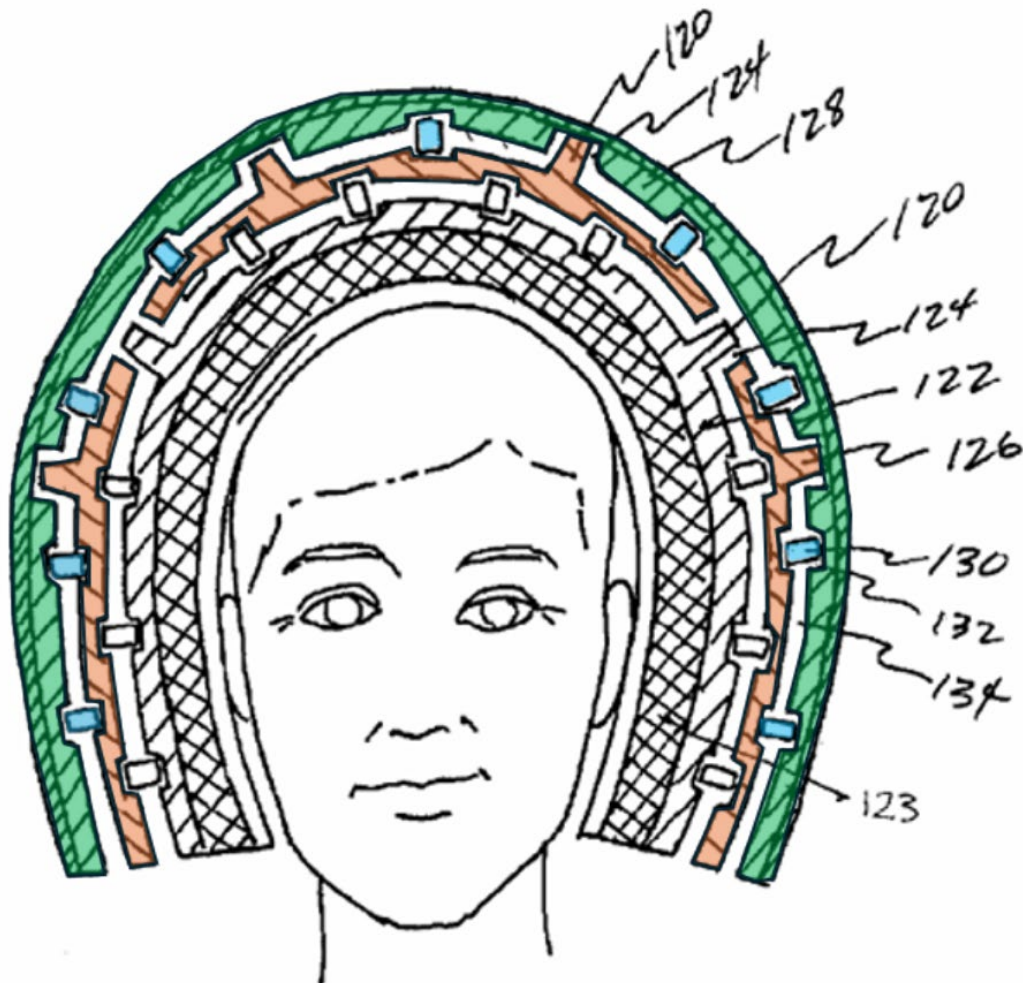


Fig. 4

Ex.1004[Weber], FIG. 4. Ex.1002, ¶130.

Weber's first energy transformer is, *e.g.*, space filled with fluid (*e.g.*, air), which includes a first absorptive/dissipative material to allow the outer protective shell to slide relative to the inner protective shell layer. Ex.1004[Weber] [0045], [0046], [0050]. As the patent recognizes, fluids and gels are absorptive/dissipative

materials. *E.g.*, Ex.1001[USP909], 6:60-63. Air/fluid in Weber absorbs and dissipates energy from impact force through compression, displacement, and fluid flow, which results in generation of heat. This movement, consistent with movement of isolation dampers (*see* Section X.A.2.d) allows the outer protective shell to slide relative to the inner protective shell. Ex.1002, ¶131.

Thus, Weber combined with Puchalski renders claim 1 obvious. Ex.1002, ¶132.

7. Claim 11

a) “The helmet of claim 1, further comprising a middle protective shell disposed between the outer protective shell and the inner protective shell.”

Weber combined with Puchalski renders obvious claim 1. Section X.A.2. Weber discloses the additional limitations of claim 11. Weber’s intermediate liner (“middle protective shell”) is disposed between the outer and inner protective shells. Ex.1004[Weber], [0045], FIG. 4. Weber’s intermediate liner made of, *e.g.*, EPS, is a middle protective shell. *Id.*; *See* n.5. Ex.1002, ¶133.

Thus, Weber combined with Puchalski renders claim 11 obvious. Ex.1002, ¶134.

8. Claim 12

a) 12[preamble]: “A helmet comprising:”

12[a]: “an outer protective layer;”

12[b]: “an inner protective layer;”

12[c]: “a first energy transformer layer associated with a shear mechanism, the first energy transformer layer residing between the outer protective layer and the inner protective layer, wherein the shear mechanism allows the outer protective layer to slide relative to the inner protective layer;”

12[d]: “a liner layer connected to the inner protective layer, the liner layer configured to reside between the inner protective layer and a portion of a human body;”

12[e]: “a chin strap attached to the inner protective layer, the chin strap and the liner layer configured to secure the inner protective layer to the human head while the outer protective layer is allowed to slide relative to the inner protective layer.”

Weber combined with Puchalski renders claim 12 obvious for the same reasons as claim 1. Section X.A.2. Claim 12 recites outer/inner “protective layers” instead of outer/inner “shells.” The patent does not differentiate them, Ex.1001[USP909], 9:22-25, 10:17-21, Figs. 5-6, and Weber’s “outer liner” affixed to an “outer shell” is an outer protective layer and its inner liner is an “inner protective layer.” Ex.1002, ¶¶135-143.

9. Claim 13

a) “The helmet of claim 12, wherein the shear mechanism comprises a first absorptive/dissipative material.”

Weber combined with Puchalski renders obvious claim 12. The combination renders claim 13 obvious for the same reasons as claim 2. See Section X.A.3. Ex.1002, ¶¶144-145.

10. Claim 19

a) “The helmet of claim 12, wherein the shear mechanism comprises a plurality of elastomeric elements.”

Weber combined with Puchalski renders claim 12 obvious. The combination renders claim 19 obvious for the same reasons as claim 8. Section X.A.4. Ex.1002, ¶¶146-147.

11. Claim 20

a) “The helmet of claim 12, wherein the shear mechanism is a shear layer.”

Weber combined with Puchalski renders claim 12 obvious. The combination renders claim 20 obvious for the same reasons as claim 9. Section X.A.5. Ex.1002, ¶¶148-149.

B. Ground 2: Claims 1-2, 5, 8-9, 11-13, 16, and 19-20 are Obvious over Von Holst Combined with Halldin and Puchalski

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. 2	Fig. 2
Fig. 3	Fig. 3
Fig. 4	Fig. 4
Fig. 11	Fig. 11
[Title]	[0001]
[0001]	[0001]
[0005]	[0005]
[0012]	[0011]
[0013]	[0012]
[0041]	[0039]

[0042]	[0040]
[0043]	[0041]
[0044]	[0041]
[0046]	[0042]
[0047]	[0043]
[0048]	[0044]
[0050]	[0046]
[0052]	[0048]
[0057]	[0053]
[0061]	[0057]
[0062]	[0058]
[0064]	[0060]
[0069]	[0064]

Ex.1002, ¶¶150-151.

And at least *Halldin* claims 1 and 7 have 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/ or the inside of the energy absorbing layer (2) for providing slidability between the energy absorbing layer (2) and the attachment device (3).	Claims 1-3 [0001], [0003-0004], [0009-0010]
7. A method of manufacturing a helmet comprising a sliding facilitator, the method comprising the steps of: 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.	
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Ex.1002, ¶152.

2. Claim 1

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

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

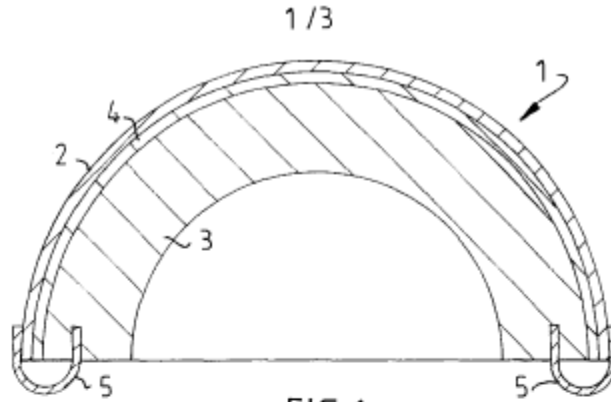


FIG. 1

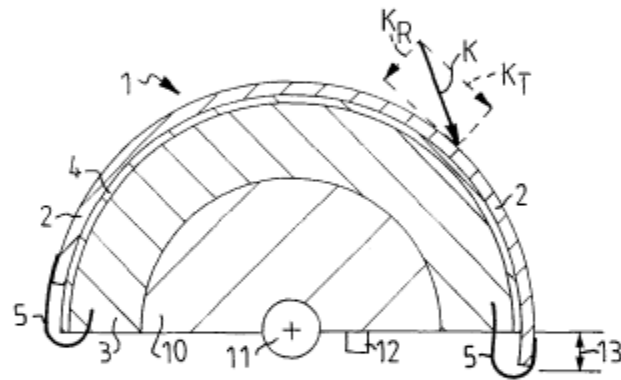


FIG. 2

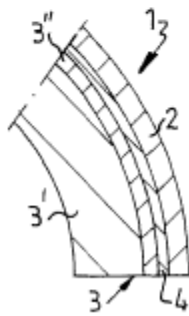


FIG. 3a

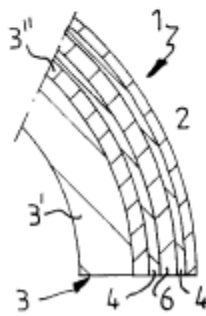


FIG. 3b

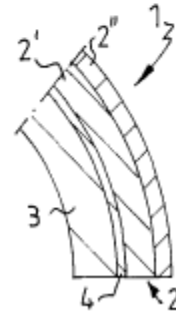


FIG. 3c

Ex.1005[VonHolst], 3:22-30, 4:10-14, Figs. 1-3, cls. 1-10. Ex.1002, ¶153.

b) 1[a]: “an outer protective shell;”

Von Holst discloses 1[a]. Von Holst discloses a helmet with “***outer shell 2.***”
Ex.1005[VonHolst], 4:10-12, Figs. 1-3, cl. 1. Ex.1002, ¶154.

c) 1[b]: “an inner protective shell;”

