UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

REVELYST SALES LLC
Petitioner

v.

BRAINGUARD TECHNOLOGIES INC.
Patent Owner

IPR2025-01032
U.S. Patent No. 9,414,635

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,414,635 CHALLENGING CLAIMS 1-4, 6, 8-12, 14, and 16-20 UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104

TABLE OF CONTENTS

Page

I. INTRODUCTION

Revelyst Sales LLC ("Petitioner") respectfully requests inter partes review ("IPR") of claims 1-4, 6, 8-12, 14, and 16-20 (the "Challenged Claims") of U.S. Patent No. 9,414,635 (the "'635 Patent") (Ex.1001[USP635]) under 35 U.S.C. §§311-19 and 37 C.F.R. §42.1 et seq.

The '635 Patent is directed to helmets with one or more layers that can slide relative to each other to increase protection upon impact. The safety issues the '635 Patents 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 that analyzing the problem and describing techniques, including directed to relative movement of helmet layers and absorption/dissipation of energy, to protect wearers. The '635 Patent received no substantive prosecution; minimal art was identified beyond Patent Owner's sparse disclosures, and the claims received no anticipation or obviousness rejection save double-patenting rejections. As this Petition demonstrates, however, the concepts and structures of the Challenged Claims, indeed the same layers filled with components, were widely known in the prior art, and the Challenged Claims are anticipated or would have been obvious. For instance, Madey and Dotsuko'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 many of the Challenged Claims. Other references render all Challenged Claims obvious.

This Petition, supported by the declaration of Dr. Duma (Ex.1002), demonstrates that there is 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 '635 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.

Lead Counsel:	David Cavanaugh, Reg. No. 36,476
Backup Counsel:	Heather Petruzzi (Reg. No. 71,270)
	Patrick Nyman (Reg. No. 76,123)
	Amy Wigmore (*pro hac vice* to be filed)
	Joshua Stern (*pro hac vice* to be filed)

D. Service Information

E-mail:	David.Cavanaugh@wilmerhale.com
	Heather.Petruzzi@wilmerhale.com
	Patrick.Nyman@wilmerhale.com
	Joshua.Stern@wilmerhale.com
	Amy.Wigmore@wilmerhale.com
Post and hand delivery:	Wilmer Cutler Pickering Hale and Dorr LLP
	2100 Pennsylvania Avenue NW
	Washington, DC 20037
	Telephone: 202-663-6025
	Fax: 202-663-6363

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 '635 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 '635 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 '635 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 ’635 Patent claims 1-4, 6, 8-12, 14, and 16-20 of the ’635 Patent.

A. Prior Art

As Section VII.C discusses, the priority date of the ’635 Patent is July 20, 2012 and not July 21, 2011 as claimed. Petitioner relies on Exhibits including:

- U.S. Patent Application Publication No. US2012/0198604 to Weber et al. (“Weber”) (Ex.1004[Weber]), filed February 8, 2012 and published August 9, 2012, which claims the benefit of U.S. Provisional Application No. 61/462914 (filed February 9, 2011) (“*Weber Provisional*”), 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. 61/333817 (filed May 12, 2010) ("*Halldin Provisional*"), 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 ("Madey") (Ex.1047[Madey]), which published on June 24, 2004, 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

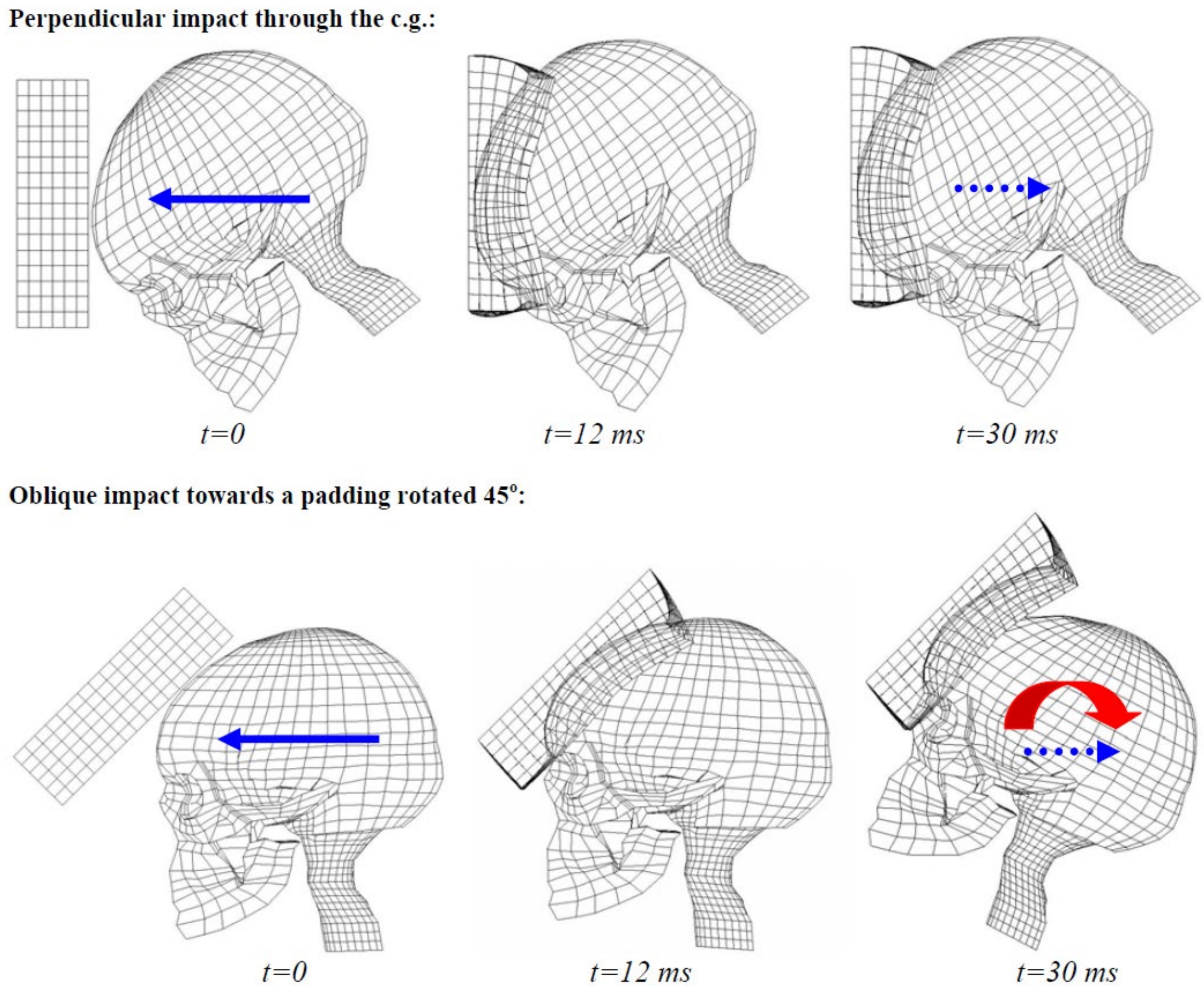
Under 37 C.F.R. §§42.22(a)(1) and 42.104(b)(1)–(2), Petitioner requests cancellation of the Challenged Claims on the following grounds:

Ground	Basis	Claims	References
1	§103	1-4, 6, 8-12, 14, 16-20	Weber in view of Puchalski
2	§103	1-4, 6, 8-12, 14, 16-20	Von Holst in view of Halldin and Puchalski
3	§103	1-4, 6, 8-12, 14, 16-20	Kleiven in view of Puchalski
4	§102	1-3, 9-11, 17-19	Dotsuko
5	§103	8, 16	Dotsuko in view of Puchalski
6	§102	1-3, 8-11, 16-19	Madey

VI. TECHNOLOGY BACKGROUND

A. Rotational Motion from Impact

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



Ex.1026[Kleiven-2007], Fig. 3. "Rotational acceleration" in turn "result[s] in shear strains inside the brain." Ex.1031[Bosch], 55. "Shearing" results from "shear forces," which refer to forces from parallel translation in different or opposing directions exerted on the helmet or brain. Ex.1002, ¶¶37-40.

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-2004], 502 ("[R]otational acceleration is more damaging than linear…."). Ex.1002, ¶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:

1 /3

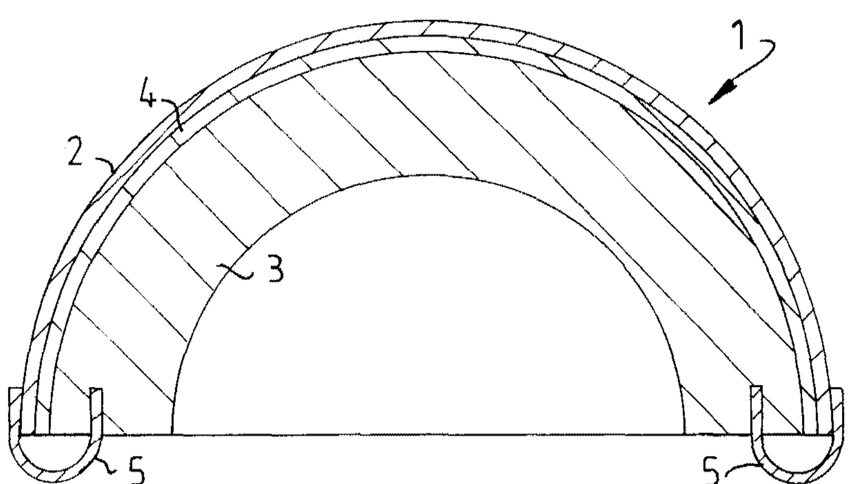


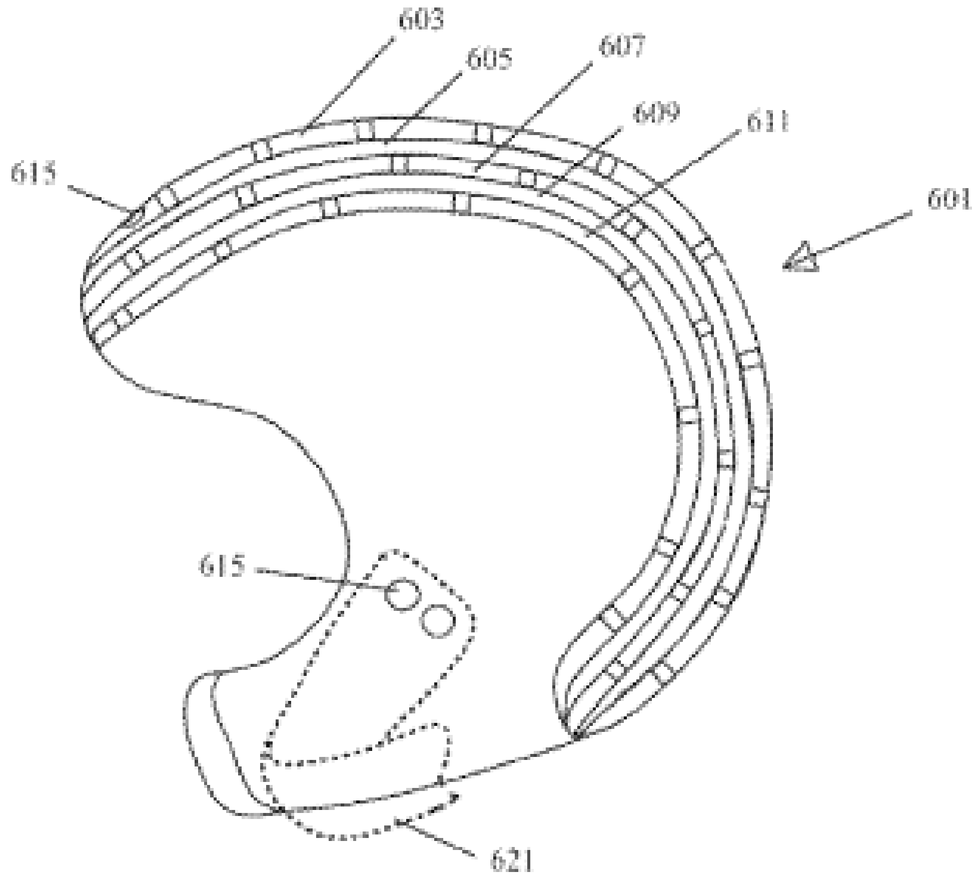
FIG.1

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. *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 '635 Patent

A. Specification

The '635 Patent is directed to preventing damage from "rotational" and other forces. Ex.1001[USP635], 2:51-57. 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[USP635], 2:64-3:3, 6:35-38. Figure 6 depicts three helmet layers (603, 607, 611) joined by "energy and impact transformer" layers (605, 609):



Ex.1001[USP635], 10:3-11, FIG. 6. The helmet shell layers are connected (directly or indirectly) through transformer layers, Ex.1001[USP635], 10:39-41, which "transform" energy—e.g., impact or rotational force—via sliding into *e.g.*, heat or rotational energy. *Id.*, 9:5-24, 6:18-28, FIG. 5 (shell 501 "mov[ing] and/or sliding" [1] relative to 503). The Patent identify several materials—in various combinations—

[1] The '635 Patent uses "move relative to" and "slide relative to" synonymously. Ex.1001[USP635], Abstract, 2:37-41, 8:49-56, 9:5-14, 9:15-24. Ex.1002, ¶51 n.2.

that may make up a transformer layer. Ex.1001[USP635], 6:29-7:50, 9:29-10:2, 11:3-5 (fluid or gel alone or with mechanical spacers). The '635 Patent specification does not reference "shear mechanism" or "shear layer." Ex.1002, ¶¶49-51.

The '635 Patent further discusses typical prior-art helmet components like lining layers, Ex.1001[USP635], 8:7-10, 10:7-9, and chin-straps. *Id.*, 10:9-11, 10:23-25. Ex.1002, ¶52.

B. Prosecution History

The '635 Patent issued from U.S. Patent Application No. 14/809,142. Prosecution of the '142 application was abbreviated, with only one office action with double patenting rejections, and allowance after terminal disclaimers. Ex.1003[Knight-635-FH], 57-62, 94-100. Ex.1002, ¶53.

With the '635 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 times*** before allowing significantly narrower claims. *See generally* Ex.1013[Knight-162-FH]. Ex.1002, ¶¶54-55.

C. Priority Date

For this IPR, the ’635 Patent is entitled at most to a priority date of July 20, 2012.[2] Ex.1002, ¶56.

The ’635 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)). Ex.1002, ¶¶56-57.

Every claim of the ’635 Patent recites “a chin strap.” Ex.1001[USP635] claims 1, 9, 17. But the ’401 Provisional ***nowhere mentions a chin-strap***, much less one “attached” to the inner shell/conforming 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 for designed for the head in discussing (1) “Related Art” and (2) a “Coconut and Fiber Element” embodiment that does not refer to sliding layers. Ex.1029[401Prov] at 5-6, 11. Ex.1002, ¶57.

---

[2] Petitioner reserves the right to argue a different priority date in District Court.

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 the purposes of this IPR, it provides the earliest date the '635 Patent's claims are entitled to. Ex.1002, ¶58.

VIII. PRIOR ART

A. US2012/0198604 ("Weber")

Weber recognizes "rotational acceleration" risks "shearing brain tissue." Ex.1004[Weber], [0006]. Weber describes multi-layered helmets to "significantly reduce both rotational and linear forces" from impacts. Ex.1004[Weber], [0009]. Ex.1002, ¶¶64-65.

Weber describes outer, intermediate, and inner liners separated by components that allow relative movement between them. For example, Weber describes isolation dampers that allow for "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.