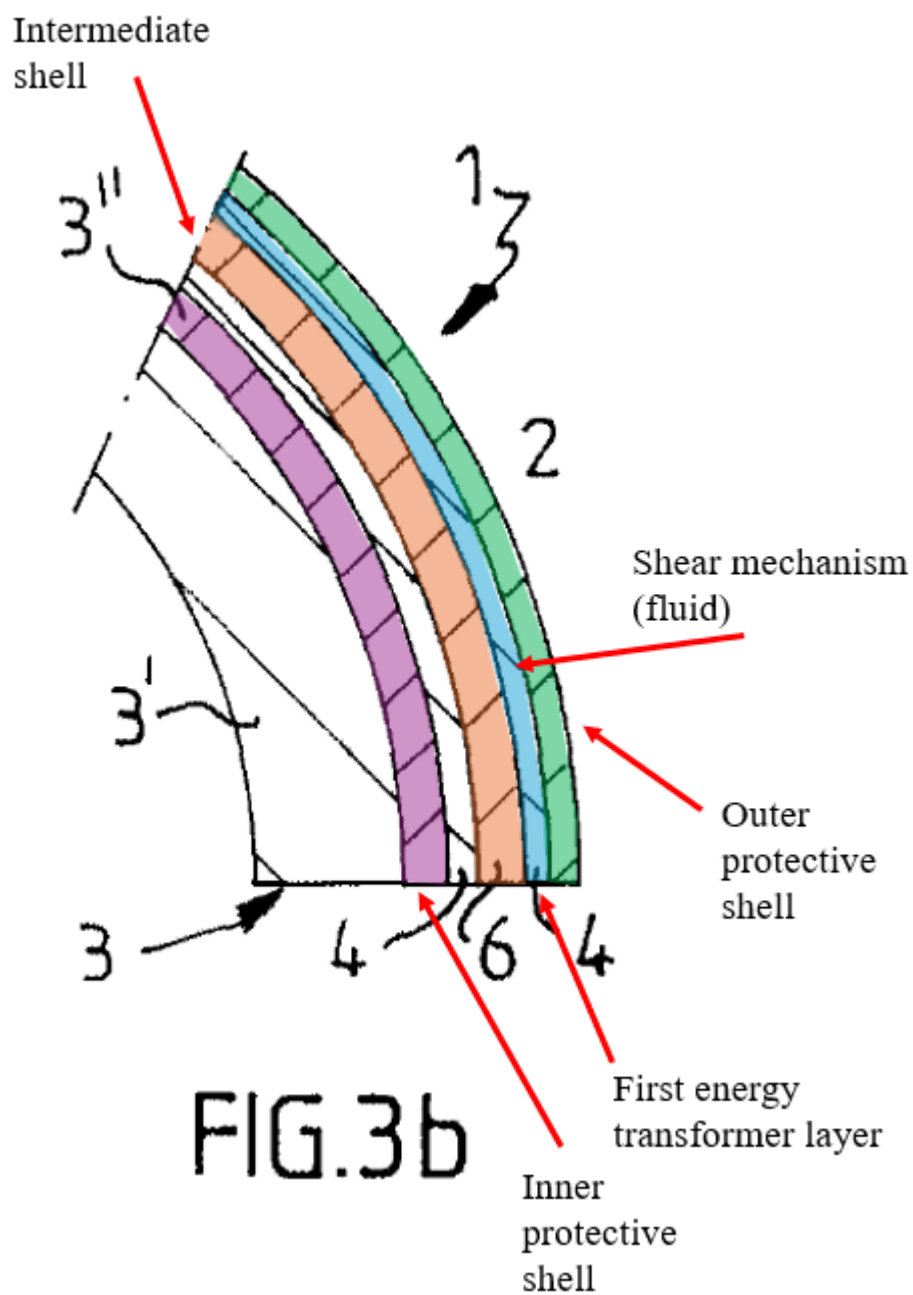
Von Holst discloses 1[b]. Von Holst discloses a helmet with “inner shell 3 []
constructed from a **harder, relatively thin outer layer 3**” [inner protective shell]
and a softer, relatively thick inner layer 3” in Figs. 3a-b. Ex.1005[VonHolst], 5:39-
6:4. Ex.1002, ¶155.

*d) 1[c]: “a first energy transformer layer associated with a
shear mechanism, the first energy transformer layer residing
between the outer protective shell and the inner protective
shell, wherein the shear mechanism allows the outer
protective shell to slide relative to the inner protective shell;”*

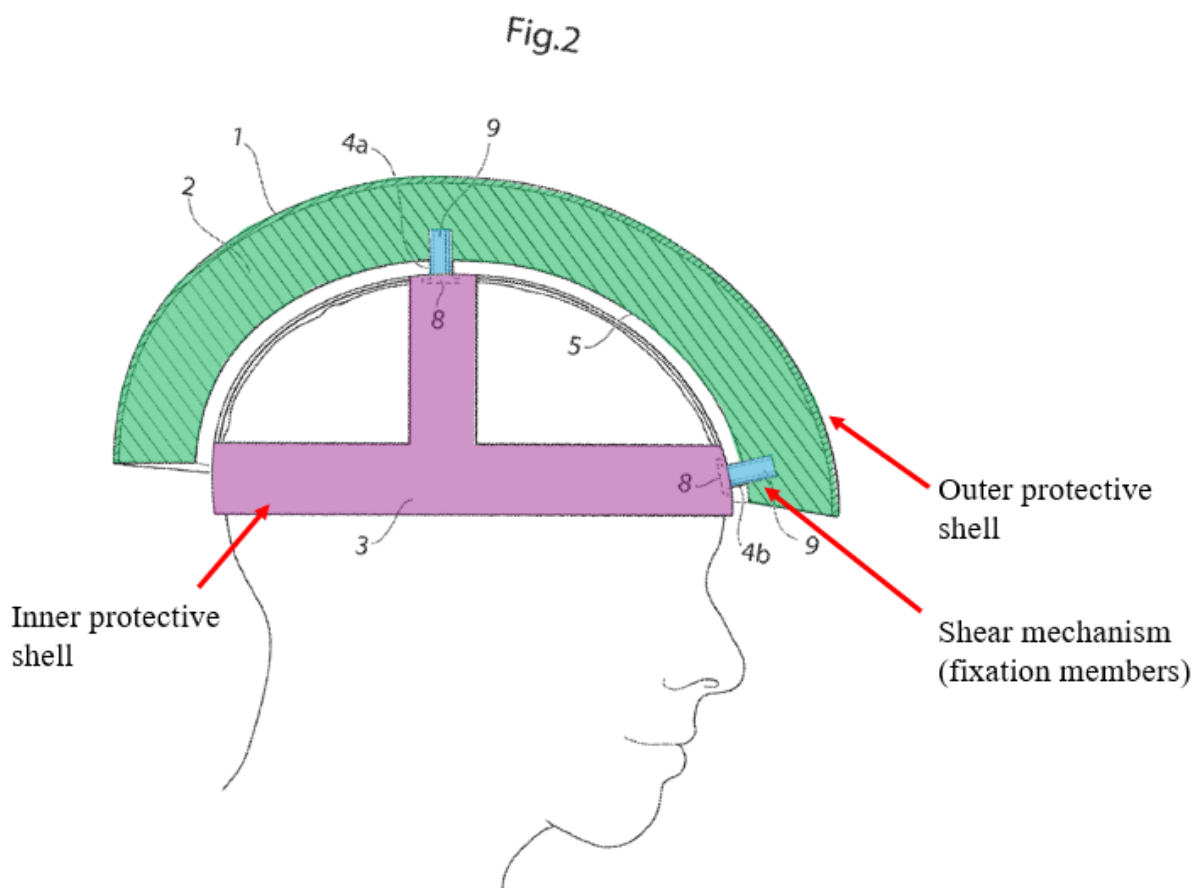
A helmet with Von Holst’s outer sliding layer 4 modified to be associated
with Halldin’s fixation members would have been obvious and teaches 1[c]. Von
Holst discloses a layer of components between its **outer layer 3** of inner shell 3
(inner protective shell) and outer shell 2 (outer protective shell) that transform
energy from impact, where the layer is associated with the components that allow
shearing so these shells to slide relative to each other. Ex.1005[VonHolst], 6:4-6.
Von Holst discloses a layer with components including sliding layers 4 with
intermediate shell 6 between. Ex.1005[VonHolst], FIG. 3; *id.* claims 1, 4. Halldin
also discloses components that allow relative sliding and energy transformation,
including fixation members, Ex.1006[Halldin], [0041], [0043], that a POSA would

have been motivated to include between Von Holst's outer and inner shells with a reasonable expectation of success for the reasons below. As exemplified below, Von Holst combined with Halldin teaches the claimed energy transformer layer associated with a shear mechanism. Ex.1002, ¶¶156-169.

The combination discloses 1[c] in as much, if not more detail, as the '909 Patent. For example, to a POSA, the combination teaches at least a first energy transformer layer, as Figure 3b of Von Holst combined with Figure 2 of Halldin show, located between Von Holst's **outer layer 3"** of inner shell 3 (inner protective shell), **outer shell 2** (outer protective shell), including outer **sliding layer 4** with fixation members from Halldin. Ex.1002, ¶¶156-159.



Ex.1005[VonHolst], FIG. 3; *see also id.* cls. 1, 4.



Ex.1006[Halldin], Fig. 2, *see also* Fig. 3.

The layer including Von Holst's sliding layers 4 and Halldin's fixation members transforms energy. For example, Von Holst's outer sliding layer 4 (*e.g.*, air/oil), transforms energy when the outer protective shell is allowed to slide relative

to its inner protective shell. Ex.1005[VonHolst], Abstract, 4:15-17, 4:32-34, 5:31-34, 6:8-10, 6:35-7:10, 7:38-8:2, Figs. 4-6, cls. 1, 4.¹² Ex.1002, ¶¶157-159.

Halldin shares an inventor with Von Holst and teaches fixation members that also transform energy by allowing relative sliding between the outer and inner layers. Ex.1006[Halldin], [0013], [0047-48]. Halldin teaches multiple types of fixation members, including members 4a-4d that “**absorb energy** by deforming....” Ex.1006[Halldin], [0043], Figs. 2-3. Figures 2 and 3 teach fixation members 4a and 4b. *Id.*, [0047] (Figure 3, with fixation members, allows “**energy absorbing layer 2** [and attached outer shell] to slide in relation to the **attachment device 3**” and “[t]he fixation absorbs the rotational forces by deforming”), Figs. 2-3 (outer layer 2 connected at portion 9 and inner attachment device connected at portion 8). Ex.1002, ¶¶160-162.

Von Holst combined with Halldin teaches its energy transformer layer (of, e.g., sliding layer 4 and fixation members) is associated with a shear mechanism, which are components that shear and allow the outer shell to slide relative to the inner shell. The shear mechanism includes Von Holst’s sliding layer 4 and Halldin’s

¹² Von Holst’s **connecting member 5** is made from deformable plastic strips, connects outer shell 2 and inner shell 3, and “absorb[s] energy.”

Ex.1005[VonHolst], 4:17-21. Ex.1002, ¶158, n.15.

fixation members. As discussed, Holst's outer sliding layer 4 (with *e.g.*, air/oil), transforms energy when the outer protective shell is allowed to slide relative to its inner protective shell, and Halldin's fixation members "absorb[] rotational forces by deforming" and allow layers to slide. Ex.1005[VonHolst], 4:15-17, 5:31-34; Ex.1006[Halldin], [0047]. Ex.1002, ¶¶162-163.

Alternatively, to the extent Patent Owner argues the claimed "shear mechanism" requires a middle shell/liner, Von Holst discloses intermediate shell 6, which together with Halldin's fixation members and the material of sliding layers 4 (oil/air) between middle and outer shells, allows relative sliding between the outer and inner shells. Ex.1005[VonHolst], 4:32-34; *see also* Ex.1006[Halldin], [0043]. Ex.1002, ¶164.

A POSA would have been motivated to modify Von Holst to incorporate Halldin's fixation members (*e.g.*, in Von Holst's sliding layer 4). 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 using improved helmet sliding mechanisms. The two also share a common inventor. While Von Holst describes layers connected through transformer layers and a connecting member, the later-filed Halldin discloses 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 also "absorb

energy” by “deforming,” Ex.1006[Halldin], [0043], which would supplement energy absorption from Von Holst’s sliding layers 4. Ex.1002, ¶¶165-166.

A POSA would 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. *See* Ex.1006[Halldin], [0057], Fig. 11, [0048], [0064], [0069]. A POSA would have been motivated to improve Von Holst with internal fixation connections to increase connection throughout the helmet and provide additional energy absorption. A POSA would have found it obvious to combine these elements as a matter of routine implementation, as combination of such known elements would be straightforward and predictable according to known methods to yield predictable results, and Von Holst’s helmet is ready for improvement through incorporating of a layer of energy-absorbing internal fixation members. The known technique of using fixation members (Halldin) to further connect layers and absorb energy would improve Von Holst’s helmet in a similar way to Halldin. Ex.1002, ¶¶167-168.

A POSA would have a reasonable expectation of successfully modifying Von Holst as described. Halldin’s helmet design readily applies to Von Holst. Like Von Holst’s sliding layers, Halldin describes “sliding facilitator 5 [Fig. 2] [that] may be a low friction material,” provided outside attachment device 3 or inside its layer 2.

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." 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 success implementing Halldin's fixation members to connect Von Holst intermediate and outer shell layers. Ex.1002, ¶169.

e) 1[d]: "a liner layer connected to the inner protective shell, the liner layer configured to reside between the inner protective shell and a human head;"

Von Holst discloses element 1[d]. Von Holst discloses "softer, relatively thick **inner layer 3'**," Ex.1005[VonHolst], 5:39-6:4; cl. 6, "intended for *contact with the head of the wearer*," Ex.1005[VonHolst], 9:13-15, "made of...polyurethane foam or polystyrene." Ex.1005[VonHolst], 4:26-29, 7:26-30.