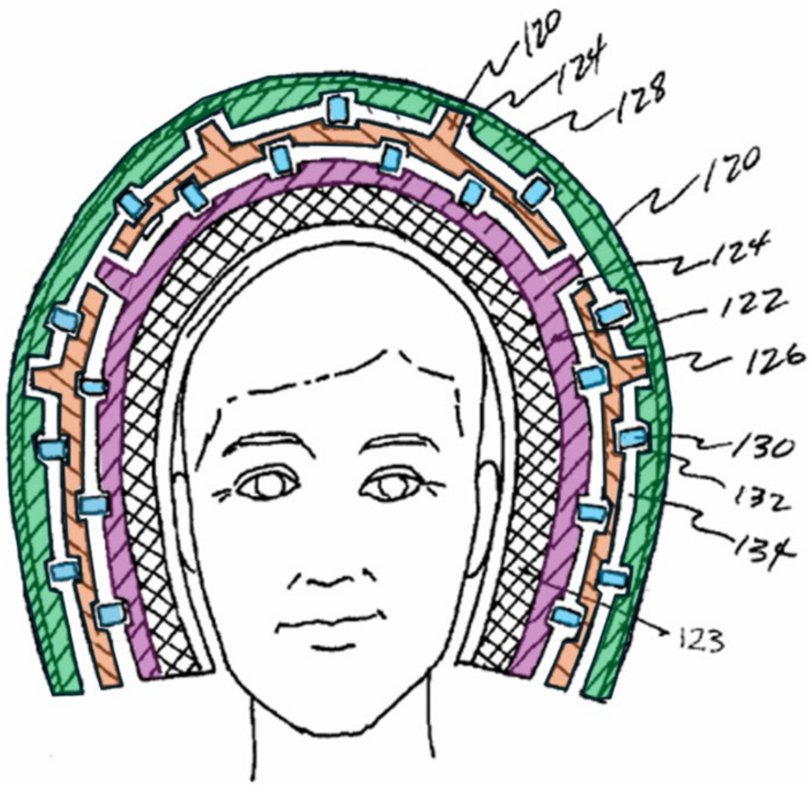


Fig. 4

Ex.1004[Weber], Fig. 4[3], [0045-46]. Ex.1002, ¶66.

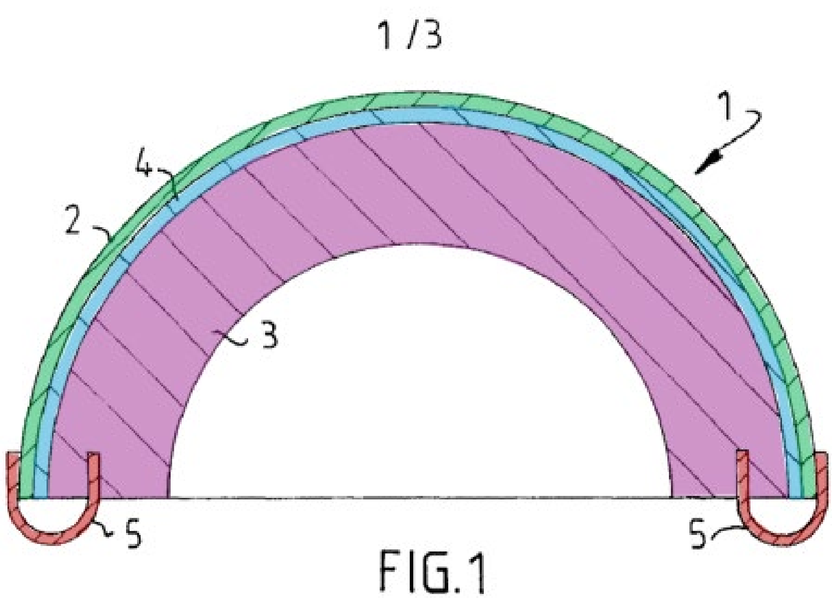
Weber explains "isolation dampers 130" "disposed between" liners "dissipate" impact energy, *id.*, *e.g.*, "enabl[ing] the inner and intermediate liners 122 and 126 to move relative to each other and/or the outer liner 128." *Id.*, [0045-46]. Ex.1002, ¶67.

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, ¶¶68-69.

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



Ex.1005[VonHolst], Fig. 1. Ex.1002, ¶70.

Von Holst's Figure 3b helmet is a five-layer variant of the Figure 1 helmet **intermediate shell 6** between "**two sliding layers 4**." Ex.1005[VonHolst], 6:2-6.

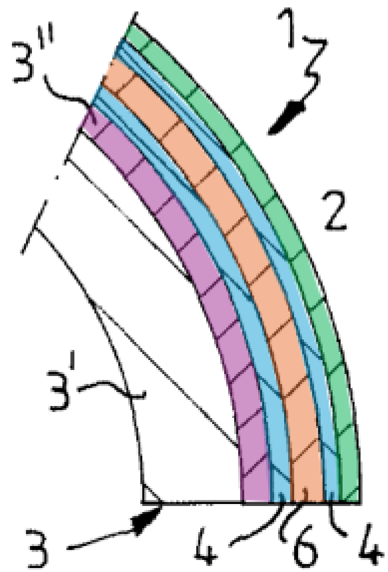


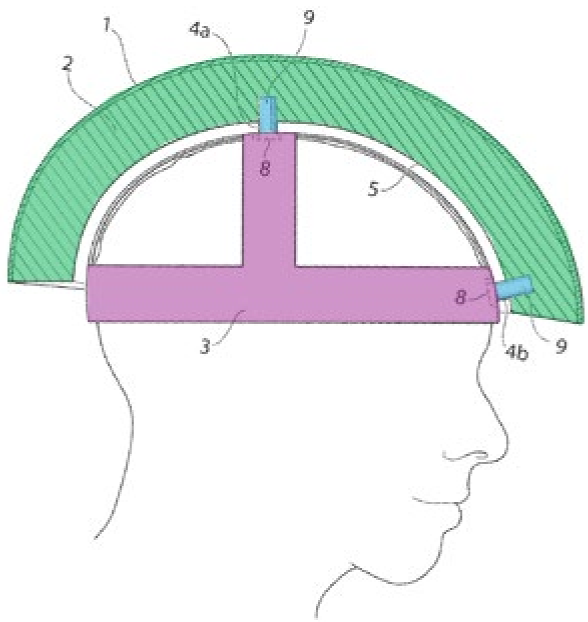
FIG.3b

Ex.1005[VonHolst], Fig. 3b. Ex.1002, ¶¶71-72.

C. WO2011/139,224 ("Halldin")

Halldin addresses reduction of "rotational acceleration affecting the brain." Ex.1006[Halldin], [0013]. Halldin's helmet has **outer shell 1, energy absorbing layer 2**, and **inner attachment device 3.** Ex.1006[Halldin], [0046-47]. **Fixation members 4a and 4b** fix **attachment device 3** to the **energy absorbing layer**, and upon impact allow "energy absorbing layer 2 to slide in relation to" device 3. Ex.1006[Halldin], [0046-47].

Fig.2



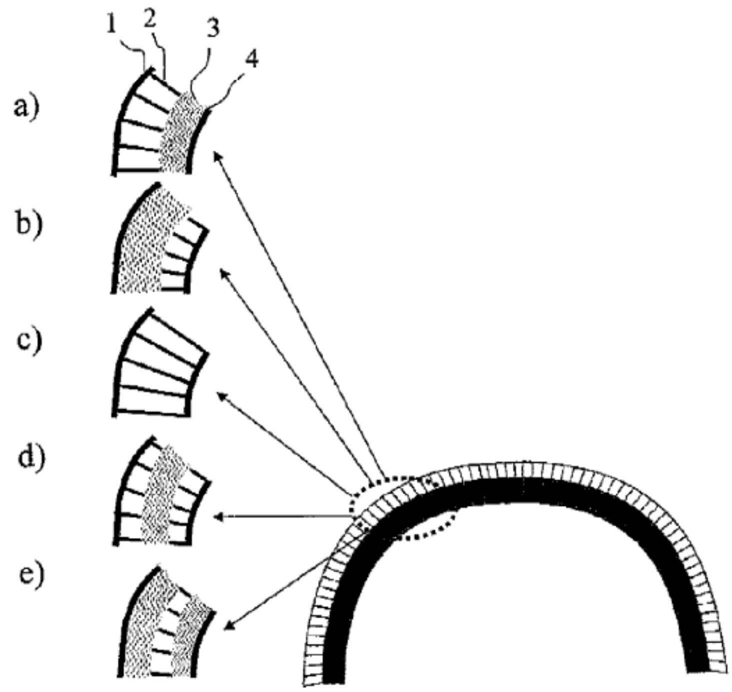
Ex.1006[Halldin], Fig. 2. Ex.1002, ¶¶73-74.

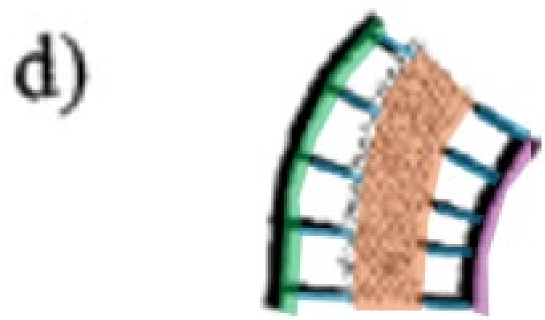
D. US2013/0122256 ("Kleiven")

Kleiven recognizes "[a]ngular or rotational motion" "induced by oblique impact" causes brain damage. Ex.1007[Kleiven], [0004]. Kleiven's helmet thus has "layers" separated by flexible "spikes or beams" that permit relative displacement. Ex.1007[Kleiven], Abstract, [0002], [0020], [0048-49], [0062]. Ex.1002, ¶¶75-76.

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

Fig. 2.



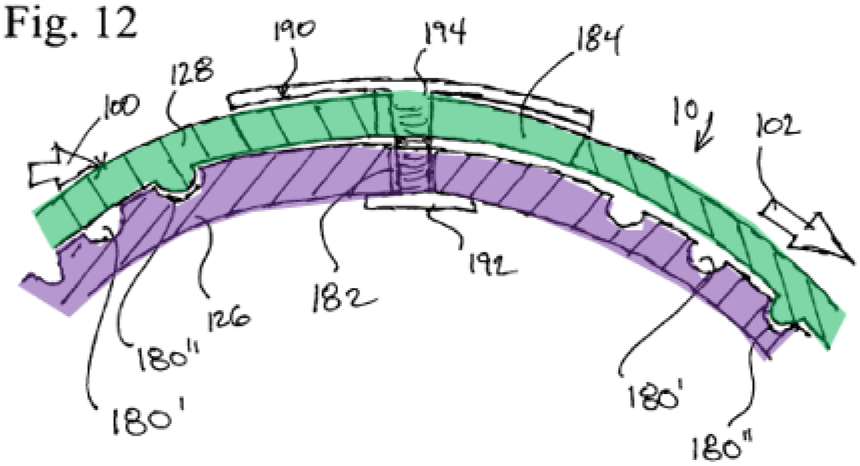


Ex.1007[Kleiven], Fig. 2, 2(d). Ex.1002, ¶77-78.

E. US6996856 ("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":

Fig. 12



Ex.1011[Puchalski], 12:55-58, Fig. 12. Ex.1002, ¶¶79-80.

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

Fig. 9

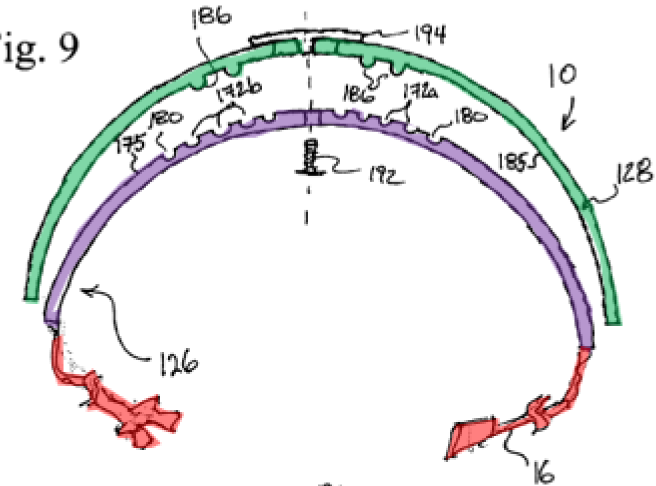
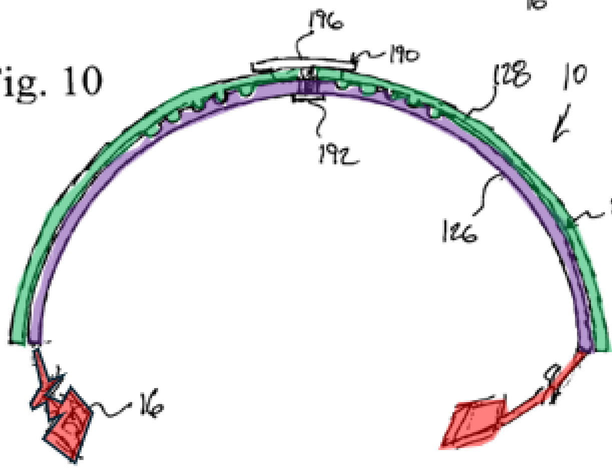


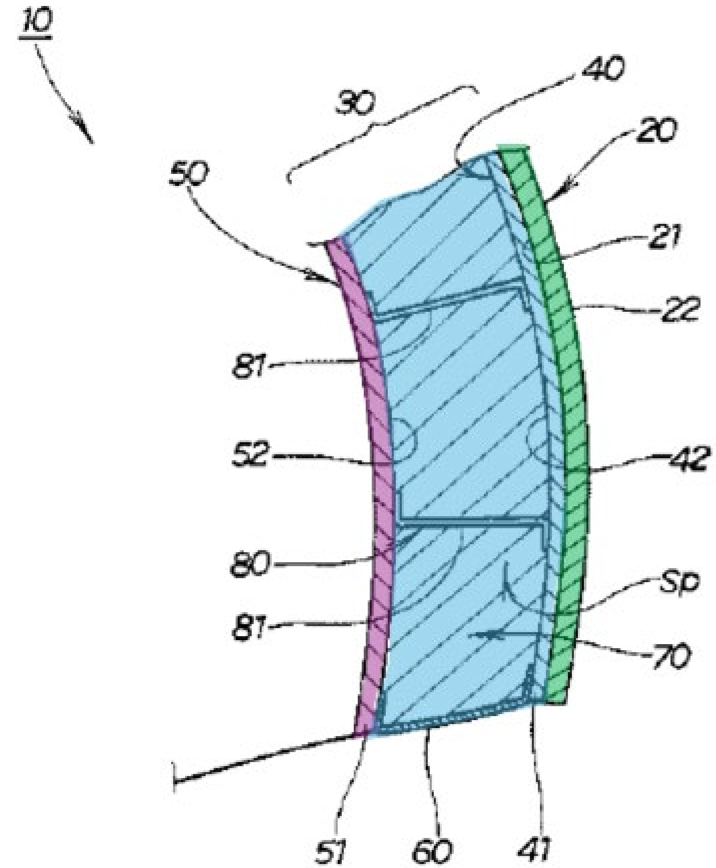
Fig. 10



Ex.1011[Puchalski], Figs. 9-10; Ex.1002, ¶81.

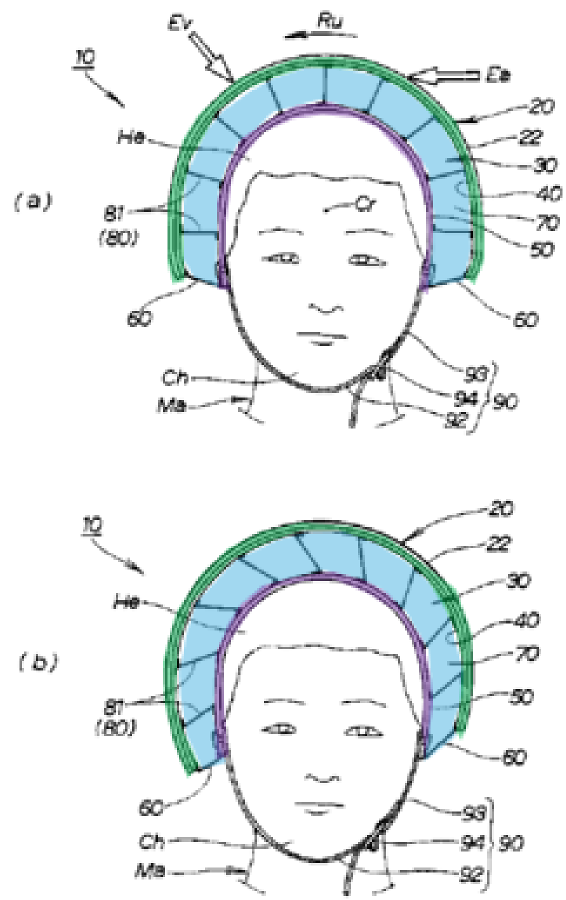
F. JP2006/016740 ("Dotsuko")

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].



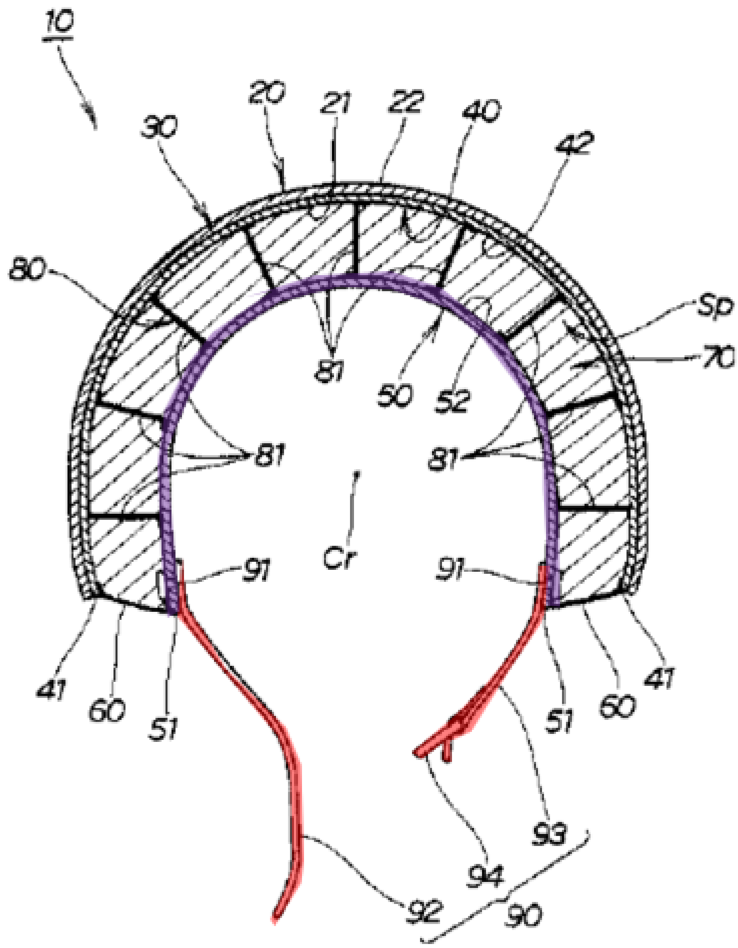
Ex.1041[Dotsuko], Fig. 2. Dotsuko's elastic body can "deform" and the straps allow "relative rotation of the shell 20 and the outer liner 40 with respect to the inner liner 50…." Ex.1041[Dotsuko], [0016], [0017].

[Fig. 4]



Ex.1041[Dotsuko], Fig. 4. Ex.1002, ¶¶82-83.

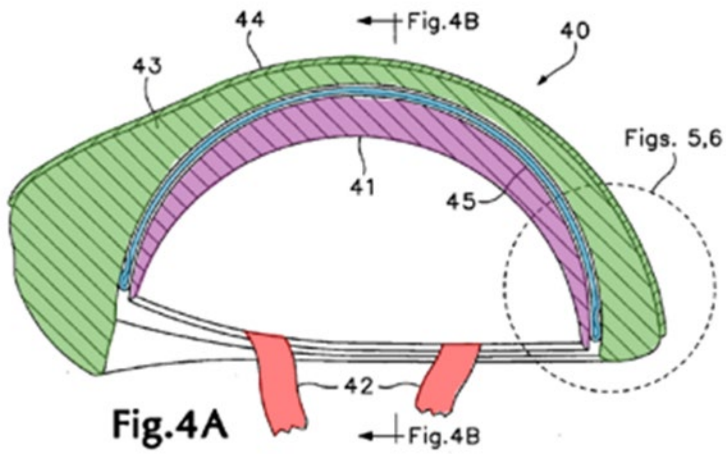
Dotusko further discloses a **chin-strap 90** attached to the sides "of the **inner liner 50**…." Ex.1041[Dotsuko], [0018].



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 Ea." Ex.1041[Dotsuko], [0022]. Ex.1002, ¶84.

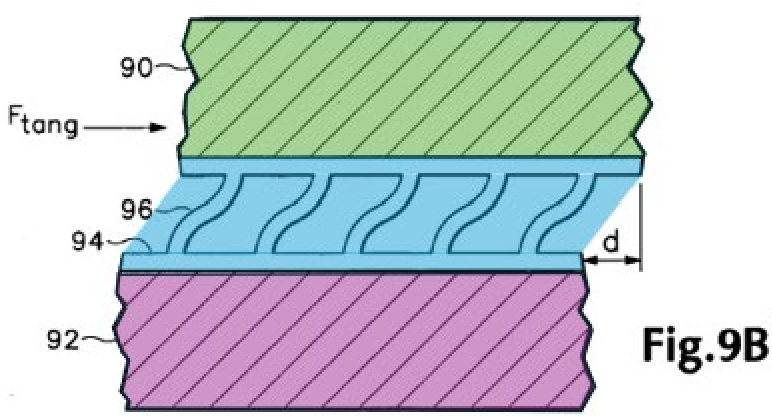
G. US2004/0117896 ("Madey")

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



Ex.1047[Madey], Fig. 4A. Ex.1002, ¶85-86.

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, ¶86.

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 shell layer to slide relative to the inner shell [conforming] layer" is something that shears and allows the outer shell layer to slide relative to the inner shell [conforming] layer. Claim 2 makes clear that the shear mechanism recited in this phrase can be a shear layer, which is a layer that shears. Ex.1002, ¶¶59-63.

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

X. SPECIFIC GROUNDS FOR UNPATENTABILITY

Under 37 C.F.R. § 42.104(b)(4)-(5), and as Dr. Duma confirms (Ex.1002, ¶¶87-371), the prior art anticipates and/or renders obvious the Challenged Claims.

A. Ground 1: Claims 1-4, 6, 8-12, 14, and 16-20 are Obvious over Weber in view of 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:

Weber	*Weber Provisional*
FIG. 2	FIG. 2
FIG. 4	FIG. 3
[0002]	p.3: helmets to e.g. "reduce…rotational brain injury [and] shearing of brain matter…" and "force applied to the helmet…result[ing] in…rotational brain injury…"
[0006]	
[0008]	p.4: helmets to e.g. "absorb and dissipate as much energy as possible, in the shortest amount of time possible" where energy includes "direct linear translational energy" and "angular acceleration or deceleration energy" to "reduce or significantly diminish the risk of head and brain injury."
[0009]	p.4: helmet "omni-directional impact energy management system" and its effects
[0034]	pp.3, 4: helmet system reducing "rotational and linear forces on the brain"
[0036]	pp.4, 5, 6: helmet layers including inner comfort liner "in contact with the wearer's head"
[0037]	p.4, 5: engagement between liners and allowance of movement to reduce force and acceleration from outer shell
[0038]	p.5: multiple layers with omni-directional control using components with or without air gaps

[0039]	p.5: outer liner fixed to inside of helmet shell
[0040] [0041]	p.5: "inner and outer liners" and their engagement using isolation dampers; Figure 2 embodiment
[0042]	pp.4, 5: outer liner affixed to outer shell
[0043]	pp.5, 6: "inner and outer liners" and their engagement using isolation dampers, Figure 2 embodiment, and flex bumpers and their properties
[0044]	p.5: "inner liner" and engagement by head through "comfort liner"; "restraint" "managed by the chin-strap or neck security device commonplace on all helmets." p.4: stops to "prevent over-rotation."
[0045]	pp.4, 5, 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 describes 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.4, 5, 6: "flex bumpers" (isolation dampers) may create a space between surfaces and air gaps for "omni-directional 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 of "flex bumpers" (isolation dampers)) to allow relative movement and absorb energy

[0062]	p.6: materials for "flex bumpers" (isolation dampers)

Ex.1002, ¶¶89-90.

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

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

Ex.1002, ¶91.

2. Claim 1

a) 1[preamble][4]: "A helmet comprising:"

Weber discloses "helmets." Ex.1004[Weber], [0002], Fig. 4. Ex.1002, ¶¶92-93.

b) 1[a]: "an outer shell layer;"

[4] Petitioner takes no position herein on whether any preamble is limiting. In all cases, it is taught in the prior art. Ex.1002, ¶¶87-371.

Weber discloses 1[a]. Weber's "outer shell" and "outer liner" (made of e.g., EPS) "affixed directly to the inside surface of the outer shell," Ex.1004[Weber], [0039], [0042], Figs. 2, 4, is an outer shell layer.[5] Ex.1004[Weber], [0036], [0038], [0045]; Ex.1001[USP635], 2:33-35; 6:4-17. Weber equates "layers" and "liners." *E.g.*, Ex.1004[Weber], [0036]. Ex.1002, ¶¶94-97.

c) 1[b]: "an inner shell layer connected to the outer shell layer through a shear mechanism allowing the outer shell layer to slide relative to the inner shell layer, wherein the

---

[5] The specification does not define "shell," but states outer 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[USP635], 10:15-17, 11:5-12. Weber's outer "liner" discloses to a POSA an outer "shell layer" because, for example, it spans the entirety of the helmet and is made of EPS (a plastic constructed from a plastic resin). Ex.1004[Weber], [0036], [0038]; Ex.1049[Epsole]; *see* Ex.1031[Bosch], 2 (standard for different materials at outer and inner layers). Ex.1002, ¶94.

shear mechanism includes a first energy transformer[6] having a first absorptive/dissipative material,"

Weber discloses element 1[b]. Weber's "inner liner 122" made of, e.g., EPS, is an inner shell layer. *See* n.5 (Weber's outer liner). Ex.1004[Weber], [0036], [0038], [0045], Figs. 2, 4. Ex.1002, ¶¶98-99.

Weber further discloses inner and outer shell layers connected through a shear mechanism, which also includes a first energy transformer. Weber discloses components between its outer and inner liners that shear and allow those liners to slide relative to each other and to transform energy from impact. These components includes dampers and surrounding fluid (i.e., air), which connect Weber's inner and outer shell layers. [7] Ex.1004[Weber] Figs. 2-4, [0045], [0040] ("The inner and outer liners 104 and 102 are coupled to each other …by the use of a plurality of resilient, e.g., elastomeric, structures" or "isolation dampers."),

---

[6] The specification does not use "shear mechanism" or "energy transformer." For purposes of this IPR, an energy and impact transformer encompasses an energy transformer. Ex.1002, ¶102.

[7] As the '635 Patent discusses, connection may be through the shear mechanism and other layers because, "a 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[USP635], 2:25-31, 10:39-44. Ex.1002, ¶103.

[0050]. Thus, as exemplified below, Weber discloses the claimed shear mechanism and first energy transformer. Ex.1002, ¶100.

Weber discloses 1[b] in as much, if not more detail, as the '635 patent, which does not identify a "shear mechanism," nor explain how it differs from an "energy transformer." For example, to a POSA, Weber discloses a shear mechanism, which includes at least the components between its outer and inner liners that shear and allow the outer shell/liner (outer shell layer) to slide relative to the inner liner (inner shell layer). The shear mechanism includes "**isolation dampers 130**" and fluid (e.g., air), which connect Weber's inner and outer shell layers. Ex.1004[Weber] Figs. 2-4, [0038], [0045], [0040], [0050]. Ex.1002, ¶¶100-102.

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, ¶103.

As another example, Weber states the space can be an air gap that also 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 absorb or dissipate impact energy through compression, displacement, and fluid flow, also generates heat.[9] Ex.1002, ¶104-105.

---

[8] In conjunction, Weber discloses inner liner "later[ally] or rotational[ly] displace[d]" "relative to the outer liner," as "controlled" by lugs engaged with corresponding recesses. Ex.1004[Weber], [0047]. Such lugs also allow rotational movement between "intermediate 126 and the inner and outer liners 122 and 128" which have "isolation dampers 130" between them "to further dissipate the energy of impacts." *Id.* [0045]. Ex.1002, ¶107.

[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, ¶105.

Alternatively, if Patent Owner argues the claimed "shear mechanism" requires a middle shell/layer,[10] Weber further discloses "**intermediate liner 126**"[11] associated with inner and outer layers of dampers and fluid/air gaps. The components between Weber's outer and inner liners—the intermediate liner, lugs, and inner/outer layers of "**isolation dampers 130"** and fluids, collectively shear and allow relative sliding of the inner and outer liners. Ex.1004[Weber], [0045-46], Fig. 4. Ex.1002, ¶106-107.

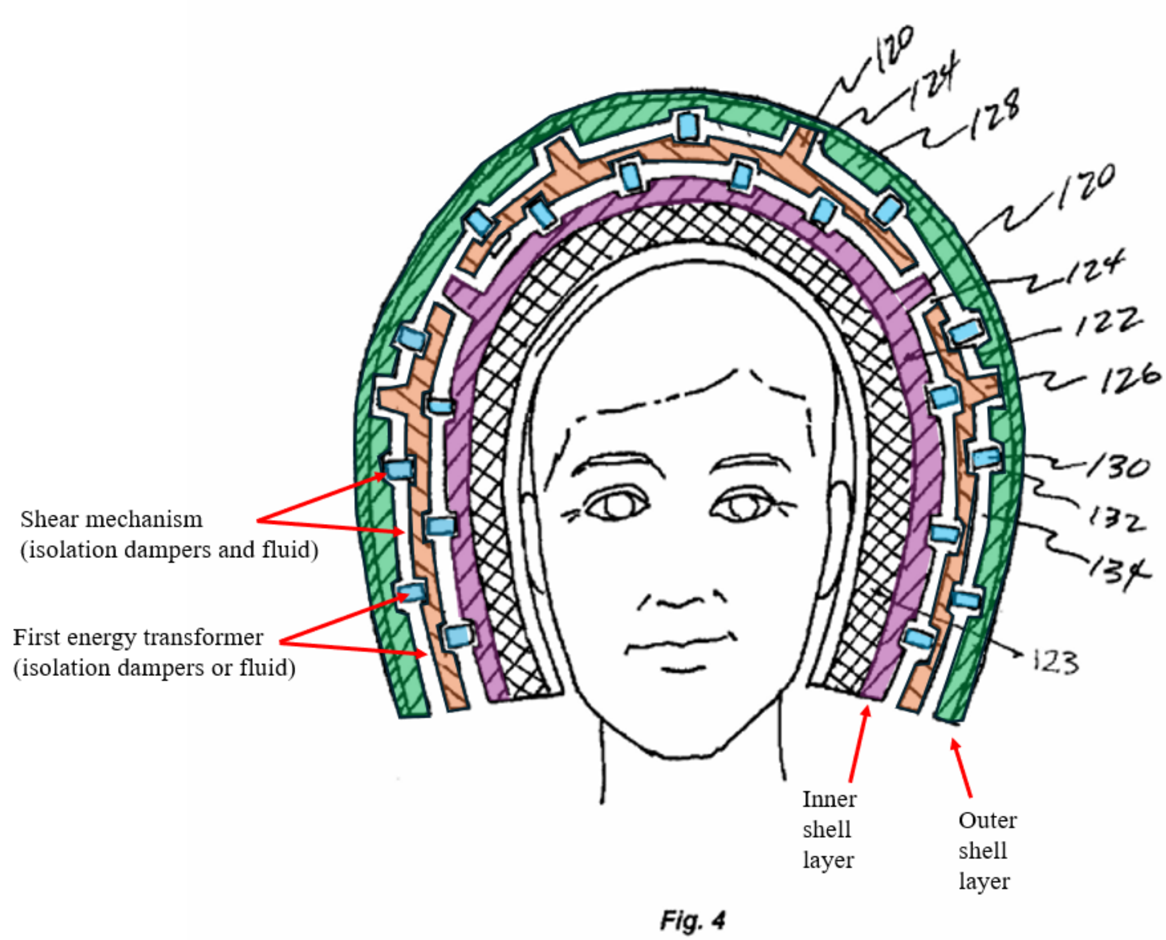
Weber discloses that the shear mechanism includes a first energy transformer having a first absorptive/dissipative material. The first energy transformer is a component that transforms energy, including Weber's outer **dampers 130** or air gap 134 with fluid as in Figure 4, or a single set of **dampers 108** or air gap 134 with fluid as in Figure 2. *Id.*, [0045]-[0046], [0039-41]. As Weber explains and Dr.