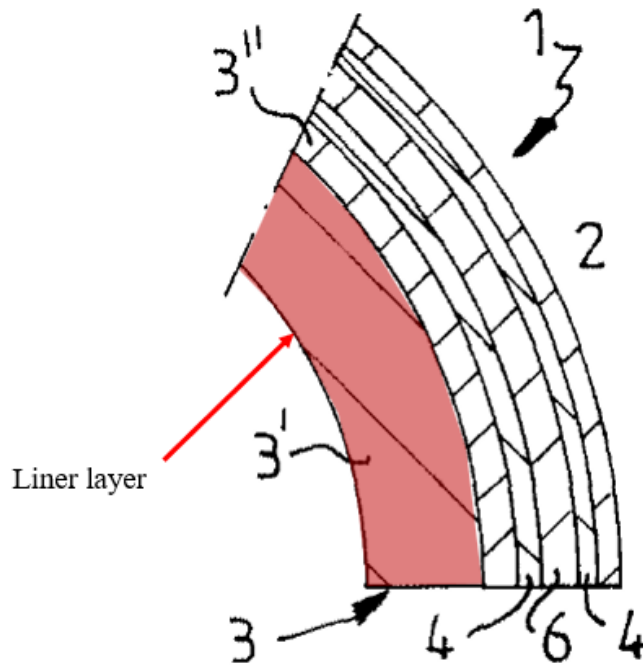


FIG.3b

Ex.1005[VonHolst], Fig. 3b. Ex.1002, ¶¶170-171.

f) 1[e]: “a chin strap attached to the inner protective shell, the chin strap and the liner layer configured to secure the inner protective shell to the human head while the outer protective shell is allowed to slide relative to the inner protective shell.”

Von Holst combined with Puchalski teaches 1[e]. A POSA would have been motivated to incorporate Puchalski’s chin-strap and location into Von Holst’s helmet. As discussed in Section X.A.2.f), Puchalski discloses, “[a]lthough not essential, most preferably, the helmet **chin-straps 16** are secured to the peripheral edge of the **inner panel 126**, along each of its sides.” Ex.1011[Puchalski] 12:1-3;

Figs. 9-10. It would have been obvious to attach the chin-strap of Puchalski to the periphery of the inner shell of Von Holst. Further, Von Holst's liner layer affixed to the inner protective shell further aids in securing the inner protective shell to the human head while the outer protective shell is allowed to move relative to the inner protective shell. As discussed for 1[d] (Section X.B.2.e)), Von Holst's "inner shell 3 is intended for *contact with the head of the wearer*," Ex.1005[VonHolst], 9:13-15, and includes softer **inner layer 3'** (lining layer) which "can be made of...polyurethane foam or polystyrene," Ex.1005[VonHolst], 4:26-29. The inner liner layer, by nature of being conformed to a human head, further assists in securing the inner protective shell by improving fit. *Id.*; *see also* Ex.1011[Puchalski], 1:52-55; *see also, e.g.*, Ex.1031[Bosch], 2. Ex.1002, ¶172.

A POSA would be motivated and have a reasonable expectation of success in combining Von Holst and Puchalski. Von Holst and Puchalski are analogous art directed to the same problem of reducing rotational impact via multiple sliding layers. Section X.A. Ex.1002, ¶173.

As Puchalski recognizes, the chin-strap is most preferably placed on an inner layer that slides relative to an outer layer and that maintains its position relative to the wearer's head. Placing a chin-strap on the inner layer that, along with the comfort liner layer, conforms to the wearer's head is an obvious design choice to ensure that the helmet stays attached by allowing those layers to continue to conform

to the head and allowing the outer layer to slide upon rotational impact, as discussed for 1[c] (Section X.B.2.d)). Ex.1002, ¶174.

Further, there are only a finite number of places in which to attach a chin-strap with a limited number of solutions. It must be attached to a structural feature, particularly one of the shell layers or liners, and there are only up to three possible layers: the inner, intermediate, or outer. A POSA would have been motivated to try each of these limited options and would be motivated to select a layer that does not move in relation to the user's head to ensure a consistent, proper fit and position of the strap. A POSA would have had a reasonable expectation of successfully modifying Von Holst with Puchalski's chin-strap. As discussed above, Puchalski teaches that placing chin-straps along an inner layer of a multi-layered sliding helmet would be successful. A POSA would have, as a matter of routine experimentation, been able to configure the chin-strap to attach on the inner protective shell of Von Holst's helmet. Further, POSAs recognized chin-straps attached to the inner layer that conforms to the head in helmets as conventional. *See* Section X.A. Ex.1002, ¶175.

Thus, Von Holst combined with Halldin and Puchalski renders claim 1 obvious. Ex.1002, ¶176.

3. Claim 2¹³

Von Holst combined with Halldin and Puchalski teaches claim 1. Section X.B.2 The combination teaches the shear mechanism of sliding layers of, *e.g.*, oil or air and fixation members “comprise a first absorptive/dissipative material.” Von Holst’s sliding layer of *e.g.* oil or air absorbs and/or dissipates energy from forces through relative sliding and translational movement and heat from friction. Ex.1005[VonHolst], Abstract, 4:15-17, 5:31-34, 6:35-7:10, Figs. 34-6, cls. 1, 4; Ex.1001[USP909], 6:60-63. Halldin’s fixation members are also made of materials “adapted to ***absorb*** energy by deforming in an elastic, semi-elastic or plastic way.” Ex.1006[Halldin, [0043]; *id.*, [0013]. As Section X.B.2 further discusses, Halldin’s fixation members deform elastically and allow translational movement, and, as Dr. Duma explains, such deformation and movement dissipates energy. Ex.1002, ¶177.

Thus, Von Holst combined with Halldin and Puchalski renders claim 2 obvious. Ex.1002, ¶178.

4. Claim 5

Von Holst combined with Halldin and Puchalski renders claim 1 obvious. Section X.B.2. Halldin’s plurality of fixation members are made of material that

¹³ Petitioner omits language of claims that have been previously reproduced in other Grounds, except for claim 1.

“deform[s] in an elastic, semi-elastic or plastic way.” Halldin, [0043]. Halldin further discloses fixation members with attached elastic male and female parts (28 and 12) that detach upon impact. Ex.1006[Halldin], [0061]. Thus, Halldin discloses fixation members that are elastic and shaped in such that its fixation members are “elastic bands.” Ex.1002, ¶¶179-183.

As Section X.B.2 discusses, Von Holst combined with Halldin teaches outer and inner protective shells connected by elastic fixation members. Ex.1002, ¶179.

Thus, Von Holst combined with Halldin and Puchalski renders claim 5 obvious. Ex.1002, ¶184.

5. Claim 8

Von Holst combined with Halldin and Puchalski teaches claim 1. Section X.B.2. The combination discloses the additional limitation of claim 8 and renders it obvious. Halldin’s fixation members are “elastomeric elements.” Section X.B.4. Ex.1002, ¶¶185-186.

6. Claim 9

Von Holst combined with Halldin and Puchalski renders claim 1 obvious, Section X.B.2, and also teaches “shear mechanism is a shear layer.” In Von Holst’s helmet, a POSA would have included Halldin’s fixation members in a layer between the outer and inner layers, consistent with how such fixation members are placed in the space between the energy absorbing layer and attachment device in Halldin.

Ex.1006[Halldin], [0062]. As Section X.B.2.d) discusses, this layer of fixation members and oil/air allows relative movement of outer and inner layers and is a shear layer. Ex.1006[Halldin], [0047-48], Figs. 3-4. Ex.1002, ¶187.

Thus, Von Holst combined with Halldin and Puchalski renders claim 9 obvious. Ex.1002, ¶188.

7. Claim 11

Von Holst combined with Halldin and Puchalski renders claim 1 obvious. Section X.B.2. The combination discloses “middle protective shell” and renders it obvious. As Section X.B.2.d) discusses, Von Holst discloses an intermediate shell (“middle protective shell”) between the outer and inner protective shells. Ex.1005[VonHolst], 6:2-6, Fig. 3b. Ex.1002, ¶¶189-190.

8. Claim 12

Von Holst combined with Halldin and Puchalski renders claim 12 obvious for the same reasons as claim 1. Section X.B.2. Claim 12 recites outer and inner “protective layers” instead of outer and inner “shells.” The patent does not differentiate them, Ex.1001[USP909], 9:22-25, 10:17-21, Figs. 5-6, and Von Holst’s “outer shell 2” is an outer protective layer and its “inner shell 3 [] constructed from a **harder, relatively thin outer layer 3**” is an inner protective layer. Ex.1002, ¶¶191-197.

9. Claim 13

Von Holst combined with Halldin and Puchalski renders claim 12 obvious.
See Section X.B.8. The combination renders claim 13 obvious for the same reasons
as claim 2. Section X.B.3; Ex.1002, ¶¶198-199.

10. Claim 16

Von Holst combined with Halldin and Puchalski renders claim 12 obvious.
See Section X.B.8. The combination renders claim 16 obvious for the same reasons
as claim 5. Section X.B.4. Ex.1002, ¶¶200-201.

11. Claim 19

Von Holst combined with Halldin and Puchalski renders claim 12 obvious.
See Section X.B.8. The combination renders claim 19 obvious for the same reasons
as claim 8. Section X.B.5. Ex.1002, ¶¶202-203.

12. Claim 20

Von Holst combined with Halldin and Puchalski renders claim 12 obvious.
Section X.B.8. The combination renders claim 20 obvious for the same reasons as
claim 9. Section X.B.6; Ex.1002, ¶¶204-205.

**C. Ground 3: Claims 1-2, 4-5, 8-9, 11-13, 15-16, and 19-20 are
Obvious Over Kleiven Combined with Puchalski**

1. Claim 1

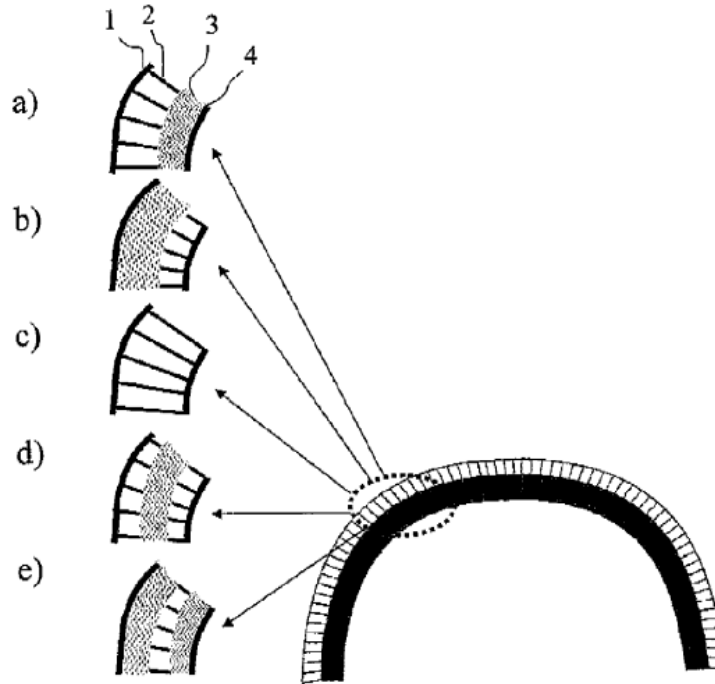
a) 1[preamble]: “A helmet comprising:”

Kleiven discloses “a *helmet*.” Ex.1007[Kleiven], [0031], Fig. 2. Ex.1002,
¶206.

b) 1[a]: “an outer protective shell;”

Kleiven discloses 1[a]. Kleiven Figure 2 includes, as a “layer[],” “outer ... shell” 1.

Fig. 2.

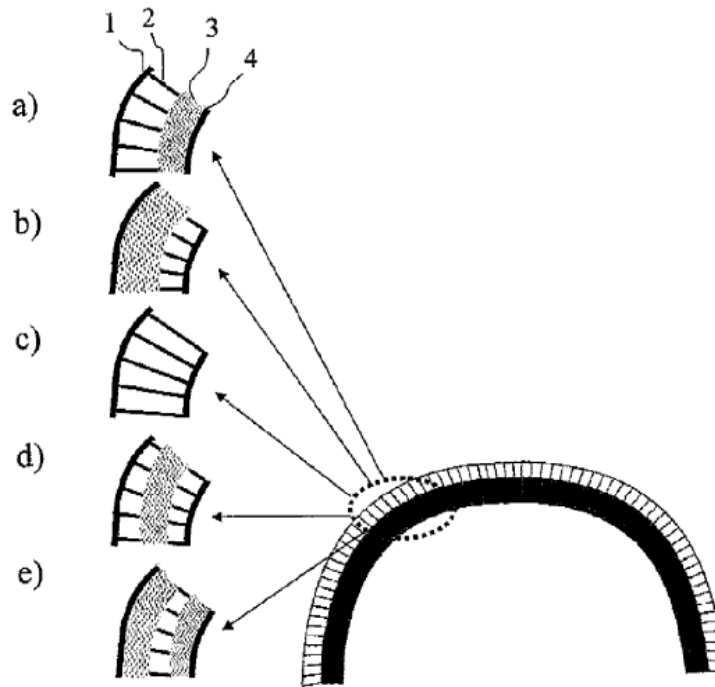


Ex.1007[Kleiven], [0031], Fig. 2. Ex.1002, ¶207.

c) 1[b]: “an inner protective shell;”

Kleiven discloses 1[b]. Kleiven Figure 2 includes, as a “layer[],” “inner shell” 4.