---

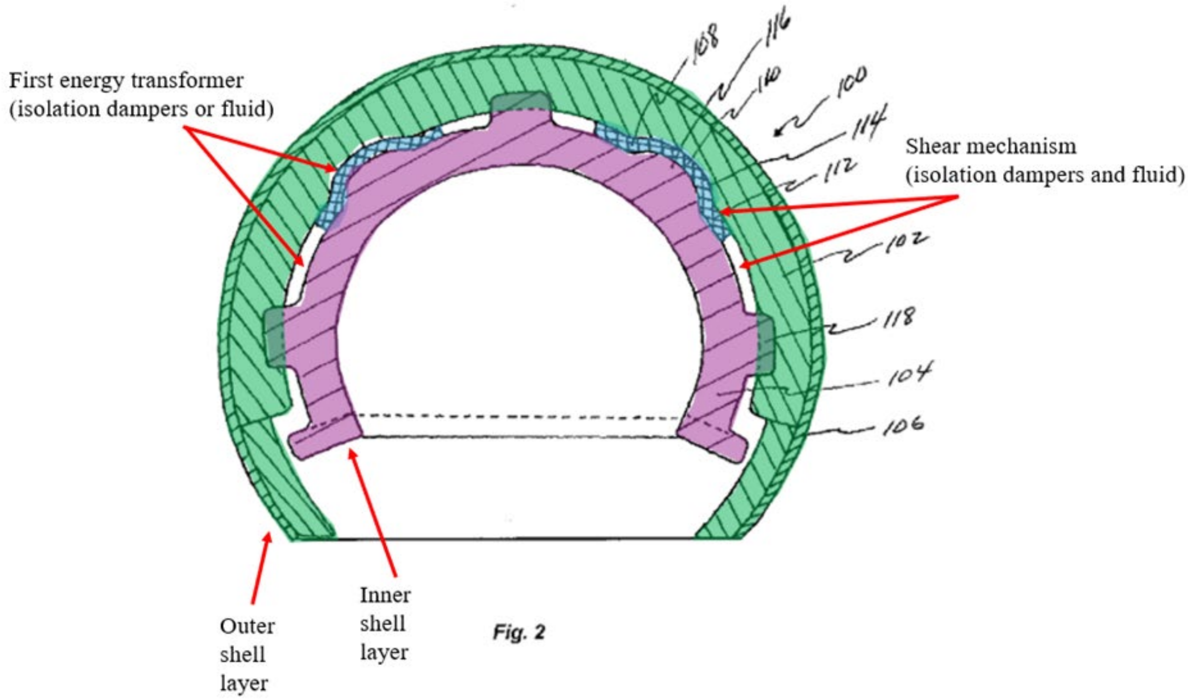
[10] Petitioner disagrees. U.S. Patent No. 9,516,909 (Ex.1050[USP909])—from the same family as the '635 Patent—also claims a "shear mechanism" in claim 1, but separately claims a helmet "***further comprising*** a middle protective shell" in dependent claim 11. The differentiation between "shear mechanism" and "middle protective shell" precludes reading the former as the latter. Ex.1002, ¶106.

[11] As discussed above, intermediate liner 126 made of, e.g., EPS, is a "shell." Ex.1004[Weber], [0045]; *see* n.5. Ex.1002, n.8.

Duma confirms, this air and dampers transform energy from impact force to movement and heat via fluid flow and mechanical deformation, respectively. *E.g.,* Ex.1004[Weber], [0034] ("[O]mnidirectional impact energy management systems…significantly reduce both rotational and linear forces generated from impacts."); *see* Ex.1001[USP635], 6:39-45 (fluids, gels, absorptive/dissipative materials).



Ex.1004[Weber], Fig. 4.



Ex.1004[Weber], Fig. 2. Ex.1002, ¶¶100, 108.

Further, Weber's isolation dampers and fluids are made of absorptive/dissipative materials. Weber describes, e.g., that isolation dampers 130/108 "further ***dissipate*** the energy of impacts," "***absorb*** the energy of impacts," and are made of elastomeric material. Ex.1004[Weber], [0045], [0046], [0040], [0044]. Weber describes isolation dampers made of "elastomeric materials, including MCU (micro-cellular urethane)," that "flex, bend, and/or compress to ***absorb*** the energy of impacts." Ex.1004[Weber], [0062], [0046]. Ex.1002, ¶108-109.

Weber's air gap further absorbs and/or dissipates impact energy as previously discussed through compression, displacement, and fluid flow, which results in generation of heat.[12] The '635 specification recognizes fluids and gels are absorptive/dissipative materials. Ex.1001[USP635], 6:43-45. Air is a type of fluid. Ex.1002, ¶110.

d) 1[c]: "the inner shell layer configured to conform to a human head;"

Weber discloses element 1[c]. For example, Weber's "inner liner" is "disposed in contact with the wearer's head, either directly or via a fitment or so-called 'comfort liner.'" Ex.1004[Weber], [0036], *see id.*, [0045], [0050]. The **inner liner 122** conforming to a human head is depicted in purple in Figures 2 and 4, reproduced below:

[12] 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, ¶105.

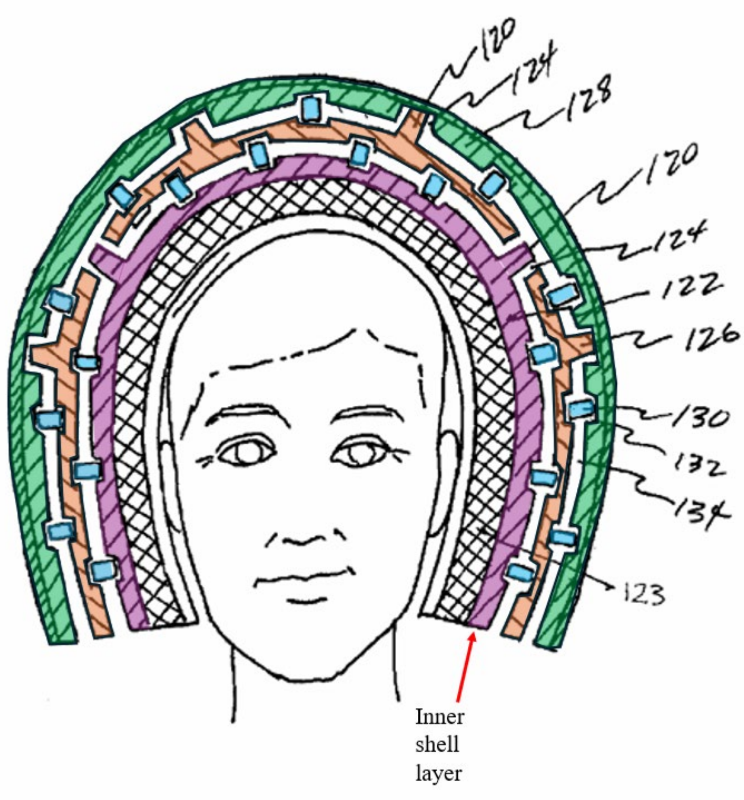


Fig. 4

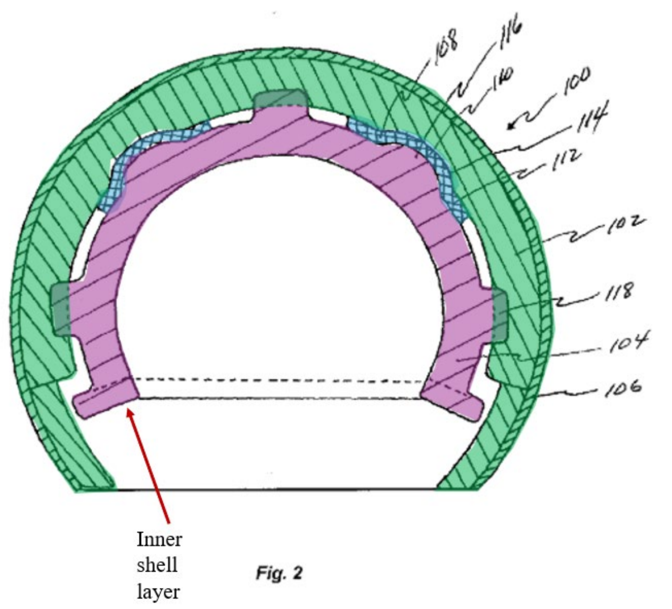


Fig. 2

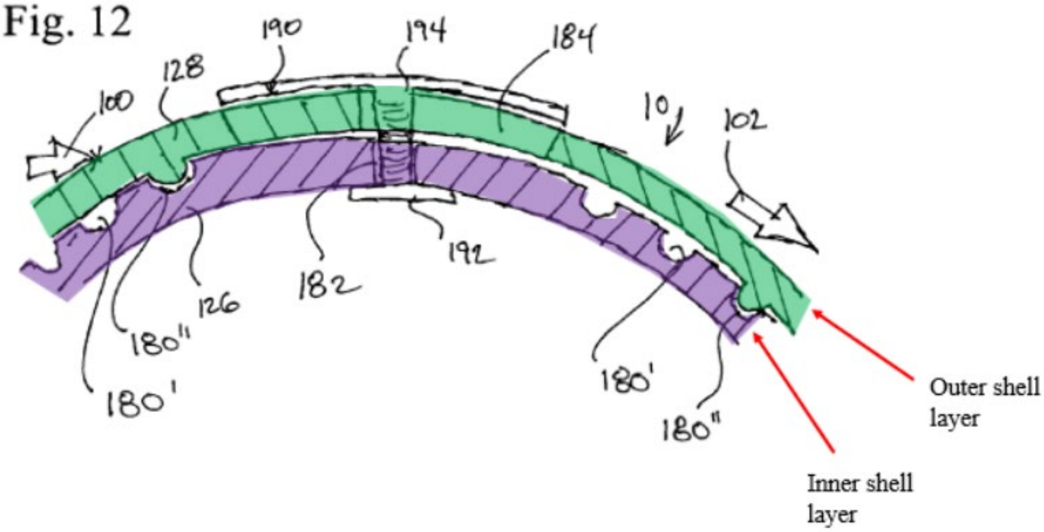
Ex.1004[Weber], Figs. 2, 4. Ex.1002, ¶111.

e) 1[d]: "a chin strap attached to the inner shell layer to maintain the position of the inner shell layer on the human head during rotational force impact while the outer shell layer is allowed to slide."

Weber combined with Puchalski renders obvious 1[d]. A POSA would have found it obvious to incorporate Puchalski's chin-strap location for 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]. However, Weber does not expressly disclose where it is attached to the helmet. Ex.1002, ¶112.

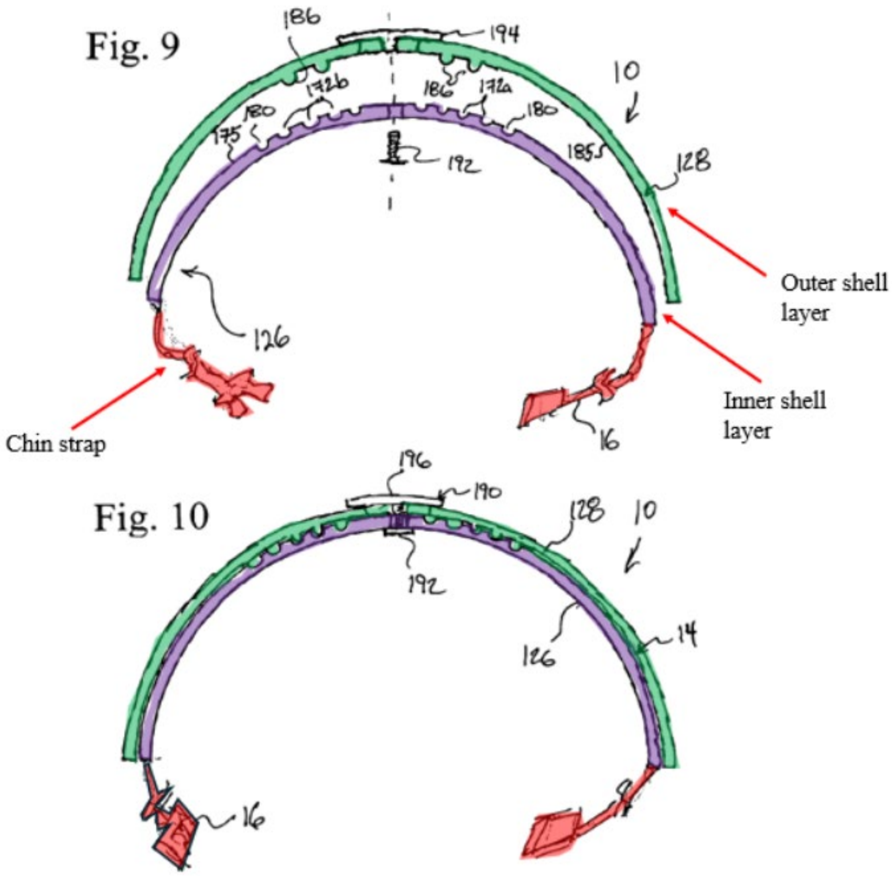
Similar to Weber, Puchalski discloses a helmet with a "two-part dome shaped shell 14" with "**separate and distinct inner dome-shaped panel 126** and an **outer dome-shaped panel 128**." Ex.1011[Puchalski] 11:36-39. Puchalski, like Weber, states, "upon the application of a predetermined minimum impact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

Fig. 12



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 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 that slides relative to an outer layer and that maintains its position relative to the wearer's head. Because the purpose of the chin-strap is for "[p]roper restraint on the wearer's head," placing it on the inner layer is an obvious design choice to ensure such attachment while allowing the outer layer to slide upon rotational impact, as Section X.A.2.c) discusses. *See* 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 an outer layer would move relative to the layer conforming to the head, 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 '635 Patent identifies no design challenge with such attachment. Ex.1001[USP635], 10:3-38. 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 is a shear layer."

Weber combined with Puchalski renders obvious claim 1. Section X.A.2. Weber further discloses the shear mechanism is a shear layer. As Section X.A.2.c) discusses, Weber's isolation dampers and fluid (e.g., air) are arranged in layers between the inner and outer liners. Ex.1004[Weber], [0046], [0049], Fig. 4. Ex.1002, ¶120.

Alternatively, Weber's intermediate layer and the aggregate distribution of the dampers, in conjunction with the surrounding air gaps is a shear layer. Ex.1004[Weber], [0045-46], Fig. 4. Ex.1002, ¶120.

Thus, Weber combined with Puchalski renders claim 2 obvious. Ex.1002, ¶121.

4. Claim 3

a) "The helmet of claim 2, wherein the shear layer is connected to the outer shell layer through the first energy transformer, the first energy transformer operable to absorb energy from forces imparted onto the outer shell layer, wherein the first energy transformer includes a first absorptive/dissipative material to allow the outer shell layer to slide relative to the inner shell layer."

Weber combined with Puchalski renders obvious claim 2. Section X.A.3. Weber's shear layer (Section X.A.3) is connected to the outer shell layer (i.e., outer liner) through the first energy transformer (i.e., outer dampers or outer air gap with fluid). *See* Sections X.A.2-X.A.3; Ex.1004[Weber] [0036], [0046], [0049]-[0050], Fig. 4. Weber's first energy transformer (e.g., outer dampers or air gap with fluid) includes a first absorptive/dissipative material to allow the outer shell layer to slide relative to the inner shell layer as Section X.A.2.c) discusses. Ex.1004[Weber] [0045], [0046], [0050]; Ex.1002, ¶122-130.

Thus, Weber combined with Puchalski renders claim 3 obvious. Ex.1002, ¶131.

5. Claim 4

a) "The helmet of claim 3, wherein the inner shell layer is connected to the shear layer, the inner shell layer configured to conform to a human head, the inner shell layer associated with a second energy transformer, the second energy

transformer including a second absorptive/dissipative material, the second energy transformer operable to absorb energy from forces imparted onto the shear layer through the outer shell layer and the first energy transformer."

Weber combined with Puchalski renders obvious claim 3. Section X.A.4. As discussed, Weber's inner shell layer (i.e., inner liner), configured to conform to a human head, is connected to the shear layer (Section X.A.3) through the second energy transformer (the inner dampers or fluid), which is thereby associated with the inner shell layer. Sections X.A.2-X.A.3; Ex.1004[Weber] [0036], [0046], [0062]. Weber's second energy transformer, whether it is the inner dampers or fluid, also includes a second absorptive/dissipative material to absorb energy from forces imparted onto the shear layer through the outer shell layer and the first energy transformer as Section X.A.2 discusses. Ex.1004[Weber] [0045-46], [0049-50]. Weber discloses its helmet has "controlled, omnidirectional relative movement" that reduces forces "originating from the hard outer shell of the helmet ***to the head and brain of a wearer***." Ex.1004[Weber], [0037], *id.* [0008] (helmet to "reduce" impact transferred to brain). Thus, it discloses some forces originating from the outer shell pass through the first layer of dampers/air to be further absorbed/dissipated by the second layer of dampers/air. Ex.1002, ¶¶132-133.

Thus, Weber combined with Puchalski renders claim 4 obvious. Ex.1002, ¶134.

6. Claim 6

a) "The helmet of claim 1, wherein the first absorptive/dissipative material comprises a fluid."