Fig. 2.



Ex.1007[Kleiven], [0031], Fig. 2. Ex.1002, ¶208.

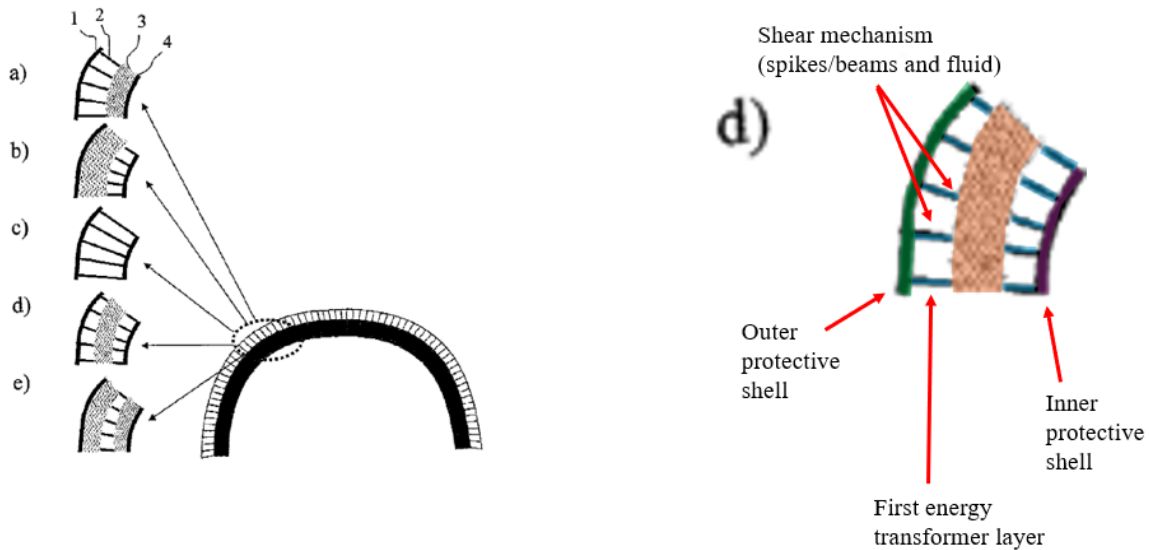
d) 1[c]: “a first energy transformer layer associated with a shear mechanism, the first energy transformer layer residing between the outer protective shell and the inner protective shell, wherein the shear mechanism allows the outer protective shell to slide relative to the inner protective shell;”

Kleiven discloses element 1[c]. Kleiven discloses a layer of components between outer and inner shells that transform energy from impact and shear to allow them to slide relative to each other. This layer of components includes spikes/beams 2 with fluid/air compartments. Thus, as exemplified below, Kleiven discloses the claimed shear mechanism and energy transformer layer. Ex.1002, ¶¶209-219.

Kleiven discloses 1[c] in as much, if not more detail, as the '909 Patent. For example, to a POSA, Kleiven discloses at least a first energy transformer layer, as

Figure 2 shows, between **outer protective shell (outer shell 1)** and **inner protective shell (inner shell 4)** including **spikes/beams** and fluid/air compartments. As Kleiven explains, and Dr. Duma confirms, this layer including spikes/beams and fluid/air compartments absorbs and dissipates energy from impact force through compression, displacement, and fluid flow, which generates heat. Klevin's spikes are "flexible, plasticizing, yielding or frangible in order to absorb/reduce the force of an impact...." Ex.1007[Kleiven], [0048], [0062], [0020], [0002].

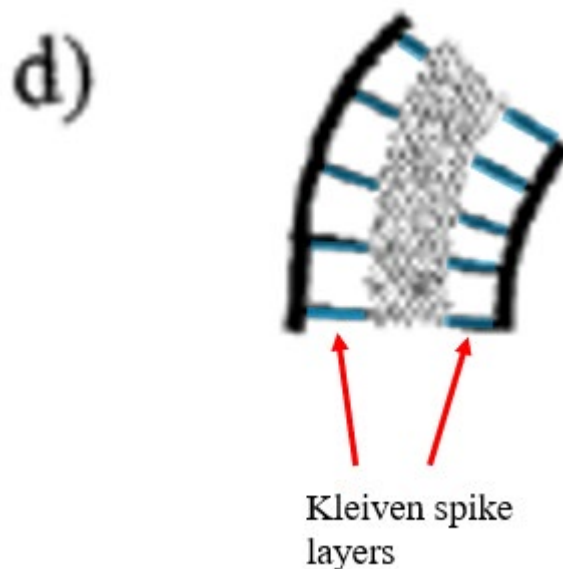
Fig. 2.



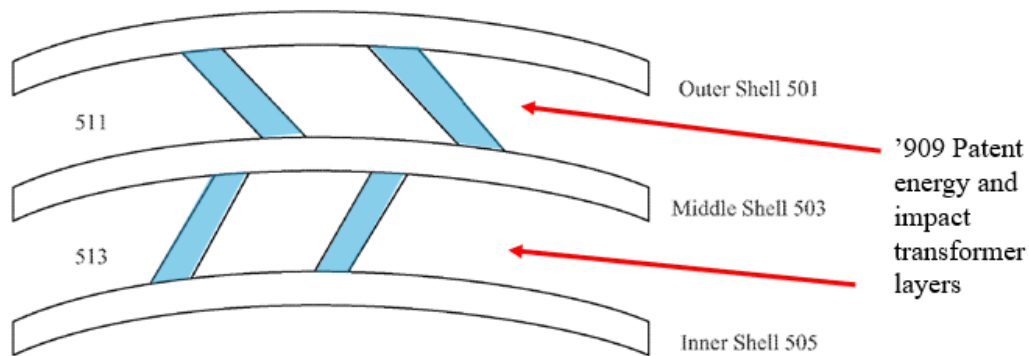
Ex.1007[Kleiven], Fig. 2. And the fluid/air compartments transform energy through translational movement from fluid flow, which generates heat. *Id.* [0040], Fig.11. Ex.1002, ¶209.

Kleiven also discloses its layer of spikes/beams and fluid (e.g., air) is associated with a shear mechanism, which in Kleiven are at least the components that shear and allow the outer shell to slide relative to the inner. The shear mechanism includes spikes/beams and fluid (e.g., air). Ex.1002, ¶¶210-218.

For example, Kleiven's spikes/beams are "flexible, plasticizing, [or] yielding" to "give way" or shear and "permit *displacement of the outer shell relative to the inner shell.*" Ex.1007[Kleiven], [0048], [0062]. Like '909 Patent Figure 5 layers 511 and 513, Kleiven's spike layers are a "shear truss-like structure connecting" layers that "dampen[s] any force or impact" and allows them to "slide relative" to each other. Ex.1001[USP909], 6:46-63; *id.*, Fig. 5, 9:40-48 ("elastomeric trusses").



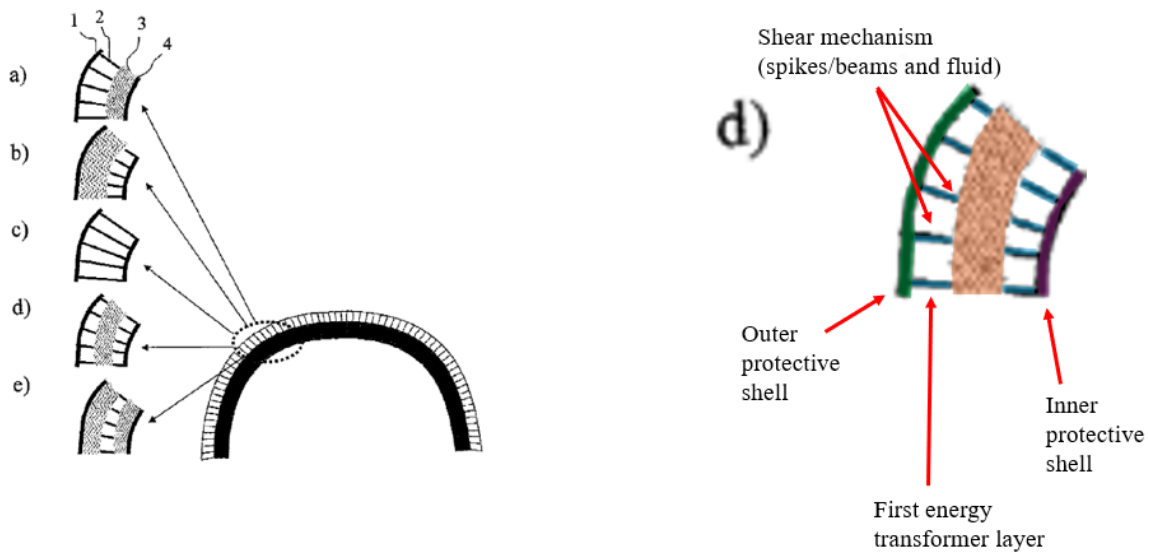
Ex.1007[Kleiven], Fig. 2.



Ex.1001[USP909], Fig. 5; *see* Ex.1013 [Knight-162-FH], 147 (elastomeric trusses in Figure 5). Ex.1002, ¶¶212-217.

As another example, Kleiven discloses fluid compartments between spikes filled with fluid (*e.g.*, air) that also shear and allow the outer protective shell to slide relative to the inner and transform energy. Ex.1007[Kleiven], [0039-41] (“fluid/air layer *shears*”), [0047], Figs.10-12; Ex.1001[USP909], 6:46-63; Ex.1002, ¶218.

Fig. 2.



Ex.1007[Kleiven], [0031], Fig. 2.

Alternatively, if Patent Owner argues the claimed “shear mechanism” requires a middle shell/liner, Kleiven discloses a middle energy-absorbing foam layer with “inserts that attach the spikes to the shells/layers,” and which together with the spikes and fluid compartments allows relative sliding between outer and inner shell layers.

Ex.1007[Kleiven], [0041], Fig. 12a. Ex.1002, ¶219.

e) 1[d]: “a liner layer connected to the inner protective shell, the liner layer configured to reside between the inner protective shell and a human head;”

Kleiven combined with Puchalski teaches element 1[d]. Puchalski teaches “padding or cushioning [‘liner layer’]” “provided along the inside of the shell” and contoured to a wearer’s head (*i.e.*, between inner shell and head) “for increased

comfort, better fit and to assist in the absorption of any impact forces.”

Ex.1011[Puchalski], 1:52-55; Abstract, cl. 9. Ex.1002, ¶220.

A POSA would have been motivated to combine Kleiven and Puchalski.

They are analogous to the challenged claims: they are in similar fields and directed to the same problem—and similar solutions—of reducing rotational impact via sliding layers. Kleiven anticipates “numerous modifications [to its helmets] will readily occur to those skilled in the art,” and identifies prior-art interior foam that “improves the capacity of the headgear to conform to the head....”

Ex.1007[Kleiven], [0014], [0070]. Puchalski details a liner layer, including “strips of resiliently compressible foam cushioning” that “assist[] in maintaining the shell [] comfortably in the correct position on top of the user’s head [] and furthermore, advantageously acts to assist in the absorption of impact forces.”

Ex.1011[Puchalski], 7:34-39; *see also id.*, 1:52-55. A POSA would have been motivated to incorporate Puchalski’s comfort liner in Kleiven’s helmet for increased comfort and impact-force absorption. 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 using known methods to yield predictable results, and Kleiven’s helmet is ready for improvement through incorporation of Puchalski’s liner. This known technique of

adding a (customary) user comfort layer would improve Kleiven's helmet similarly to Puchalski. Ex.1002, ¶¶221-222.

A POSA would have reasonably expected success using Puchalski's comfort liner in Kleiven's design. Kleiven discloses benefits of headgear conformed to the head, Ex.1007[Kleiven], [0014], without implementation details, while explaining its helmet is ready for modification. *Id.*, [0069-0070]. A POSA would have, as a matter of routine implementation, been able to configure Kleiven's design to fit Puchalski's comfort liner, including because Puchalski's comfort liner is positioned under an inner layer like Kleiven's and would easily fit into Kleiven's design. Ex.1002, ¶223.

f) 1[e]: "a chin strap attached to the inner protective shell, the chin strap and the liner layer configured to secure the inner protective shell to the human head while the outer protective shell is allowed to slide relative to the inner protective shell."