Weber combined with Puchalski renders obvious claim 1. Section X.A.2. As Section X.A.2 discusses, Weber discloses first absorptive/dissipative material comprises a fluid. Ex.1004[Weber], [0049]; Ex.1002, ¶135.

Thus, Weber combined with Puchalski renders claim 6 obvious. Ex.1002, ¶136.

7. Claim 8

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

Weber combined with Puchalski renders obvious claim 1. Section X.A.2. Weber discloses its "inner liner" (inner shell layer) coupled at its inner surface to "**'comfort' liner 123** configured to closely surround the head of the wearer…." Ex.1004[Weber], [0045], *see id.*, [0036], [0050].

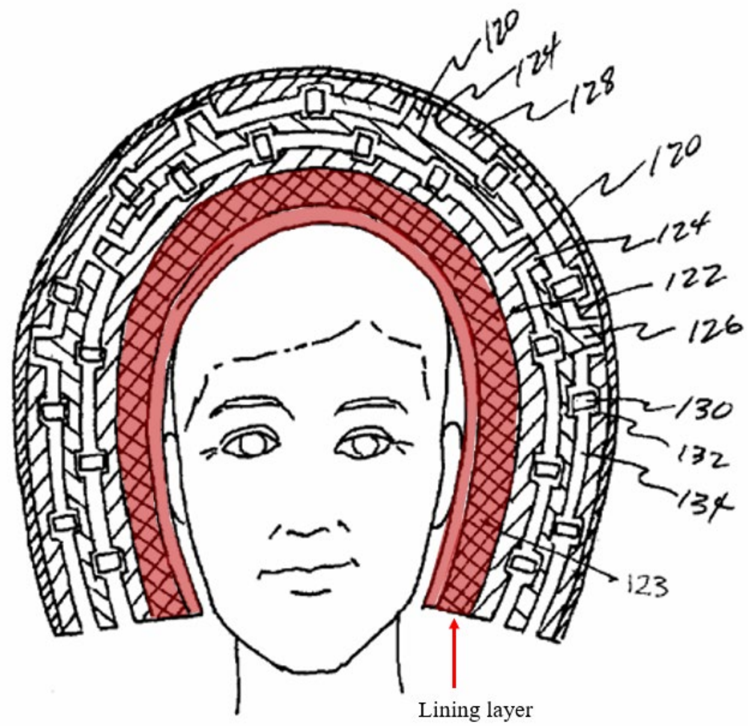


Fig. 4

Ex.1004[Weber], Fig. 4. Ex.1002, ¶137.

Thus, Weber combined with Puchalski renders claim 8 obvious. Ex.1002, ¶138.

8. Claim 9

a) 9[preamble]: "Protective gear comprising:"

9[a]: "an outer shell layer;"

9[b]: "an inner conforming layer connected to the outer shell layer through a shear mechanism allowing the outer shell layer to slide relative to the inner conforming layer, wherein the shear mechanism includes a first energy transformer having a first absorptive/dissipative material,"

9[c] "the inner conforming layer configured to conform to a human head;"

9[d]: "a chin strap attached to the inner conforming layer to maintain the position of the inner conforming layer on the human head during rotational force impact while the outer shell layer is allowed to slide."

Weber combined with Puchalski renders claim 9 obvious for the same reasons as claim 1. Section X.A.2. Claim 9 differs in two respects taught by the combination. First, Weber's helmets are "[p]rotective gear." Ex.1001[USP635], 1:30. Second, Weber's inner liner is an "inner shell layer" and also an "inner conforming layer" as it is a layer that conforms to the user's head. Ex.1004[Weber], [0036], *see id.*, [0045], [0050]; Section X.A.2.c)-X.A.2.d). Ex.1002, ¶¶139-144.

9. Claim 10

a) "The protective gear of claim 9, wherein the shear mechanism is a shear layer."

Weber combined with Puchalski renders obvious claim 9. Section X.A.8. The combination renders claim 10 obvious for the same reasons as claim 2. Section X.A.3. ¶¶145-146.

10. Claim 11

a) "The protective gear of claim 10, wherein the shear layer is connected to the outer shell layer through the first energy transformer, the first energy transformer operable to absorb energy from forces imparted onto the outer shell layer, wherein the first energy transformer includes a first absorptive/dissipative material to allow the outer shell layer to slide relative to the inner conforming layer."

Weber combined with Puchalski renders obvious claim 10. Section X.A.9. The combination renders claim 11 obvious for the same reasons as claim 3. Section X.A.4. ¶¶147-148.

11. Claim 12

a) "The protective gear of claim 11, wherein the inner conforming layer is connected to the shear layer, the inner conforming layer configured to conform to a human head, the inner conforming layer associated with a second energy transformer, the second energy transformer including a second absorptive/dissipative material, the second energy transformer operable to absorb energy from forces imparted onto the shear layer through the outer shell layer and the first energy transformer."

Weber combined with Puchalski render obvious claim 11. Section X.A.10. The combination renders claim 12 obvious for the same reasons as claim 4. Section X.A.5. Ex.1002, ¶¶149-150.

12. Claim 14

a) "The protective gear of claim 9, wherein the first absorptive/dissipative material comprises a fluid."

Weber combined with Puchalski renders obvious claim 9. Section X.A.8. The combination renders claim 14 obvious for the same reasons as claim 6. Section X.A.12. Ex.1002, ¶¶151-152.

13. Claim 16

a) "The protective gear of claim 9, wherein the inner conforming layer is associated with a lining material configured to conform to a human head."

Weber combined with Puchalski renders obvious claim 9. Section X.A.8. The combination renders claim 16 obvious for the same reasons as claim 8. Section X.A.7. Ex.1002, ¶153-154.

14. Claim 17

a) 17[preamble]: "A helmet comprising:"

17[a]: "an outer shell layer;"

17[b]: "an inner conforming layer connected to the outer shell layer through a shear mechanism allowing the outer shell layer to slide relative to the inner conforming layer, wherein the shear mechanism includes a first energy transformer having a first absorptive/dissipative material,"

17[c] "the inner conforming layer configured to conform to a human head;"

17[d]: "a chin strap attached to the inner conforming layer to maintain the position of the inner conforming layer on the human head during rotational force impact while the outer shell layer is allowed to slide."

Weber combined with Puchalski renders claim 17 obvious for the same reasons as claim 9 and claim 1. Sections X.A.8, X.A.2. Ex.1002, ¶¶155-160.

15. Claim 18

a) "The helmet of claim 17, wherein the shear mechanism is a shear layer."

Weber combined with Puchalski renders obvious claim 17. Section X.A.14. The combination renders claim 18 obvious for the same reasons as claim 2. Section X.A.3. Ex.1002, ¶¶161-162.

16. Claim 19

a) "The helmet of claim 18, wherein the shear layer is connected to the outer shell layer through the first energy transformer, the first energy transformer operable to absorb energy from forces imparted onto the outer shell layer, wherein the first energy transformer includes a first absorptive/dissipative material to allow the outer shell layer to slide relative to the inner conforming layer."

Weber combined with Puchalski renders obvious claim 18. Section X.A.15. The combination renders claim 19 obvious for the same reasons as claims 3 and 11. Section X.A.4, X.A.10. Ex.1002, ¶¶163-164.

17. Claim 20

a) "The helmet of claim 19, wherein the inner conforming layer is connected to the shear layer, the inner conforming layer configured to conform to a human head, the inner conforming layer associated with a second energy transformer, the second energy transformer including a second absorptive/dissipative material, the second energy transformer operable to absorb energy from forces imparted onto the shear layer through the outer shell layer and the first energy transformer."

Weber combined with Puchalski renders obvious claim 19. Section X.A.16. The combination renders claim 20 obvious for the same reasons as claims 4 and 12. Section X.A.5, X.A.11. Ex.1002, ¶¶165-166.

B. Ground 2: Claims 1-4, 6, 8-12, 14, and 16-20 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]).

Halldin	*Halldin Provisional*
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, ¶167-168.

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

Halldin	*Halldin Provisional*

7. A method of manufacturing a helmet comprising a sliding facilitator, the method comprising the steps of:	Claim 9 [0008], [0011], [0014], [0041]
providing an energy absorbing layer in a mould, and	
providing a sliding facilitator in relation to the energy absorbing layer.	

Ex.1002, ¶169.

2. Claim 1

a) 1[preamble]: "A helmet comprising:"

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

1 /3

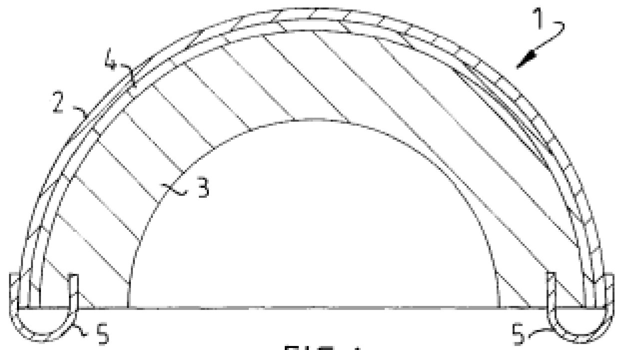


FIG.1

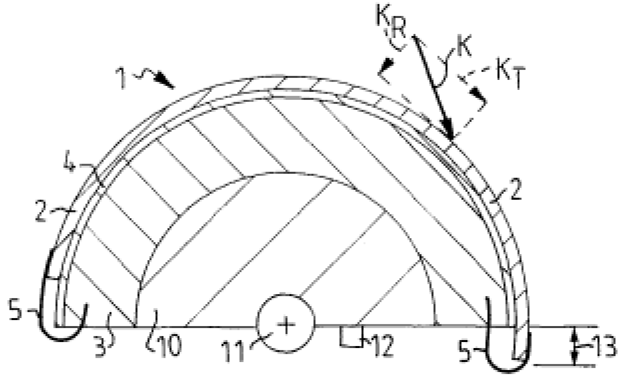


FIG.2

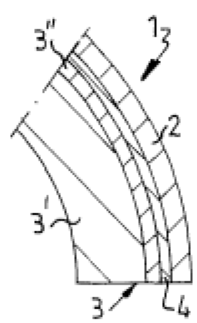


FIG.3a

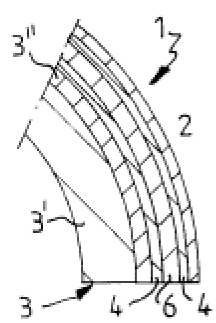


FIG.3b

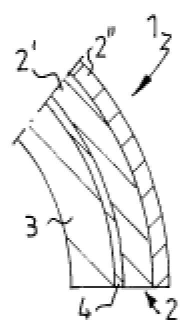


FIG.3c

Ex.1005[Von Holst], 3:22-30, 4:10-14, Figs. 1-3, cls. 1-10. Ex.1002, ¶170.

b) 1[a]: "an outer shell layer;"

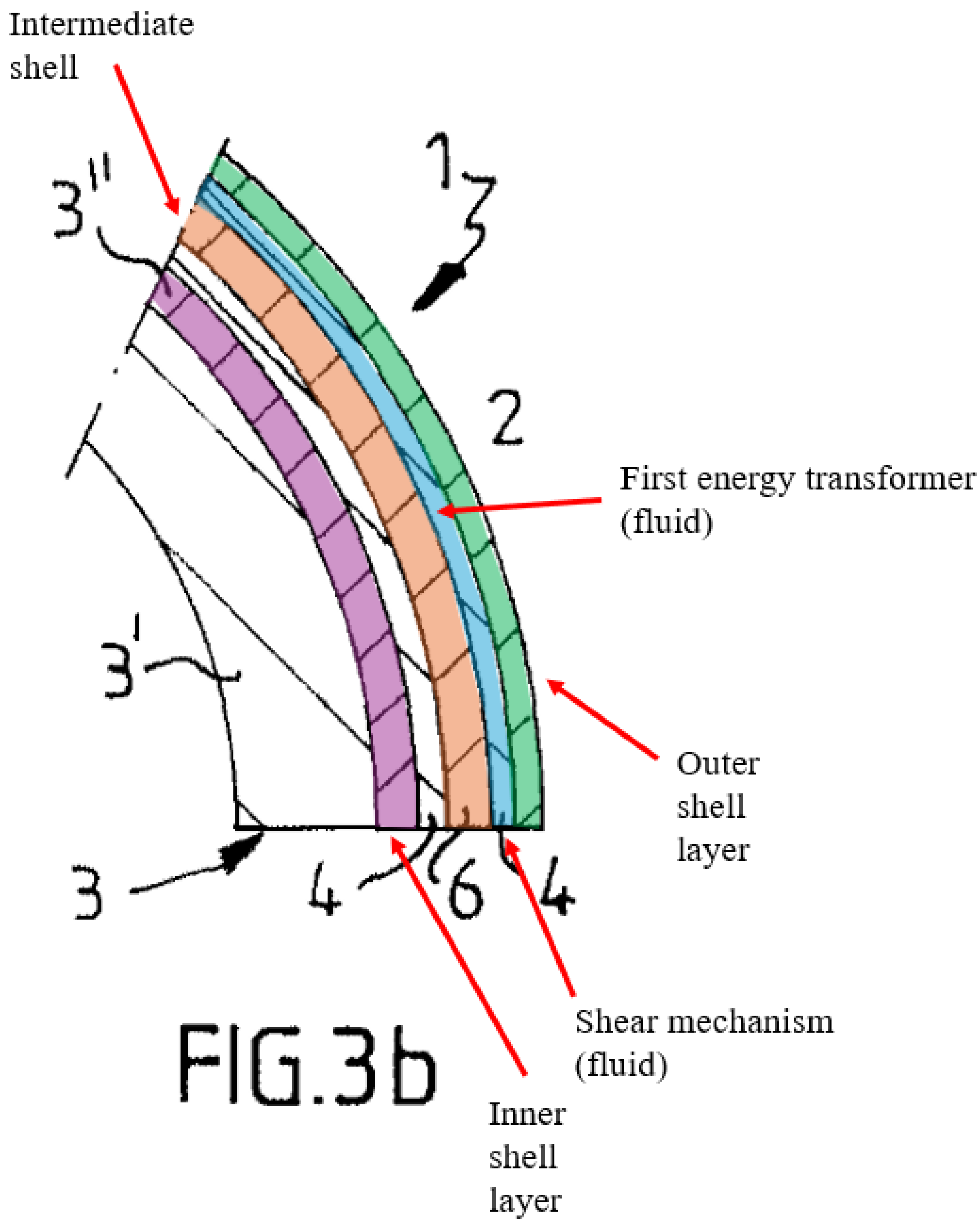
Von Holst discloses 1[a]. Von Holst discloses a helmet "constructed from an ***outer shell 2***…." Ex.1005[VonHolst], 4:10-12, Figs. 1-3, cl. 1. Ex.1002, ¶171.

c) 1[b]: "an inner shell layer connected to the outer shell layer through a shear mechanism allowing the outer shell layer to slide relative to the inner shell layer, wherein the shear mechanism includes a first energy transformer having a first absorptive/dissipative material,"

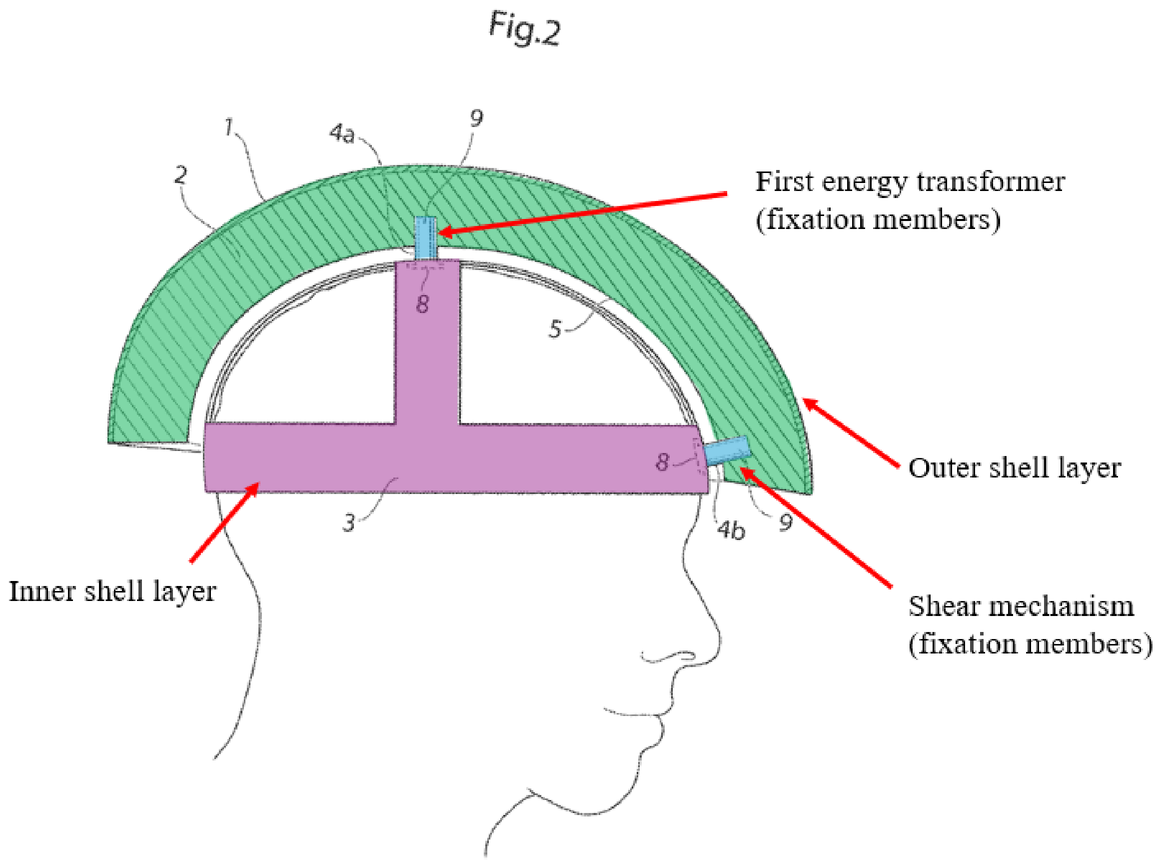
A helmet with Von Holst's sliding layers 4 modified to include Halldin's fixation members would have been obvious and teaches 1[b]. Von Holst discloses components connecting its **outer layer 3"** of inner shell 3 and **outer shell 2** that shear and allow these shells to slide relative to each other and transform energy from impact, including sliding layers 4. Ex.1005[VonHolst], 6:4-6, FIG. 3; *id.* claims. 1, 4. Halldin also discloses components that shear and 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. Ex.1002, ¶172-174.

Von Holst combined with Halldin discloses 1[b] in as much, if not more detail, as the '635 Patent. For example, to a POSA, the combination discloses at least a shear mechanism including inner and outer "**sliding layers 4**" ("between which there is an intermediate shell 6") from Von Holst, and Halldin's **fixation members**, located between and connecting[13] Von Holst's **outer layer 3"** of inner shell 3 (inner shell layer) and **outer shell 2** (outer shell layer).

[13] As Ground 1 discusses, connection can be indirect. Ex.1002, ¶¶103, 177.



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



Ex.1006[Halldin], Fig. 2; *see id*., Fig. 3. Ex.1002, ¶¶175-176.

Von Holst's sliding layers of, e.g., oil or air (part of the shear mechanism), "facilitate[] mutual displacement" between the inner and outer shell "by sliding." Ex.1005[VonHolst], 8:12-14. Von Holst's outer sliding layer of oil or air includes a first energy transformer having an absorptive/dissipative material because it transforms energy by absorbing and dissipating it via sliding and through the creation of heat from friction when the outer shell layer is allowed to slide relative to its inner shell layer. Ex.1005[VonHolst], Abstract, 4:15-17, 4:32-34, 6:8-10, 6:35-7:10, 7:38-8:2 (describing friction), Figs. 4-6, cls. 1, 4; *see* 5:21-34 (25% reduction in force with oil film). Oil and air are both fluids, which the '635 Patent recognizes as absorptive/dissipative material. Ex.1001[USP635], 6:43-45. Ex.1002, ¶177.

Halldin's fixation members incorporated into Von Holst's sliding layers are also part of the shear mechanism. Halldin shares an inventor with Von Holst and teaches fixation members that transform energy by "deform[ing]" and shearing and that allow relative sliding between the outer and inner layers. Ex.1006[Halldin], [0013], [0047-48]. The fixation members incorporated into Von Holst's outer sliding layer 4 are also a first energy transformer having an absorptive/dissipative material. Halldin teaches fixation members 4a-4d that "***absorb energy*** by deforming…." Ex.1006[Halldin], [0043], Figs. 2-3, [0047]. These fixation members further absorb and dissipate energy via allowing mechanical deformation and relative sliding as discussed above. Ex.1006[Halldin], [0013], [0043], [0047-48]. Ex.1002, ¶178.

Alternatively, to the extent PO argues the claimed "shear mechanism" requires a middle shell/liner, Von Holst discloses intermediate shell 6, which together with the material of sliding layers 4 (oil or air) modified with Halldin's fixation members between middle and outer shells, allows relative sliding between the outer and inner shells. Ex.1005[VonHolst], 4:32-34; *see* Ex.1006[Halldin], [0043]. Ex.1002, ¶179.

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 peripheral connecting member 5, the later-filed Halldin discloses additional ways to connect layers while maintaining desired sliding to address impact forces, including internal connections (*i.e.*, members 4a-d). A POSA would have been motivated to use these internal fixation members to replace or supplement peripheral connecting member 5 because 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, s*ee* Ex.1006[Halldin], [0043], which would supplement energy absorption from Von Holst's sliding layers 4. 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 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, ¶180-181.

A POSA would have a reasonable expectation of successfully modifying Von Holst. 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. Ex.1006[Halldin], [0044]. Halldin's fixation members are not exclusive to its embodiments, and a POSA would have readily adapted them to other designs, *e.g.*, Von Holst's helmets, as a matter of routine implementation: "the attachment device 3 could be … any other design functioning as an attachment device for mounting on a wearer's head." 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, ¶182.

d) 1[c] "the inner shell layer configured to conform to a human head;"

Von Holst combined with Halldin teaches element 1[c]. Von Holst's "inner shell 3 is intended for contact with the head of the wearer…." Ex.1005[VonHolst], 9:13-15, 5:39-6:1, 4:26-29. Both outer layer 3" and soft layer 3' are designed to conform to a human head as Figure 3b shows. *See* Figs. 1-3, Ex.1005[VonHolst], 6:18-28. Ex.1002, ¶183.

e) 1[d]: "a chin strap attached to the inner shell layer to maintain the position of the inner shell layer on the human head during rotational force impact while the outer shell layer is allowed to slide."

Von Holst combined with Puchalski teaches 1[e]. As discussed in Section X.A.2.e), 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 Puchalski's chin-straps to the periphery of the inner shell of Von Holst. Ex.1002, ¶184.

A POSA would have been motivated to incorporate Puchalski's chin-strap and location into Von Holst's helmet. Von Holst and Puchalski are analogous art to the challenged claims directed to the same problem of reducing rotational impact via multiple sliding layers. *See* Section VIII. Ex.1002, ¶185.

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 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[b]. Section X.B.2.c). Ex.1002, ¶186.

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 or liners, and there are only up to three possible layers: the inner, intermediate, or outer layers. 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 shell layer of Kleiven'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.2.e). Ex.1002, ¶187.

Thus, Von Holst combined with Puchalski renders claim 1 obvious. Ex.1002, ¶188.

3. Claim 2[14]

Von Holst combined with Halldin and Puchalski renders claim 1 obvious. Section X.B.1, and also teaches "shear mechanism is a shear layer." Section X.B.2.c)) (Halldin's fixation members in Von Holst's sliding ***layer*** 4 span the layer and so does the oil/air). Ex.1006[Halldin], [0047-48], Figs. 3-4; Ex.1005[VonHolst], 4:10-21, 6:2-6, Figs. 1-3. Ex.1002, ¶189.

Thus, Von Holst combined with Halldin and Puchalski renders claim 2 obvious. Ex.1002, ¶190.

4. Claim 3

Von Holst combined with Halldin and Puchalski renders claim 2 obvious. Section X.B.3. As discussed, Von Holst's and Halldin's shear layer (sliding layer of oil or air with fixation members) is "connected to the outer shell layer through the first energy transformer" (*i.e.*, the outer layer of fluids or outer layer of fixation members). Section X.B.2-X.B.3; Ex.1005[VonHolst] 6:2-6, Fig. 3b; *see id.*, cls. 1, 4; Ex.1006[Halldin], [0013], [0047-48]. The outer layer of oil/air and fixation members are "absorptive/dissipative material[s]" connecting the shell layers that "absorb energy from forces imparted on the outer shell layer" and "allow the outer

---

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

shell layer to slide relative to the inner shell layer." Section X.B.2. Ex.1005[VonHolst], 6:2-6, Fig. 3b; *see id.*, cls. 1, 4. Ex.1002, ¶191-192.

Thus, Von Holst combined with Halldin and Puchalski renders claim 3 obvious. Ex.1002, ¶193.

5. Claim 4

Von Holst combined with Halldin and Puchalski renders claim 3 obvious. Section X.B.44. The combination teaches claim 4's additional limitations. Von Holst's inner shell layer, "configured to conform to a human head," is "connected to the shear layer" and outer shell layer as Sections X.A.2.c)-X.B.2.c) discuss, through inner sliding layer 4 or Halldin's fixation members (second energy transformer) "associated with" the inner shell layer. Ex.1005[VonHolst], 5:38-6:6, Fig. 3b; Section X.A.2.c) ('635 Patent includes indirect connection). The "second energy transformer (sliding layer or fixation members) include[es] a second absorptive/dissipative material" in the inner sliding layer 4 comprising oil or air and fixation members, and is "operable to absorb energy from forces imparted onto the shear layer through the outer shell layer and first energy transformer." *See* Section X.B.2; Ex.1005[VonHolst], 4:10-21, 4:32-36, 5:21-34, 6:2-6, Fig. 1-3. At least some force imparted onto an outer shell layer would travel through outer sliding layer 4 to the second energy transformer, which would absorb energy in the same way as the first energy transformer. Ex.1005[VonHolst], 4:32-36, 5:21-34. Ex.1002, ¶¶194-195.

Thus, Von Holst combined with Halldin and Puchalski renders claim 4 obvious. Ex.1002, ¶196.

6. Claim 6

Von Holst combined with Halldin and Puchalski renders claim 1 obvious. Section X.B.2. Von Holst further discloses "wherein the first absorptive/dissipative material comprises a fluid." Von Holst's sliding layers 4 can comprise "oil" or "air" which are fluids. Ex.1005[VonHolst], 4:32-34. Ex.1002, ¶197.

Thus, Von Holst combined with Puchalski renders claim 6 obvious. Ex.1002, ¶198.

7. Claim 8

Von Holst combined with Halldin and Puchalski renders claim 1 obvious. Section X.B.1. Von Holst further discloses "a lining layer" "connected to the inner shell layer" in Figures 3a-b: "inner shell 3 is constructed from a harder, relatively thin outer layer 3" and a softer, relatively thick inner layer 3'." Ex.1005[VonHolst], 5:39-6:4. Von Holst's inner layer 3' is configured to conform to a human head: "[I]nner 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. Ex.1002, ¶199.

Thus, Von Holst combined with Halldin and Puchalski renders claim 8 obvious. Ex.1002, ¶200.

8. Claim 9

Von Holst combined with Halldin and Puchalski renders claim 9 obvious for the same reasons as claim 1. Section X.B.2. Claim 9 differs in two respects taught by the combination. First, Von Holst's helmets are "protective gear." Ex.1001[USP635], 1:30. Second, Von Holst's inner layer 3" is an "inner shell layer" and also an "inner conforming layer" as it is a layer that conforms to the user's head. *See* Ex.1005[VonHolst], 6:18-28, Figs. 1-3; Sections X.B.2.c)-X.B.2.d). Ex.1002, ¶¶201-206.

9. Claim 10

Von Holst combined with Halldin and Puchalski render obvious claim 9. Section X.B.8. The combination renders claim 10 obvious for the same reasons as claim 2. Section X.B.3. Ex.1002, ¶¶207-208.

10. Claim 11

Von Holst combined with Halldin and Puchalski renders claim 10 obvious. Section X.B.9. The combination renders claim 11 obvious for the same reasons as claim 3. Section X.B.4. Ex.1002, ¶¶209-210.

11. Claim 12

Von Holst combined with Halldin and Puchalski render obvious claim 11. Section X.B.10. The combination renders claim 12 obvious for the same reasons as claim 4. Section X.B.5. Ex.1002, ¶¶211-212.

12. Claim 14

Von Holst combined with Halldin and Puchalski render obvious claim 9. Section X.B.8. The combination renders claim 14 obvious for the same reasons as claim 6. Section X.B.6. Ex.1002, ¶¶213-214.

13. Claim 16

Von Holst combined with Halldin and Puchalski renders claim 9 obvious. Section X.B.8. The combination renders claim 16 obvious for the same reasons as claim 8. Section X.B.7. Ex.1002, ¶¶215-216.

14. Claim 17

Von Holst combined with Halldin and Puchalski renders claim 17 obvious for the same reasons as claims 9 and 1. Sections X.B.8, X.B.2. Ex.1002, ¶¶217-222.

15. Claim 18

Von Holst combined with Halldin and Puchalski render obvious claim 17. Section X.B.14. The combination renders claim 18 obvious for the same reasons as claims 2 and 10. Sections X.B.3, X.B.9. Ex.1002, ¶¶223-224.

16. Claim 19

Von Holst combined with Halldin and Puchalski renders claim 18 obvious. Section X.B.15. The combination renders claim 19 obvious for the same reasons as claims 3 and 11. Sections X.B.4, X.B.10. Ex.1002, ¶¶225-226.

17. Claim 20

Von Holst combined with Halldin and Puchalski renders claim 19 obvious. Section X.B.16. The combination renders claim 20 obvious for the same reasons as claims 4 and 12. Sections X.B.5, X.B.11. Ex.1002, ¶¶227-228.

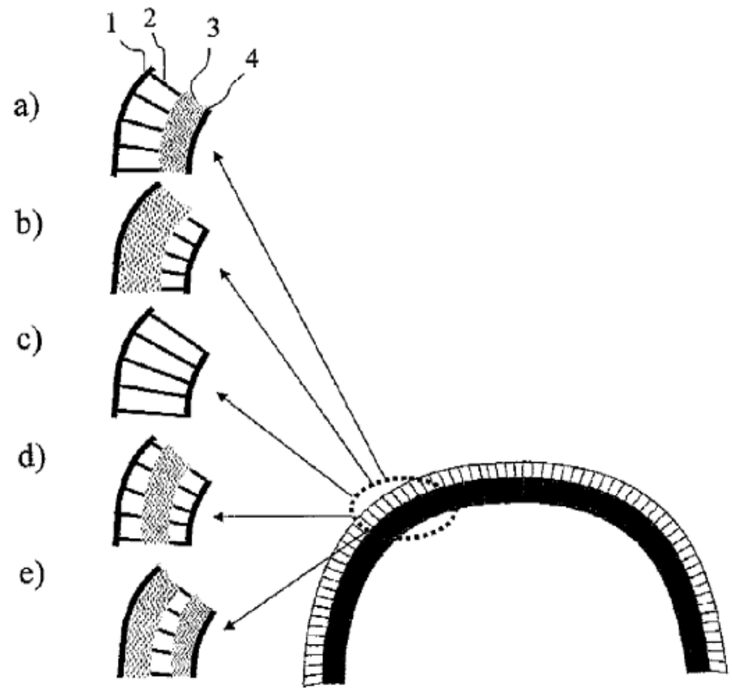
C. Ground 3: Claims 1-4, 6, 8-12, 14, and 16-20 are Obvious over Kleiven Combined with Puchalski

1. Claim 1

a) 1[preamble]: "A helmet comprising:"

Kleiven discloses "a ***helmet***."

Fig. 2.