Kleiven combined with Puchalski renders obvious 1[e]. A POSA would have found it obvious to incorporate Puchalski's chin-strap and location into Kleiven's helmet. As discussed in Section X.A.2.f), Puchalski discloses, "[a]lthough not essential, most preferably, the helmet **chin-straps 16** are secured to the peripheral edge of the **inner panel 126**, along each of its sides." Ex.1011[Puchalski] 12:1-3; Figs. 9-10. It would have been obvious to attach the chin-strap of Puchalski to the inner shell of Kleiven. Further, as discussed for 1[d] (Section X.C.1.e)), Puchalski's

liner layer incorporated into Kleiven's helmet and affixed to the inner protective shell further aids in securing the inner protective shell to the human head while the outer protective shell is allowed to move relative to the inner protective shell. Ex.1002, ¶¶224.

A POSA would be motivated to incorporate Pulchalski's chin-strap and location into Kleiven's helmet. Kleiven and Puchalski are analogous art to the challenged claims directed to the same problem of reducing rotational impact via multiple sliding layers. *See* Section X.A; Ex.1002, ¶¶225-226.

As Puchalski recognizes, the chin-strap is most preferably placed on an inner layer that slides relative to an outer layer and that maintains its position relative to the wearer's head. Placing a chin-strap on the inner layer that, along with the comfort liner layer, conforms to the wearer's head is an obvious design choice to ensure that the helmet stays attached by allowing those layers to continue to conform to the head and allowing the outer layer to slide upon rotational impact, as discussed for 1[c] (Section X.C.1.d)). Ex.1002, ¶226.

Further, there are only a finite number of places in which to attach a chin-strap with a limited number of solutions. They must be attached to a structural feature, particularly one of the shell layers/liners, and there are only up to three possible layers: the inner, intermediate, or outer. A POSA would thus be motivated to try each of these limited options and would be motivated to select a

layer that does not move in relation to the user's head to ensure a consistent, proper fit and position of the strap. Ex.1002, ¶227.

A POSA would have a reasonable expectation of success in modifying Kleiven with Puchalski's chin-strap. As discussed above, Puchalski teaches that placing chin-straps along an inner layer of a multi-layered sliding helmet would be successful. A POSA would have, as a matter of routine experimentation, been able to configure the chin-strap to attach on the inner protective shell of Kleiven's helmet. Further, POSAs recognized chin-straps attached to the inner layer that conform to the head in helmets as conventional. *See* Section X.A. Ex.1002, ¶228.

Thus, Kleiven combined with Puchalski renders claim 1 obvious. Ex.1002, ¶229.

2. Claim 2

Kleiven combined with Puchalski renders claim 1 obvious. *See* Section X.C.1. As Section X.C.1.d) discusses, Kleiven's shear mechanism comprises an "absorptive/dissipative material." Kleiven's outer and inner spike/beams are "flexible, plasticizing, yielding or frangible in order to ***absorb/reduce the force of an impact***" Ex.1007[Kleiven], [0048], Fig. 2; *see also id.*, [0011], Fig. 9. Kleiven's spikes/beams further are absorptive/dissipative material because they allow for relative sliding, which, as Dr. Duma explains, absorbs and dissipates energy through movement and heat. Ex.1002, ¶230.

Additionally, fluid (*e.g.*, air) in fluid compartments in the spike/beam layer is also absorptive/dissipative material. For example, as Dr. Duma explains, air absorbs and dissipates impact energy through compression, displacement, and fluid flow, which results in generation of heat. *See also* Ex.1007[Kleiven], [0039-41], [0062], [0065]; Ex.1001[USP909], 6:57-63 (fluid/gel are absorptive/dissipative materials). Ex.1002, ¶¶231-232.

Thus, Kleiven combined with Puchalski renders claim 2 obvious. Ex.1002, ¶¶233-234.

3. Claim 4

Kleiven combined with Puchalski renders claim 1 obvious. Section X.C.1. Kleiven discloses its spike/beams are a “plurality of truss-like structures” as Section X.C.1.d) discusses.¹⁴ As Figure 2 shows, spikes connect outer and inner shells, either directly (Fig.2(c)), or through a middle layer (Fig.2(d)). Ex.1007[Kleiven], Fig. 2, [0031]. Ex.1002, ¶¶235.

Thus, Kleiven combined with Puchalski renders claim 4 obvious. Ex.1002, ¶236.

4. Claim 5

¹⁴ The '909 patent does not define “truss.” Its plain meaning is a structure or structures in a framework that supports another structure. Ex.1002, ¶235, n.22.

Kleiven combined with Puchalski renders claim 1 obvious. Section X.C.1. Kleiven's plurality of spikes/beams are made from elastic material and shaped like "elastic bands" That connect outer and inner protective shells. As Section X.C.1.d) discusses, Kleiven's spikes/beams are "*flexible*, plasticizing, yielding or frangible," "are designed to be thin/slim," and "made of flexible polymer materials such as plastics, [elastic] rubber or fibers." Ex.1007[Kleiven], [0048], [0020], Fig. 2. Kleiven's spikes/thin beams are flat, thin strips inserted into and attached to each layer. Ex.1007[Kleiven], [0041], Fig. 12a, [0049]. Kleiven defines "flexible" material as "material that returns to its original shape" after deforming due to external force. *Id.* [0042], Fig.12. The '909 Patent does not discuss "elastic bands," and Kleiven's spikes/beams disclose this limitation in as much or more detail than the patent. Ex.1002, ¶¶237-239.

Further, as discussed for claims 1 and 4, Kleiven's spikes connect outer and inner shells, either directly (Fig.2(c)), or through a middle layer (Fig.2(d)). Ex.1007[Kleiven], Fig. 2, [0031]. Ex.1002, ¶239.

Thus, Kleiven combined with Puchalski renders claim 5 obvious. Ex.1002, ¶240.

5. Claim 8

Kleiven combined with Puchalski renders obvious claim 1. *See* Section X.C.1. Kleiven combined with Puchalski renders claim 8 obvious because Kleiven's

spikes/beams are “elastomeric elements.” Section X.C.4; Ex.1007[Kleiven], [0048], [0020], Fig. 2. Ex.1002, ¶241-42.

6. Claim 9

Kleiven combined with Puchalski renders claim 1 obvious. Section X.C.1. Kleiven discloses “the shear mechanism is a shear layer” (*i.e.*, spikes and fluid arranged in layer 2) as Section X.C.1.d) discusses. Ex.1007[Kleiven], [0020], [0031], [0039-41], [0048], Figs. 1-2. Ex.1002, ¶243.

Thus, Kleiven combined with Puchalski renders claim 9 obvious. Ex.1002, ¶244.

7. Claim 11

Kleiven combined with Puchalski renders claim 1 obvious. Section X.C.1. Kleiven also discloses middle foam layer (“middle protective shell”) between outer and inner protective shells. Ex.1007[Kleiven], [0031], Figs. 1-2; *see also id.*, [0020], [0048]. Kleiven’s “invention is not limited to having only two layers” and includes “[o]ne or several intermediate layers that move relative to each other or to the inner or outer layer” to “reduce[] the risk of injury following a collision/impact.” *Id.* [0048]. Kleiven’s energy absorbing foam of, *e.g.*, “expanded polystyrene and expanded polypropylene,” is a middle protective shell. *See* n.5. Ex.1002, ¶245.

Thus, Kleiven combined with Puchalski renders claim 11 obvious. Ex.1002, ¶246.

8. Claim 12

Kleiven combined with Puchalski renders claim 12 obvious for the same reasons as claim 1. Section X.C.1. Claim 12 recites outer and inner “protective layers” instead of outer and inner “shells.” The patent does not differentiate them, Ex.1001[USP909], 9:22-25, 10:17-21, Figs. 5-6, and Kleiven’s “outer shell” 1 is an outer protective layer and its “inner shell 4” is an inner protective layer. Ex.1002, ¶¶247-253.

9. Claim 13

Kleiven combined with Puchalski renders claim 12 obvious. Section X.C.8. The combination renders claim 13 obvious for the same reasons as claim 2. Section X.C.2. Ex.1002, ¶¶254-255.

10. Claim 15

Kleiven combined with Puchalski renders claim 12 obvious. *See* Section X.C.8. The combination renders claim 15 obvious for the same reasons as claim 4. *See* Section X.C.3. Ex.1002, ¶¶256-257.

11. Claim 16

Kleiven combined with Puchalski renders claim 12 obvious. Section X.C.8.
The combination renders claim 16 obvious for the same reasons as claim 5. Section
X.C.4. Ex.1002, ¶¶258-259.

12. Claim 19

Kleiven combined with Puchalski renders claim 12 obvious. Section X.C.8.
The combination renders claim 19 obvious for the same reasons as claim 8. Section
X.C.5. Ex.1002, ¶¶260-261.

13. Claim 20

Kleiven combined with Puchalski renders claim 12 obvious. Section X.C.8.
The combination renders claim 20 obvious for the same reasons as claim 9. Section
X.C.6. Ex.1002, ¶¶262-263.

**D. Ground 4: Madey Anticipates Claims 1-2, 4-5, 8-10, 12-13, 15-16,
and 19-20**

Madey discloses Claims 1-2, 4-5, 8-10, 12-13, 15-16, and 19-20 arranged as
in each Challenged Claim for the reasons below. Ex.1002, ¶¶264-307.

1. Claim 1

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

Madey discloses “a helmet.” Ex.1047[Madey], Abstract, [0025], [0037]
(alternative interface layer), claim 1, Fig. 4. Ex.1002, ¶265.

b) 1[a]: “an outer protective shell;”

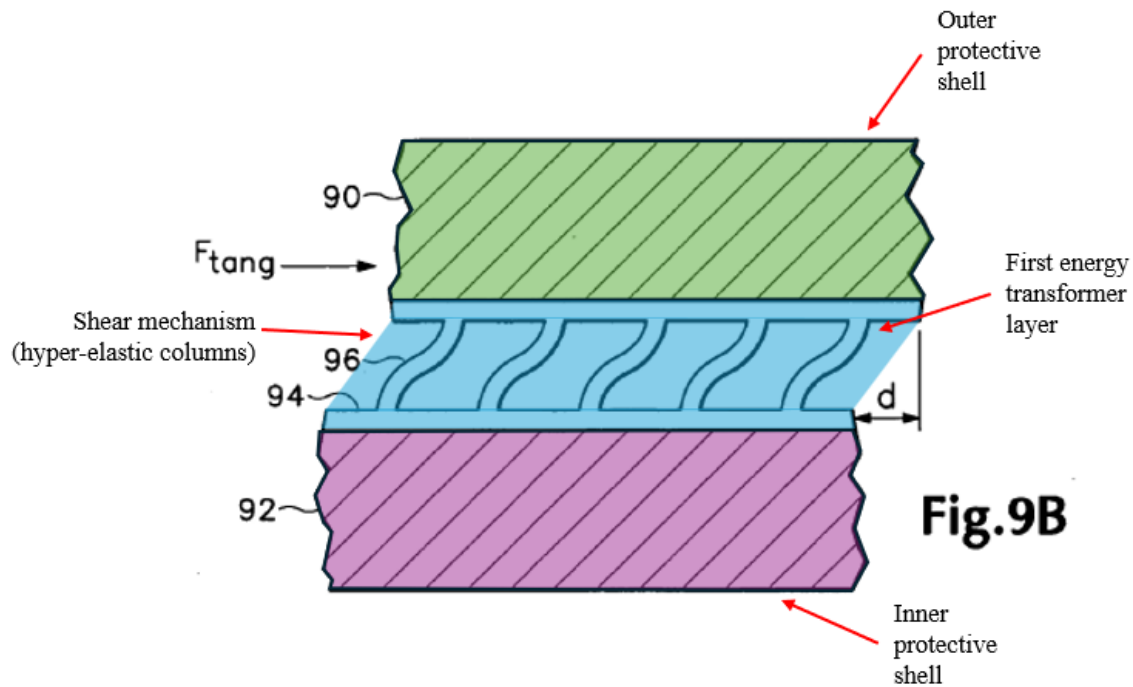
Madey discloses 1[a]. Madey's helmet has "outer helmet layer" comprising "a hard shell." Ex.1047[Madey], Abstract, claims 1-2, Fig. 4. Ex.1002, ¶¶266-267.

c) 1[b]: "an inner protective shell;"

Madey discloses 1[b]. Madey's "inner helmet layer" made of (*e.g.*) expanded polystyrene foam, is an inner protective shell. Ex.1047[Madey], Abstract, [0025], [0037], [0050], Claim 1, Fig. 4; *see n.5.* Ex.1002, ¶268.

d) 1[c]: "a first energy transformer layer associated with a shear mechanism, the first energy transformer layer residing between the outer protective shell and the inner protective shell, wherein the shear mechanism allows the outer protective shell to slide relative to the inner protective shell;"

Madey discloses 1[c]. Madey discloses a layer of components between **outer helmet layer 90** and **inner helmet layer 92** that shear and "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 Madey's Figure 9B embodiment of Figure 4, this layer of components in **interface layer 94** includes (*e.g.*) **hyper-elastic columns 96** (energy transformer layer).