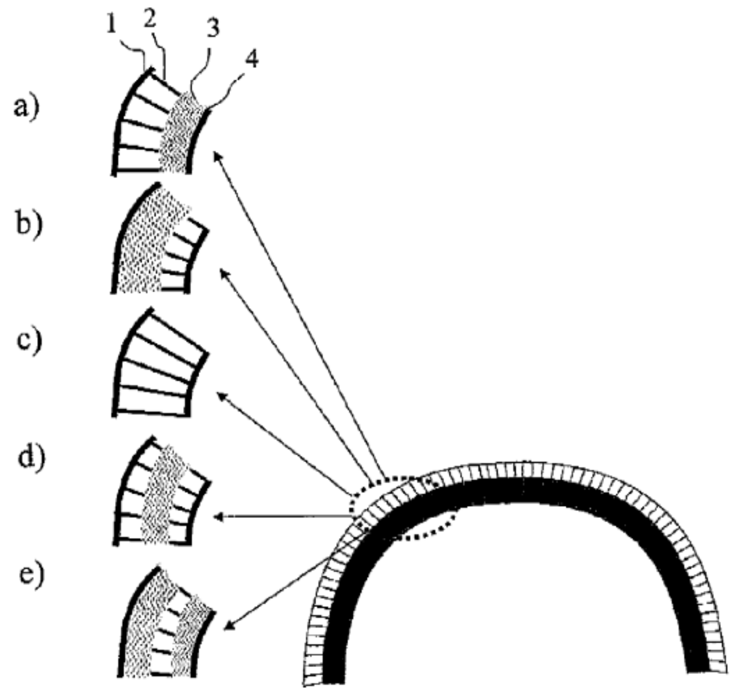


Ex.1007[Kleiven], [0031], Fig. 2. Ex.1002, ¶229.

b) 1[a]: "an outer shell layer;"

Kleiven discloses 1[a]. Kleiven Figure 2 includes, as a "layer[]," an "outer … shell" 1.

Fig. 2.



Ex.1007[Kleiven], [0031], Fig. 2. Ex.1002, ¶230.

c) 1[b]: "an inner shell layer connected to the outer shell layer through a shear mechanism allowing the outer shell layer to slide relative to the inner shell layer, wherein the shear mechanism includes a first energy transformer having a first absorptive/dissipative material,"

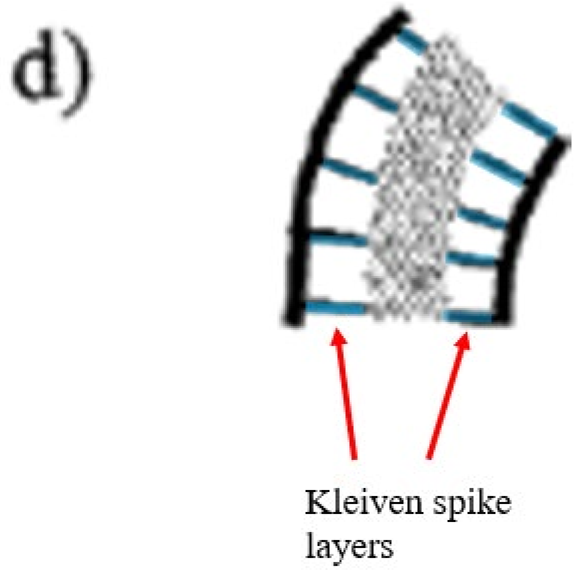
Kleiven discloses element 1[b]. Kleiven's "inner shell" 4, also described as a "layer[]," is an inner shell layer." Ex.1007[Kleiven], [0031]. Ex.1002, ¶¶231-232.

Kleiven discloses inner and outer shell layers connected through a shear mechanism, which includes a first energy transformer. Kleiven discloses components between its outer and inner shells that shear and allow relative sliding between the shells and to transform energy from impact. These components includes spikes/beams and fluid/air compartments, which connect Kleiven's inner and outer shells.[15] Thus, as exemplified below, Kleiven discloses the claimed shear mechanism and first energy transformer. Ex.1007[Kleiven], [0039-41], [0048], [0062], [0020], [0002]. Ex.1002, ¶233-234.

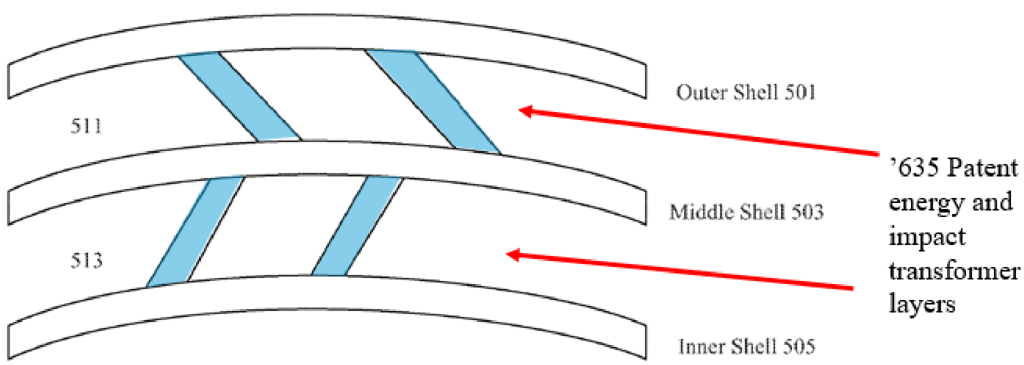
Kleiven discloses 1[b] in as much, if not more detail, as the ’635 patent. For example, to a POSA, Kleiven discloses a shear mechanism, which are at least the components that shear including spikes/beams and/or fluid/air compartments and allow the outer shell layer to slide relative to the inner shell layer. Ex.1002, ¶¶233-234.

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 layers 511 and 513 of Figure 5 of the ’635 Patent, Kleiven's spike layers are a "shear truss-like structure connecting" layers that "dampen[s] any force or impact" and allow the layers to "slide relative" to each other. Ex.1001[USP635], 6:29-45; *id.*, Fig. 5, 9:25-33 ("elastomeric trusses").

[15] As Ground 1 discusses, connection can be indirect. Ex.1002, ¶¶103, 233.



Ex.1007[Kleiven], Fig. 2.



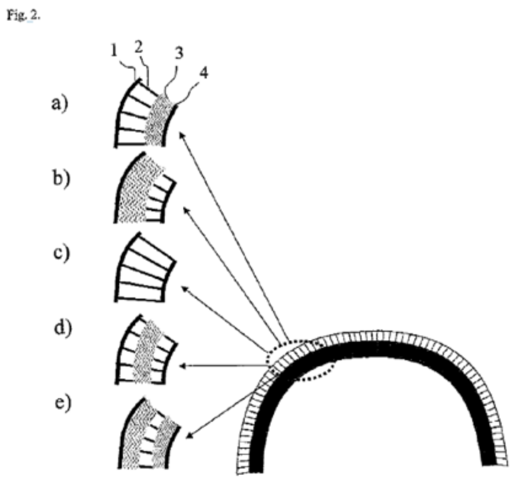
Ex.1001[USP635], Fig. 5; *see* Ex.1013[Knight-162-FH], 147 (elastomeric trusses in Figure 5). Ex.1002, ¶234-235.

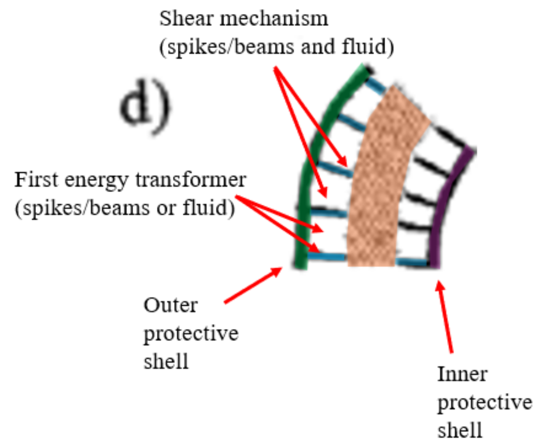
As another example, Kleiven discloses fluid compartments between spikes filled with fluid (*e.g.*, air) that also shear and allow the outer shell to slide relative to the inner shell layer and transform energy. Ex.1007[Kleiven], [0039-41] ("fluid/air layer ***shears***"), [0047], Figs.10-12; Ex.1001[USP635], 6:29-45. Ex.1002, ¶236.

Alternatively, if Patent Owner argues the claimed "shear mechanism" requires a middle shell/layer, Kleiven further discloses an energy absorbing middle layer[16] associated with inner and outer layers of spikes/beams and fluid/air compartments. The components between Kleiven's outer and inner shells—the middle layer, outer/inner spikes/beams and fluid/air compartments, collectively shear and allow relative sliding of the inner and outer shells. Ex.1007[Kleiven], [0047-48], [0062], Fig. 2. Ex.1002, ¶237.

Kleiven also discloses that the shear mechanism includes a first energy transformer having a first absorptive/dissipative material. The first energy transformer is a component that transforms energy, including Kleiven's outer spike/beam layer or fluid/air compartments (Figure 2d), or a single layer of spikes/beams or fluid/air compartments (Figures 2a-c).

[16] Kleiven's middle foam layer made of, *e.g.*, "expanded polystyrene and expanded polypropylene," is a middle shell. Ex.1007[Kleiven], [0048]; Section X.A.2.b). Ex.1002, ¶237.





Ex.1007[Kleiven], Fig. 2. Ex.1002, ¶¶233, 236.

As Kleiven explains, and Dr. Duma confirms, these layers transform energy from impact force to movement and heat. Kleiven's spikes are "flexible, plasticizing, yielding or frangible in order to ***absorb/reduce the force*** of an impact" via their mechanical deformation. Ex.1007[Kleiven], [0048], [0062], [0020], [0002]. These have absorptive/dissipative material further because they allow for relative sliding, which, as Dr. Duma explains, absorbs and dissipates energy through movement and heat. Ex.1002, ¶238.

Additionally, Kleiven's fluid/air compartments absorb and dissipate energy by compression, displacement, and fluid flow, which results in generation of heat. Ex.1007[Kleiven], [0039-41], [0062]; *see* Ex.1001[USP635], 6:39-45 (fluid/gel are absorptive/dissipative materials). Ex.1002, ¶¶239-241.

d) 1[c] "the inner shell layer configured to conform to a human head;"

Kleiven discloses element 1[c]. For example, Kleiven's inner shell layer is shaped to conform to a human head as Fig. 2 shows, and Fig. 3 further shows the inner layer compressing to shape around a head upon impact. Kleiven further recognizes inner shell layers generally conform to heads. Ex.1007[Kleiven], [0014] (earlier helmet designs "improve[] the capacity of the headgear to conform to the head"). *See* Section X.C.1.e). Ex.1002, ¶242.

e) 1[d]: "a chin strap attached to the inner shell layer to maintain the position of the inner shell layer on the human head during rotational force impact while the outer shell layer is allowed to slide."

Kleiven modified by Puchalski teaches 1[d]. As discussed in Section X.B.2.e), 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 Puchalski's chin-strap to the periphery of the inner shell of Kleiven. Ex.1002, ¶¶243-244.

A POSA would be motivated to incorporate Puchalski'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 VIII. Ex.1002, ¶245.

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 is an obvious design choice to ensure that the helmet stays attached by allowing the layer 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, ¶245.

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 or liners, and there are only up to three possible layers: the inner, intermediate, or outer layers. 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, ¶246.

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 shell layer of Kleiven'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, ¶247.

Thus, Kleiven combined with Puchalski renders claim 1 obvious. Ex.1002, ¶248.

2. Claim 2

Kleiven combined with Puchalski renders claim 1 obvious. Section X.C.1. Kleiven further discloses "the shear mechanism is a shear layer" of spikes/beams with fluid or air compartments arranged in layers between the inner and outer shell layer, as shown in Figures 2(a-d). Ex.1007[Kleiven], [0020], [0031], [0039-41], [0048], Figs. 1-2. Ex.1002, ¶249.

Alternatively, Kleiven's middle foam layer and the aggregate distribution of spikes and fluid/air compartments, as Figure 2d shows, is a shear layer. Ex.1007[Kleiven], [0031], Fig. 2. Ex.1002, ¶250.

Thus, Kleiven combined with Puchalski renders claim 2 obvious. Ex.1002, ¶251.

3. Claim 3

Kleiven combined with Puchalski renders claim 2 obvious. Section X.C.2. As discussed, Kleiven's shear layer 2 of spikes/beams and fluid/air compartments is "connected to the outer shell layer through the first energy transformer" (spikes/beams or fluid/air compartments) included in the shear layer. Sections X.C.1-X.C.2; Ex.1007[Kleiven], [0048], [0062], [0020], [0002], Fig. 2. Kleiven's first energy transformer also "includes a first absorptive/dissipative material to allow the outer shell layer to slide relative to the inner shell layer" as Section X.C.1. discusses. Ex.1002, ¶252.

Thus, Kleiven combined with Puchalski renders claim 3 obvious. Ex.1002, ¶253.

4. Claim 4

Kleiven combined with Puchalski renders obvious claim 3. Section X.C.3. As discussed, Kleiven discloses inner shell 4 is "connected to the shear layer," and that "the inner shell layer [is] configured to conform to a human head." Section X.C.1. As Figure 2(d) shows, Kleiven discloses that two layers of spikes/beams 2 would be used, and the inner layer 2 would also have spikes/beams and fluid/air compartments. Ex.1007[Kleiven], Fig.2, [0031], [0039]-[0040]. These inner spikes/beams and fluid/air compartments, each second energy transformers "associated with" the inner shell layer, are made of a "second absorptive/dissipative material operable to absorb energy from forces imparted onto the shear layer" as discussed. Kleiven recognizes some forces originating from the outer shell pass through the first spike layer to be further absorbed by the inner spike layer in Figure 2(d). Ex.1007[Kleiven], [0038], Fig. 9. *See* Section X.C.1, X.C.3. Ex.1002, ¶¶254-255.

Thus, Kleiven combined with Puchalski renders claim 4 obvious. Ex.1002, ¶256.

5. Claim 6

Kleiven combined with Puchalski renders claim 1 obvious. Section X.C.1. Kleiven renders obvious "the first absorptive/dissipative material comprises a fluid" for the same reasons as claim 1. *Id.* Ex.1002, ¶¶257-258.

6. Claim 8

Kleiven combined with Puchalski renders claim 1 obvious. Section X.C.1. Puchalski teaches that "padding or cushioning ["lining layer"] may also be provided along the inside of the shell for increased comfort, better fit and to assist in the absorption of any impact forces." Ex.1011[Puchalski], 1:52-55. Puchalski similarly describes "[a] helmet…includ[ing] a shell contoured to the shape of the user's head, with cushioning along at least part of the shell interior and a chinstrap." Ex.1011[Puchalski], Abstract; *id.*, cl. 9 ("The helmet of claim 1 further including impact absorbing cushioning secured to an inner surface of said shell, said cushioning being resiliently compressible so as to compress with any movement of said first portion relative to said second portion."). The cushioning connected to the inner surface of the shell is between the inner shell layer and the user's head and "configured to conform to a human head." Ex.1002, ¶259.

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 recognizes foam on a helmet's interior can "improve[] the capacity of the headgear to conform to the head," without specific details or application to its helmet. Ex.1007[Kleiven], [0014]. Puchalski provides those details, including that "strips of resiliently compressible foam cushioning" "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; *id.*, 1:52-55. A POSA would have been motivated to incorporate Puchalski's more-specific comfort liner to achieve increased comfort and additional 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 Kleiven's helmet is ready for improvement through incorporation of Puchalski's liner. This known technique of adding a user comfort layer would improve Kleiven's helmet in a similar way to Puchalski. A POSA would reasonably expect success using Puchalski's comfort liner in Kleiven's design. Kleiven generally discloses headgear can be configured to conform to the head and benefits of doing so, Ex.1007[Kleiven], [0014], without further implementation details. A POSA would have, as a matter of routine implementation, been able to configure Puchalski's comfort liner to fit into Kleiven's design, including because Puchalski's comfort liner is positioned under an inner layer similar to the one in Kleiven and Puchalski's comfort liner would easily fit into Kleiven's design. Ex.1002, ¶¶260-262.

Thus, Kleiven combined with Puchalski renders claim 8 obvious. Ex.1002, ¶¶260-262.

7. Claim 9

Kleiven combined with Puchalski renders claim 9 obvious for the same reasons as claim 1. Section X.C.1. Claim 9 differs in two respects taught by the combination. First, Kleiven's helmets are "protective gear." Ex.1001[USP635], 1:30. Second, Kleiven's inner shell 4 is an "inner shell layer" and also an "inner conforming layer" as it is a layer that conforms to the user's head. *See* Sections X.C.1.c)-X.C.1.d). Ex.1002, ¶¶263-268.

8. Claim 10

Kleiven combined with Puchalski renders claim 9 obvious. Section X.C.7. The combinations renders claim 10 obvious for the same reasons as claim 2. Section X.C.2. Ex.1002, ¶¶269-270.

9. Claim 11

Kleiven combined with Puchalski renders claim 10 obvious. Section X.C.8. The combination renders claim 11 obvious for the same reasons as claim 3. Section X.C.3. Ex.1002, ¶¶271-272.

10. Claim 12

Kleiven combined with Puchalski renders obvious claim 11. Section X.C.9. The combination renders claim 12 obvious for the same reasons as claim 4. Section X.C.4. Ex.1002, ¶¶273-274.