Ex.1047[Madey], Fig. 9B. Ex.1002, ¶269.

Madey discloses 1[c] in as much, if not more detail, as the '909 Patent. For example, to a POSA, Madey discloses a first energy transformer layer (**interface layer 94 of hyper-elastic columns**) between **outer** and **inner** helmet layers. Ex.1047[Madey], [0037], Fig. 9B. 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.1002, ¶¶269-270.

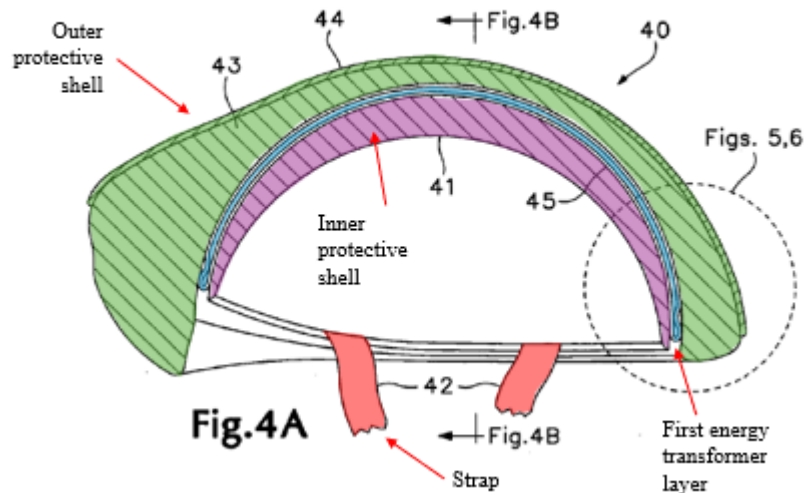
Madey also, for example, discloses interface layer 94 (first energy transformer layer) is associated with a shear mechanism, which in Madey is at least hyper-elastic columns 96 that shear and allow the outer helmet layer (protective shell) to slide relative to the inner helmet layer (protective shell). For example, Madey's hyper-elastic columns 96 "bend[] and stretch[]" in response to tangential force" and allow "relative displacement" between outer and inner layers. Ex.1047[Madey], [0037], Fig. 9A-B. Ex.1002, ¶¶270-273.

e) 1[d]: "a liner layer connected to the inner protective shell, the liner layer configured to reside between the inner protective shell and a human head;"

Madey discloses 1[d]. Madey's helmets include "a 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[Madey], [0025]; [0051] ("head cushioning"). Ex.1002, ¶274.

f) 1[e]: "a chin strap attached to the inner protective shell, the chin strap and the liner layer configured to secure the inner protective shell to the human head while the outer protective shell is allowed to slide relative to the inner protective shell."

Madey discloses 1[e]. Madey's Figure 4 helmet (and embodiment Figure 9B), includes "a 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[Madey], [0025], [0005] (straps "usually...a *chin-strap*").



Ex.1047[Madey], Fig. 4A. Madey’s chin-strap 42 is affixed to the “inner helmet layer” securing it to the head during relative displacement (sliding) of the outer layer, as Section X.D.1.d) discusses. Ex.1047[Madey], [0037], Fig. 9B. Ex.1002, ¶¶275-277.

Thus, Madey anticipates claim 1. Ex.1002, ¶277.

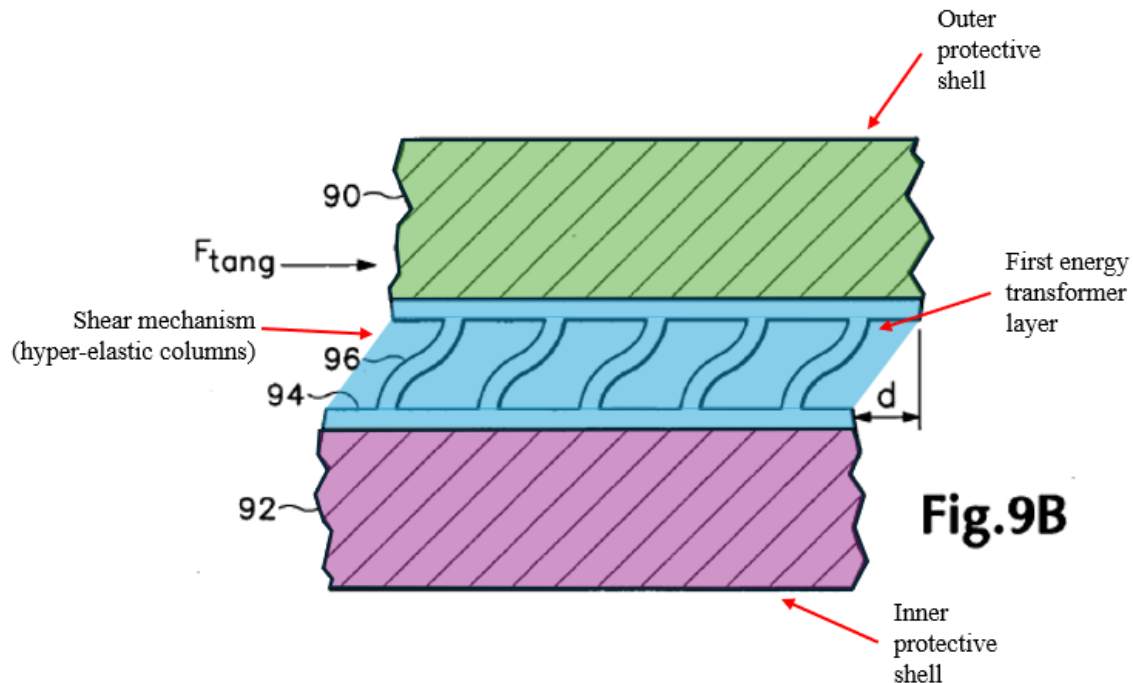
2. Claim 2

Madey discloses claim 1. Section X.D.1. Madey also discloses hyper-elastic columns made of “absorptive/dissipative material” because they “bend and stretch in response to the tangential force, thereby *deflecting* and partially *absorbing*” it. Ex.1047[Madey], [0037]. As Section X.D.1 discusses, Madey’s columns allow translational movement, and, as Dr. Duma explains, such movement dissipates (deflects) energy. Ex.1002, ¶278.

Thus, Madey anticipates claim 2. Ex.1002, ¶279.

3. Claim 4

Madey discloses claim 1. Section X.D.1. Madey discloses “the shear mechanism comprises a plurality of truss-like structures” connecting outer and inner protective shells. As Section X.D.2 discusses, Madey discloses “hyper-elastic columns” in a truss-like framework that support the outer helmet layer. Ex.1047[Madey], [0037].



Ex.1047[Madey], Fig. 9B. Ex.1002, ¶¶280-281.

Thus, Madey anticipates claim 4. Ex.1002, ¶282.

4. Claim 5

Madey discloses claim 1. Section X.D.1. Madey discloses ” the shear mechanism comprises a plurality of elastic bands” connecting outer and inner protective shells. As Section X.D.3 discusses, Madey’s columns are “hyper-elastic” and connect the outer and inner helmet layers. Ex.1047[Madey], [0037]. Ex.1002, ¶283.

Thus, Madey anticipates claim 5. Ex.1002, ¶284.

5. Claim 8

Madey discloses claim 1. Section X.D.1. Madey discloses “the shear mechanism comprises a plurality of elastomeric elements.” Madey’s “hyper-elastic columns” are elastomeric (i.e., deformable material). Ex.1047[Madey], [0037]. Ex.1002, ¶285.

Thus, Madey anticipates claim 8. Ex.1002, ¶286.

6. Claim 9

Madey discloses claim 1. Section X.D.1. Madey discloses “the shear mechanism is a shear layer”. As Section X.D.1.d) discusses, Madey’s “hyper-elastic columns” are a layer of materials that shear (shear layer). Ex.1047[Madey], [0037], Fig. 9B. Ex.1002, ¶287.

Thus, Madey anticipates claim 9. Ex.1002, ¶288.

7. Claim 10

Madey discloses claim 1. Section X.D.1. Madey discloses “the shear layer is connected to the outer protective shell through the first energy transformer, the first energy transformer operable to absorb energy from forces imparted onto the outer protective shell, wherein the first energy transformer includes a first absorptive/dissipative material to allow the outer protective shell to slide relative to the inner protective shell.” As Sections X.D.1.c) and X.D.2 discuss, Madey’s interface layer of “hyper-elastic columns” (shear layer) is connected to the outer helmet layer (outer protective shell) through hyper elastic columns (first energy transformers) of absorptive/dissipative material that absorbs energy from forces imparted onto the outer protective shell upon relative sliding. Ex.1002, ¶289.

Thus, Madey anticipates claim 10. Ex.1002, ¶290.

8. Claim 12

Madey anticipates claim for the same reasons as claim 1. Section X.D.1. Claim 12 recites outer and inner “protective layers” instead of outer and inner “shells.” The patent does not differentiate them, Ex.1001, 9:22-25, 10:17-21, Figs. 5-6, and Madey’s outer helmet layer is an outer protective layer and its inner helmet layer is an inner protective layer. Ex.1002, ¶¶291-296.

Thus, Madey anticipates claim 12. Ex.1002, ¶297.

9. Claim 13

Madey discloses claim 12. Section X.D.8. Further, Madey anticipates claim 13 for the same reasons as claim 2. Section X.D.2. Ex.1002, ¶298.

Thus, Madey anticipates claim 13. Ex.1002, ¶299.

10. Claim 15

Madey discloses claim 12. Section X.D.8. Further, Madey anticipates claim 15 for the same reasons as claim 4. Section X.D.3. Ex.1002, ¶300.

Thus, Madey anticipates claim 15. Ex.1002, ¶301.

11. Claim 16

Madey discloses claim 12. Section X.D.8. Further, Madey anticipates claim 16 for the same reasons as claim 5. Section X.D.4. Ex.1002, ¶302.

Thus, Madey anticipates claim 16. Ex.1002, ¶303.

12. Claim 19

Madey discloses claim 12. Section X.D.8. Further, Madey anticipates claim 19 for the same reasons as claim 8. Section X.D.5. Ex.1002, ¶304.

Thus, Madey anticipates claim 19. Ex.1002, ¶305.

13. Claim 20

Madey discloses claim 12. Section X.D.8. Further, Madey anticipates claim 20 for the same reasons as claim 9. Section X.D.6. Ex.1002, ¶306.

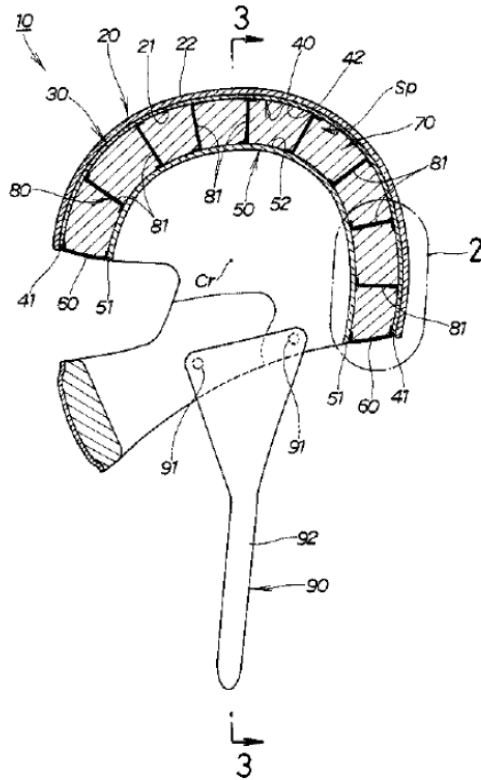
Thus, Madey anticipates claim 20. Ex.1002, ¶307.

E. Ground 5: Claims 1-2, 5, 8-9, 12-13, 16, and 19-20 are Obvious Over Dotsuko Combined with Puchalski

1. Claim 1

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

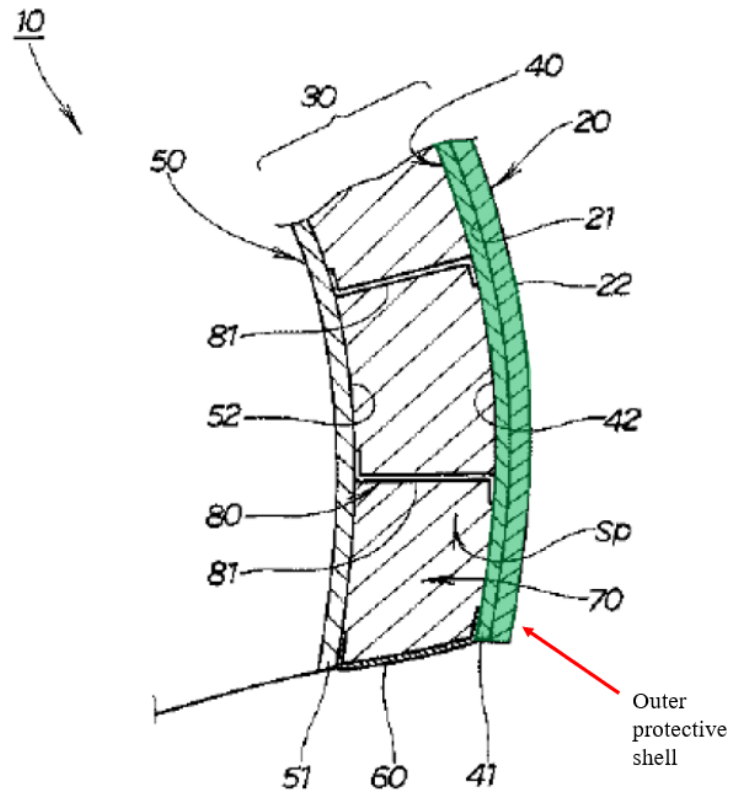
Dotsuko discloses “a helmet.” Ex.1041[Dotsuko], [Abstract].



Ex.1041[Dotsuko], Fig. 1. Ex.1002, ¶308.

b) *1[a]: “an outer protective shell;”*

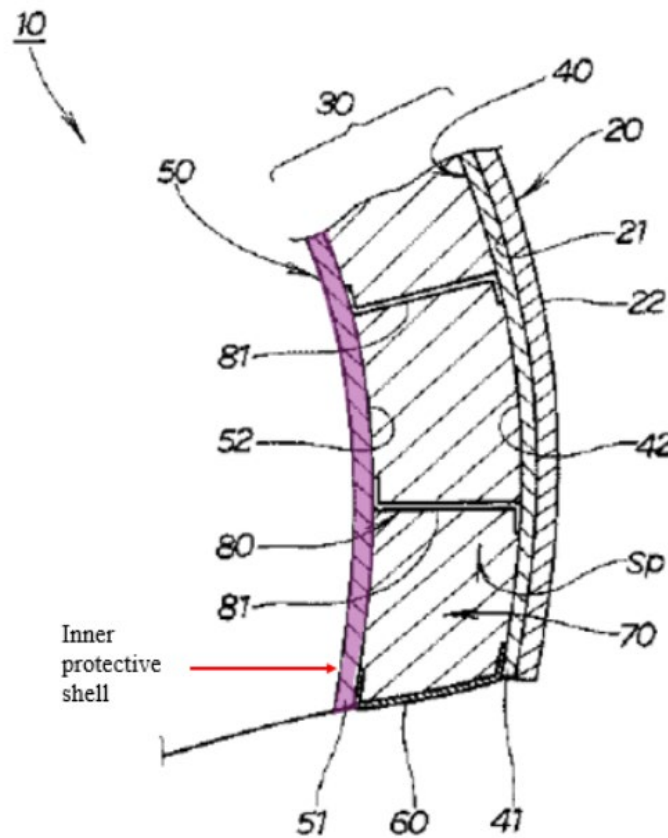
Dotsuko discloses 1[a]. Dotsuko’s helmet has “**outermost shell 20**” and “**outer liner 40.**” Ex.1041[Dotsuko], [0012], [0014].



Ex.1041[Dotsuko], Fig. 2. Outermost shell 20 is “made of a resin molded product such as FRP (fiber-reinforce plastic),” and “outer liner 40 and inner liner 50 are resin products” of, *e.g.*, hard or soft resin. Ex.1041[Dotsuko], [0012], [0014]. Dotsuko’s outer liner and outer shell made from FRP and hard resins are an outer protective shell. *See* n.5 Ex.1002, ¶¶309-310.

c) 1[b]: “an inner protective shell;”

Dotusko discloses 1[b]. Dotsuko discloses its liner 30 includes “**inner liner 50.**” Ex.1041[Dotsuko], [0013]. “[**I**nnner liner 50” is a hard or soft “resin product[]” with “overall shape...such that it can cover part or all of the head of the occupant (wearer) when fitted onto the head.” Ex.1041[Dotsuko], [0014].

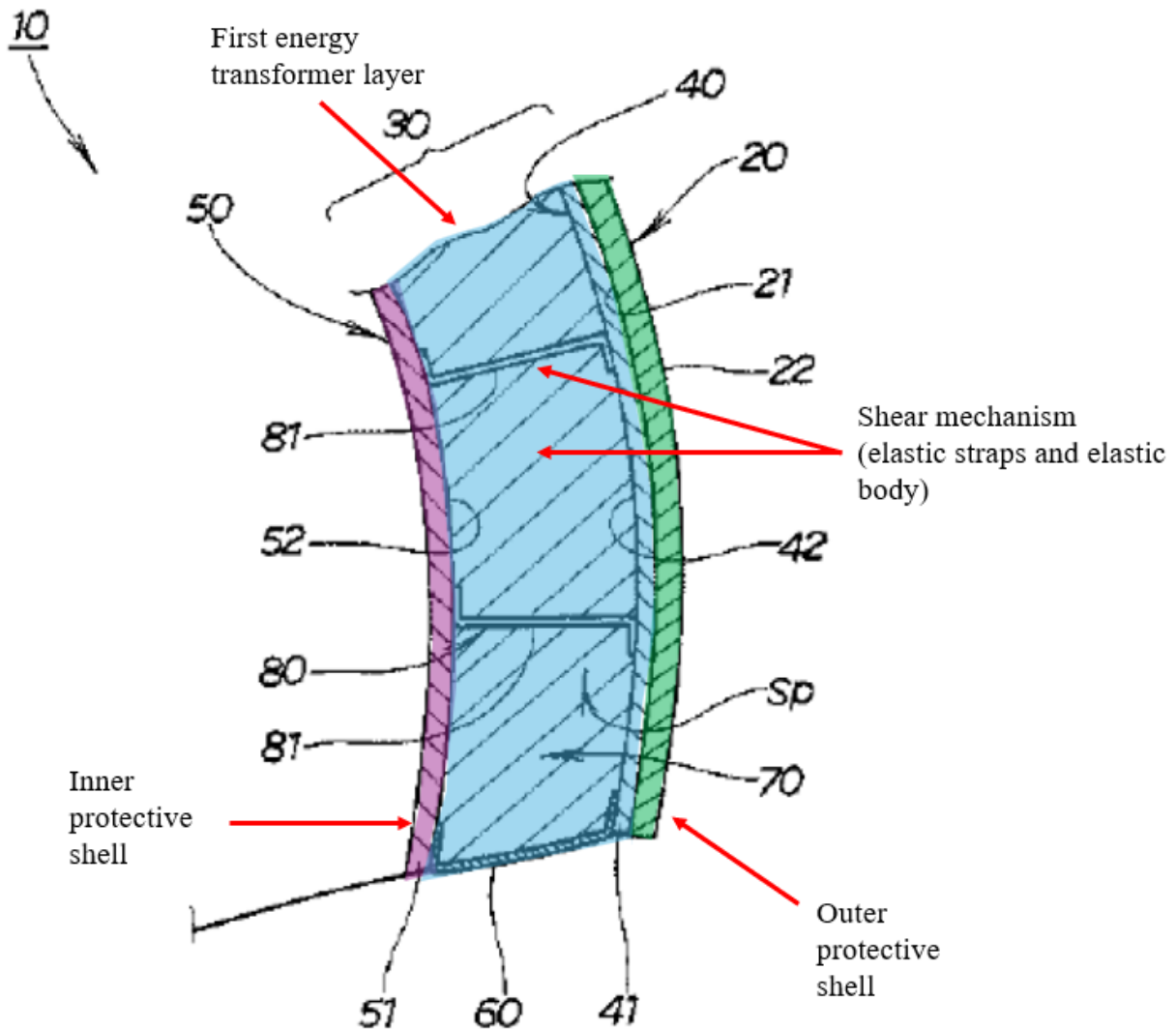


Ex.1041[Dotsuko], Fig. 2. Dotsuko's inner liner of hard resin is an inner protective shell. See n.5. Ex.1002, ¶311.

d) 1[c]: “a first energy transformer layer associated with a shear mechanism, the first energy transformer layer residing between the outer protective shell and the inner protective shell, wherein the shear mechanism allows the outer protective shell to slide relative to the inner protective shell;”

Dotsuko discloses 1[c]. Dotsuko's helmet has **inner liner 50** (inner protective shell) connected to **outer liner 40 and outer shell 20** (outer protective shell) with a **layer of space Sp** comprising a plurality of elastic straps and an elastic body (energy transformer layer) between them. Ex.1041[Dotsuko], [0013], [0017].

Thus, as exemplified below, Dotsuko discloses the claimed shear mechanism and energy transformer layer.



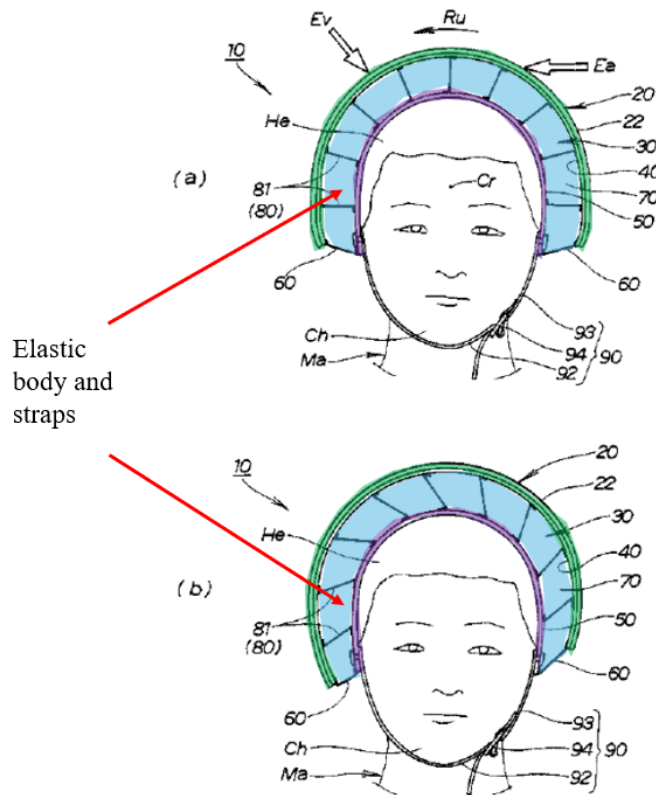
Ex.1041[Dotsuko], Fig. 2. Ex.1002, ¶312.

Dotsuko discloses 1[c] in as much, if not more detail, as the '909 Patent. For example, to a POSA, Dotsuko discloses at least a first energy transformer layer in,

as Figure 2 shows, its layer of “multiple elastic straps” and “elastic body[] that is filled in the internal space” between the inner and outer layer and transformer impact energy. Ex.1002, ¶¶312-313.

Dotusko discloses, for example, that this **layer of space Sp** is associated with a shear mechanism of the elastic straps and elastic body. “The elastic body 70 is a material that can deform” made of, *e.g.*, “resin powder, a grease-like substance, or a gel-like substance.” Ex.1041[Dotsuko], [0013], [0016]; *see also* Ex.1001[USP909], 6:60-63 (gels “absorptive/dissipative material”). Dotsuko’s elastic straps and elastic body allow the outer protective shell to slide relative to the inner protective shell. Dotsuko’s “elastic body 70 displaces ... [and] shell 20 relatively rotates with respect to the liner 30....[such that] impact energy Ea can be efficiently and sufficiently absorbed.”

[Fig. 4]



Ex.1041[Dotsuko], [0021], Fig.4. Ex.1002, ¶¶314-315.

Further, Dotsuko describes a “stopper mechanism” where “multiple straps 81 [] connect...outer liner 40 and...inner liner 50” made of “an elastic material such as rubber.” Ex.1041[Dotsuko], [0017]. These elastic straps “elongate[e]” allowing “a certain degree of relative rotation” of shell 20 and outer liner 40 relative to inner liner 50. *Id.*; *see also id.*, [0020-22], [0024-25]. Ex.1002, ¶¶315-316.

e) 1[d]: “a liner layer connected to the inner protective shell, the liner layer configured to reside between the inner protective shell and a human head;”

Dotsuko combined with Puchalski teaches 1[d]. Puchalski teaches “padding or cushioning [‘liner layer’]” “provided along the inside of the shell” and contoured to a wearer’s head (*i.e.*, between inner shell and head) “for increased comfort, better fit and to assist in the absorption of any impact forces.” Ex.1011[Puchalski], 1:52-55; Abstract, cl. 9. Ex.1002, ¶317.

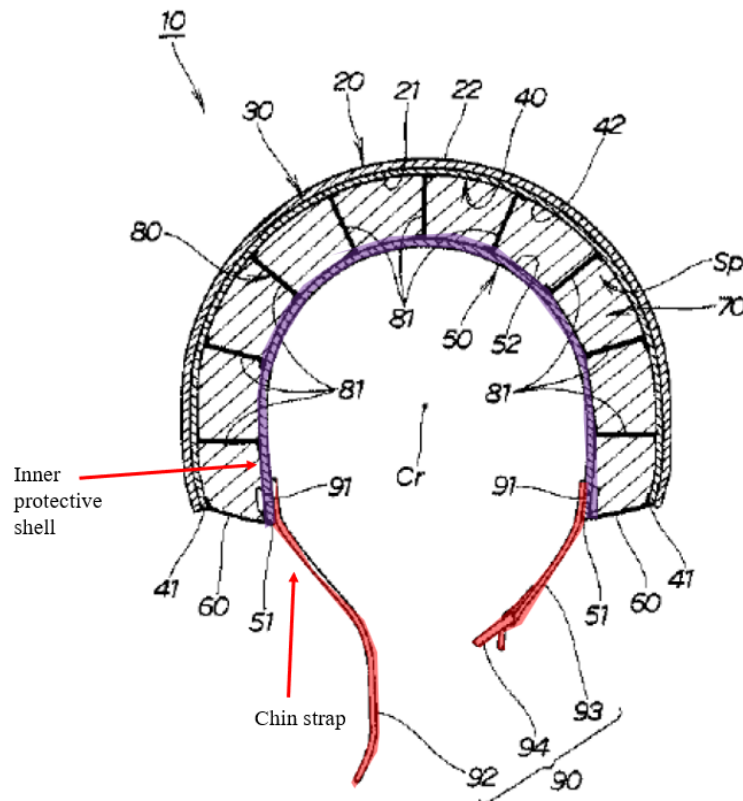
A POSA would have been motivated to combine Dotsuko and Puchalski. They are analogous to the challenged claims: they are in similar fields and directed to the same problem—and similar solutions—of reducing rotational impact via sliding layers. Dotsuko’s helmet is for occupants of “motorcycles and racing cars,” Ex.1041[Dotsuko], [0001], and “[c]omfort padding” within harder protective shells/liners is standard in motorcycle helmets. Ex.1031[Bosch], 2. Puchalski’s helmets are likewise for “motorcycle or race car driver[s],” and its “foam cushioning” “assists in maintaining the shell [] comfortably in the correct position on top of the user’s head” and “assist[s] in the absorption of impact forces.” Ex.1011[Puchalski], 7:34-39, 13:48-58; *see also id.*, 1:52-55. A POSA would have been motivated to incorporate Puchalski’s comfort liner in Dotsuko’s helmet for increased comfort and impact-force absorption. 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 Dotsuko’s helmet is ready for

improvement through incorporation of Puchalski's liner. This known technique of adding a (customary) user comfort layer would improve Dotsuko's helmet in a similar way to Puchalski. Ex.1002, ¶318.

A POSA would have reasonably expected success using Puchalski's comfort liner in Dotsuko's design. Helmets have comfort padding in standard practice. Ex.1031[Bosch], 2; Ex.1011[Puchalski], Abstract, 13:48-58. A POSA would have, as a matter of routine implementation, been able to configure Dotsuko's design to fit Puchalski's comfort liner, including because Puchalski's comfort liner is positioned under an inner layer like Dotsuko's and would easily fit into Dotsuko's design. Ex.1002, ¶319.

f) 1[e]: "a chin strap attached to the inner protective shell, the chin strap and the liner layer configured to secure the inner protective shell to the human head while the outer protective shell is allowed to slide relative to the inner protective shell."

Dotsuko combined with Puchalski teaches 1[e]. Dotsuko discloses "**chin-strap 90**" "attached to the lower portions on the left and right sides of the **inner liner 50**...." Ex.1041[Dotsuko], [0018].



Ex.1041[Dotsuko], Fig. 3. Ex.1002, ¶320.

This “attach[ment] to the liner 30,” makes it “easier for the **shell 20** to rotate relative to the liner 30 (that is, the **inner liner 50**), which is fixed to the head[] by the chin strap 90.” Ex.1041[Dotsuko], [0022]. Thus, upon impact, “the inner liner 50[] remains in place while the shell 20 alone relatively rotates...thereby absorbing the impact energy Ea.” *Id.* Ex.1002, ¶321.

Further, as Section X.E.1.e) discusses, Puchalski’s liner layer affixed to the inner liner (protective shell) of Dotsuko’s helmet further secures the inner liner to the head while the outer liner (protective shell) is allowed to move relative to the inner. Ex.1002, ¶322.

Thus, Dotsuko combined with Puchalski renders claim 1 obvious. Ex.1002, ¶323.

2. Claim 2

Dotsuko combined with Puchalski renders claim 1 obvious. Section X.E.1. As Section X.E.1.d) discusses, Dotsuko's elastic straps are made of "absorptive/dissipative material" ("elastic material such as rubber") with "elongation properties" and absorb and dissipate energy as they deform elastically. Ex.1041[Dotsuko], [0017]. Dotsuko's (*e.g.*), gel-like elastic body is also made of "absorptive/dissipative material" that absorbs and/or dissipates energy via deformation on impact and fluid flow. Ex.1041[Dotsuko], [0016], Ex.1001[USP909], 6:60-63. Dotsuko's elastic straps and elastic body are also absorptive/dissipative materials because they allow relative sliding between layers/shells, which absorbs and dissipates energy through movement and heat. *See* Section X.E.1.d); Ex.1041[Dotsuko], [0009] ("impact energy" "efficiently and sufficiently absorbed"). Ex.1002, ¶324.

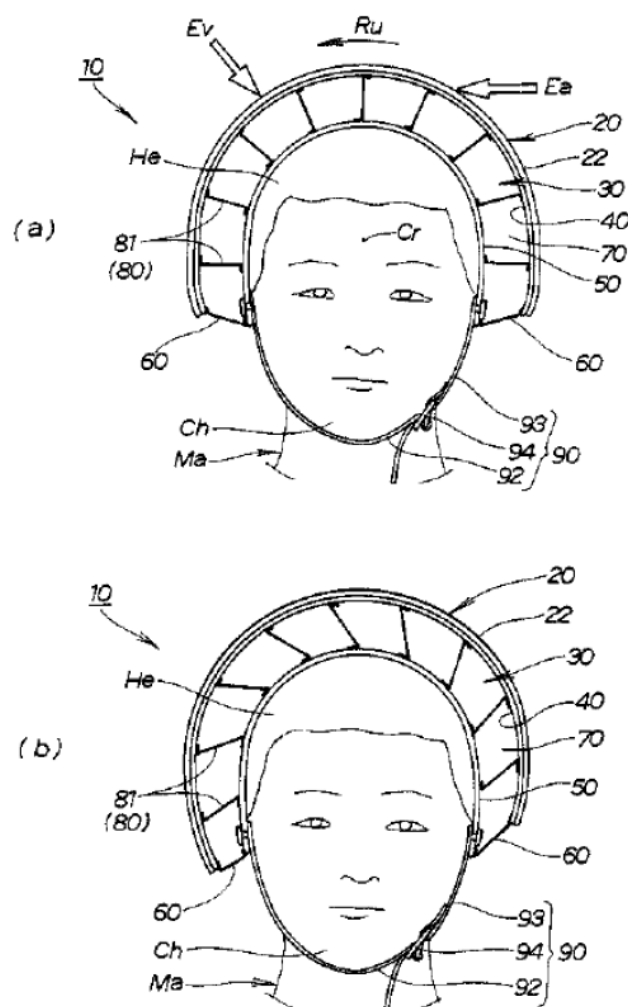
Thus, the combination renders claim 2 obvious. Ex.1002, ¶325.

3. Claim 5

Dotsuko combined with Puchalski renders claim 1 obvious. Section X.E.1. Dotsuko also discloses its elastic straps comprise "a plurality of elastic bands" connecting outer and inner liners. They are made from "elastic material such as

rubber,” with “elongation properties.” Ex.1041[Dotsuko], [0017]; [0025]; Section X.E.1.d).

[Fig. 4]



Ex.1041[Dotsuko], Fig. 4, [0017]. Ex.1002, ¶326.

Thus, the combination renders claim 5 obvious. Ex.1002, ¶327.

4. Claim 8

Dotsuko combined with Puchalski renders claim 1 obvious. Section X.E.1. As Section X.E.4 discusses, Dotsuko discloses “elastomeric elements” – its “multiple elastic straps” are made of “an elastic material such as rubber.” Ex.1041[Dotsuko], [0017], [0025]. Ex.1002, ¶328.

Thus, the combination renders claim 8 obvious. Ex.1002, ¶329.

5. Claim 9

Dotsuko combined with Puchalski renders claim 1 obvious. Section X.E.1. Dotsuko also discloses “the shear mechanism is a shear layer.” It discloses a layer including elastic straps and elastic body that shears as Section X.E.1.d) discusses. Ex.1002, ¶330.

Thus, the combination renders claim 9 obvious. Ex.1002, ¶331.

6. Claim 12

Dotsuko combined with Pulchalski renders claim 12 obvious for the same reasons as claim 1. Section X.E.1. Claim 12 recites outer and inner “protective layers” instead of outer and inner “shells.” The patent does not differentiate the two, Ex.1001[USP909], 9:22-25, Fig. 5 and 10:17-21, Fig.6, and Dotsuko’s “outermost shell 20” is an outer protective layer and its “inner liner 50” is an inner protective layer. Ex.1002, ¶¶332-338.

7. Claim 13

Dotsuko combined with Puchalski renders claim 12 obvious. Section X.E.6.
The combination renders claim 13 obvious for the same reasons as claim 2. Section
X.E.2. Ex.1002, ¶¶339-340.

8. Claim 16

Dotsuko combined with Puchalski renders claim 12 obvious. Section X.E.6.
The combination renders claim 16 obvious for the same reasons as claim 5. Section
X.E.3. Ex.1002, ¶¶341-342.

9. Claim 19

Dotsuko combined with Puchalski renders obvious claim 12. Section X.E.6.
The combination renders claim 19 obvious for the same reasons as claim 8. Section
X.E.4. Ex.1002, ¶¶343-344.

10. Claim 20

Dotsuko combined with Puchalski renders claim 12 obvious. Section X.E.8.
The combination renders claim 20 obvious for the same reasons as claim 9. Section
X.E.5. Ex.1002, ¶345.

XI. CONCLUSION

Petitioner requests institution of *inter partes* review and cancellation of '909
Patent claims 1-2, 4-5, 8-13, 15-16, and 19-20.

Respectfully Submitted,

Petition for *Inter Partes Review*
of U.S. Patent No. 9,516,909

Dated: July 9, 2025

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

TABLE OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 9,516,909 (USP909)
1002	Declaration of Dr. Stefan Duma
1003	Prosecution History for U.S. Patent No. 9,516,909 (Knight-909-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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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	U.S. Provisional App. No. 61/510,401 (401Prov)
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	English Translation of Japanese Unexamined Patent Application Publication No. JP2006-016740 (Dotsuko)

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Exhibit	Description
1042	Japanese Unexamined Patent Application Publication No. JP2006-016740 (Dotsuko-Original-Japanese)
1043	U.S. Patent No. 5,353,437 (Field)
1044	U.S. Patent No. 5,129,108 (Copeland)
1045	U.S. Patent No. 4,012,794 (Noniyama)
1046	U.S. Patent No. 7,770,239 (Goldman)
1047	U.S. Patent Application Publication No. 2004/0117896 (Madey)
1048	U.S. Patent Application Publication No. 2013/0019384 (Knight-384)
1049	EPSOLE, <i>What Is EPS Material: The Complete Guide to EPS Material</i> (April 15, 2024), https://epsole.com/what-is-eps-material/ (Epssole)
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 13,629, 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
Reg. 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. 9,516,909 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. 9,516,909 (Exs.1001-1007, 1009-1026, 1028-1034, 1036-1049)
- 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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