11. Claim 14

Kleiven combined with Puchalski renders claim 9 obvious. Section X.C.7. The combination renders claim 14 obvious for the same reasons as claim 6. Section X.C.5. Ex.1002, ¶¶275-276.

12. Claim 16

Kleiven combined with Puchalski renders claim 9 obvious. Section X.C.7. The combination renders claim 16 obvious for the same reasons as claim 8. Section X.C.6. Ex.1002, ¶¶277-278.

13. Claim 17

Kleiven combined with Puchalski renders claim 17 obvious for the same reasons as claims 9 and 1. Sections X.C.7, X.C.1. Ex.1002, ¶¶279-284.

14. Claim 18

Kleiven combined with Puchalski render obvious claim 17. Section X.C.13. X.C.13 The combination renders claim 18 obvious for the same reasons as claim 2. Section X.C.2. Ex.1002, ¶¶285-286.

15. Claim 19

Kleiven combined with Puchalski renders claim 18 obvious. Section X.C.14. The combination renders claim 19 obvious for the same reasons as claims 3 and 11. Sections X.C.3, X.C.9. Ex.1002, ¶¶287-288.

16. Claim 20

Kleiven combined with Puchalski renders obvious claim 19. Section X.C.15. The combination renders claim 10 obvious for the same reasons as claims 4 and 12. Sections X.C.4, X.C.9. Ex.1002, ¶¶289-290.

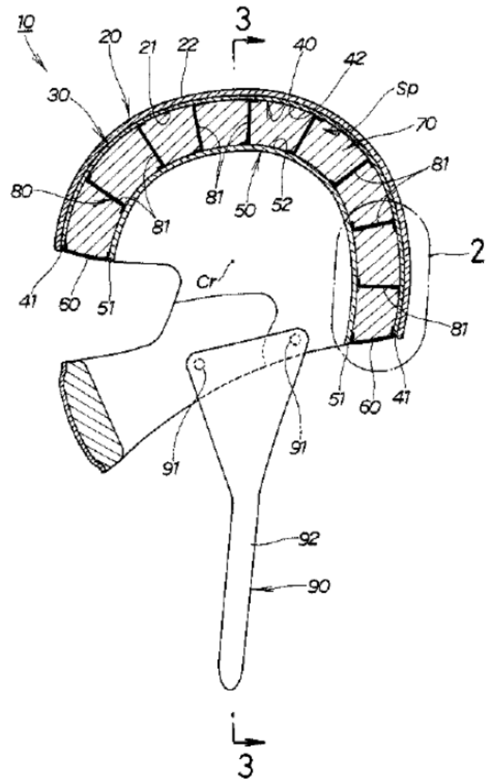
D. Ground 4: Dotsuko Anticipates Claims 1-3, 9-11, and 17-19

Dotsuko discloses Claims 1-3, 9-11, and 17-19 arranged as in each Challenged Claim for the reasons below. Ex.1002, ¶291.

1. Claim 1

a) 1[preamble]: "A helmet comprising:"

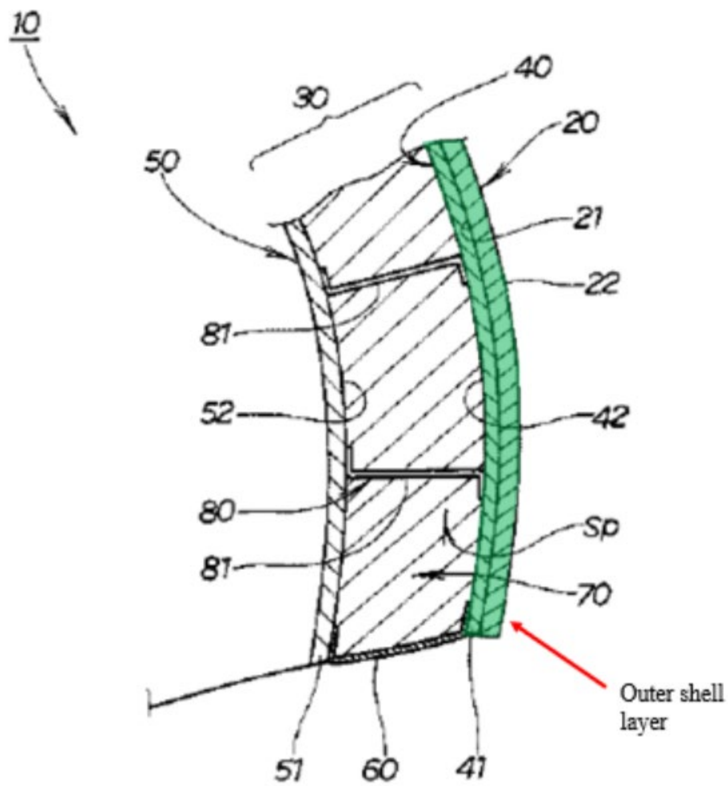
Dotsuko discloses 1[preamble]. Dotsuko discloses "a helmet." Ex.1041[Dotsuko], [Abstract].



Ex.1041[Dotsuko], Fig. 1. Ex.1002, ¶292.

b) 1[a]: "an outer shell layer;"

Dotsuko discloses 1[a]. Dotsuko's helmet has "**outermost shell 20**" and "**outer liner 40**" (collectively, an outer shell layer). Ex.1041[Dotsuko], [0012], [0014].

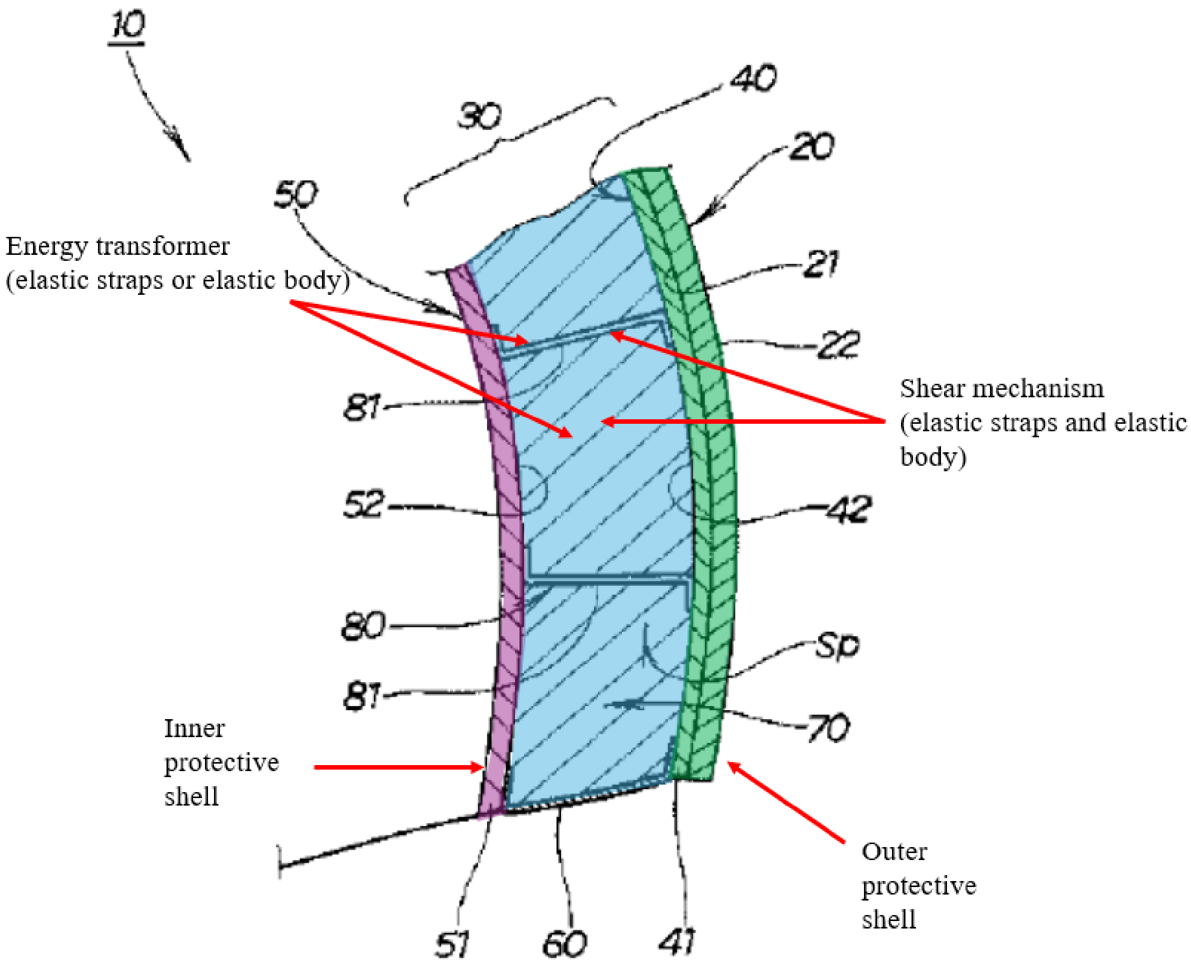


Ex.1041[Dotsuko], Fig. 2. Outermost shell 20 is "made of a resin molded product such as FRP (fiber-reinforced plastic)," and "[t]he outer liner 40 and the inner liner 50 are resin products" of, *e.g.*, hard or soft resin. Ex.1041[Dotsuko], [0012], [0014]. Dotsuko's outer liner and outer shell made from FRP and hard resins are an outer shell layer. *See* n.5. Ex.1002, ¶¶293-294.

c) 1[b]: "an inner shell layer connected to the outer shell layer through a shear mechanism allowing the outer shell layer to slide relative to the inner shell layer, wherein the shear mechanism includes a first energy transformer having a first absorptive/dissipative material,"

Dotsuko discloses 1[b]. Dotsuko's **inner liner 50** made of, *e.g.*, a hard or soft resin, is an inner shell layer. Ex.1041[Dotsuko], [0012], [0014]; Section X.A.2.b).

Dotsuko discloses a helmet with **inner liner 50** (inner shell layer) connected to **outer liner 40 and outer shell 20** (outer shell layer) through a shear mechanism in the plurality of elastic straps and an elastic body in a **layer of space Sp**.[17] Ex.1041[Dotsuko], [0013], [0017]. Thus, as exemplified below, Dotsuko discloses the claimed shear mechanism and energy transformer.



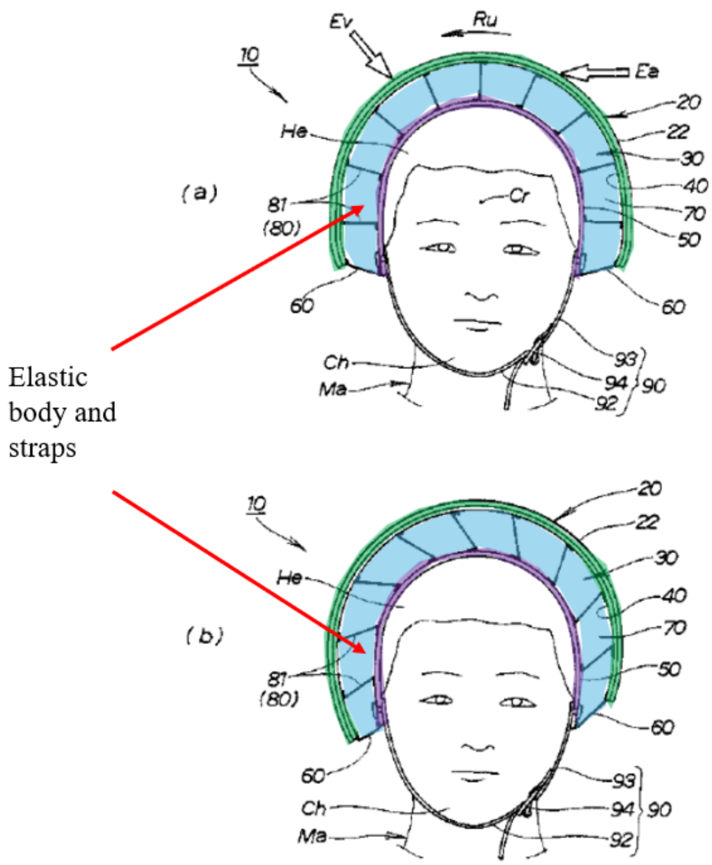
[17] As Ground 1 discusses, connection can be indirect. Ex.1002, ¶¶103, 298 n.16.

Ex.1041[Dotsuko], Fig. 2. Dotsuko's inner liner made from a hard resin is an inner shell layer. *See* n.5. Ex.1002, ¶¶295-296.

Dotsuko discloses 1[b] in as much, if not more detail as the '635 Patent. For example, to a POSA, Dotsuko discloses at least a shear mechanism in, as Figure 2 shows, its "multiple elastic straps" and "elastic body[] that is filled in the internal space." Ex.1041[Dotsuko], at [0013], [0025]. Ex.1002, ¶297.

Dotsuko's elastic body "can deform" and "is composed of, for example, … a gel-like substance." Ex.1041[Dotsuko], [0016]. The elastic body allows relative sliding by "displac[ing] in the direction of the force" such that the "shell 20 relatively rotates with respect to the liner 30…." Ex.1041[Dotsuko], [0021]. Similarly, Dotsuko's elastic straps are a "stopper mechanism" that "connect…outer liner 40 and…inner liner 50" "and are 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 the shell 20 and the outer liner 40 with respect to the inner liner 50…." *Id.*; *see id.*, [0020-22], [0024-25]. Thus, Dotsuko's elastic body and straps are the shear mechanism that shears/deforms and allows relative sliding.

[Fig. 4]



Ex.1041[Dotsuko], Fig. 4. Ex.1002, ¶¶297-298.

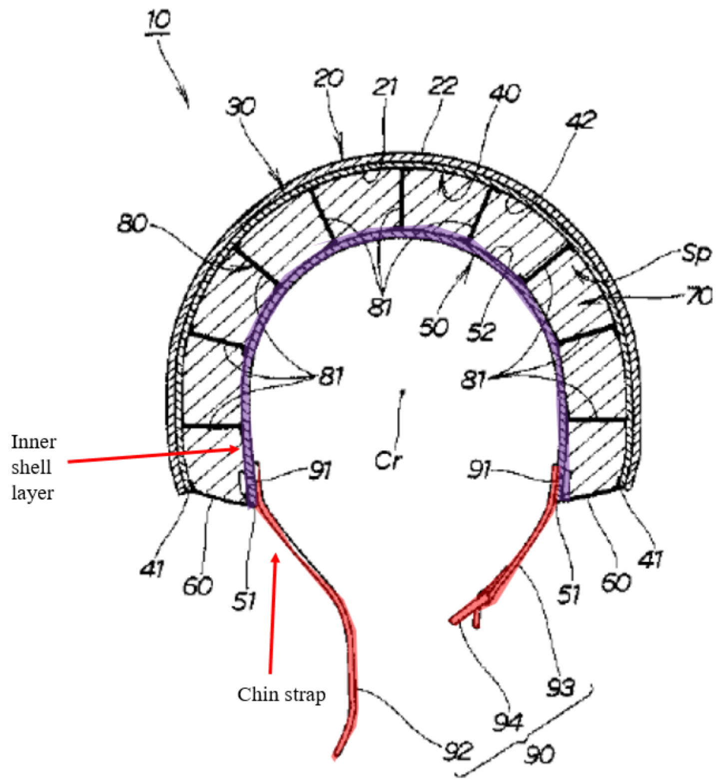
Dotsuko's elastic body or elastic straps are a first energy transformer made of material that can absorb/dissipate and transform rotational energy, *e.g.*, by allowing for relative sliding in the same way as described in the '635 Patent. Ex.1041[Dotsuko], [0020] ("[S]hell 20 is displaced inward, enabling efficient and sufficient absorption of the impact energy Ev."); *id.*, [0021-23]; Ex.1001[USP635], 6:18-45. The straps are absorptive/dissipative material ("elastic material such as rubber") that absorbs/dissipates energy by mechanically deforming elastically due to their "elongation properties…." Ex.1041[Dotsuko], [0017]. Dotsuko's elastic body's gel-like substance "is a material that can deform within the filled internal space Sp," which absorbs/dissipates energy via deformation and fluid flow. Ex.1041[Dotsuko], [0016]. Gels are also absorptive/dissipative material as the '635 Patent describes. Ex.1001[USP635], 6:43-45 (gels "absorptive/dissipative material"); Ex.1041[Dotsuko], [0016-17], [0025]. Ex.1002, ¶299.

d) 1[c] "the inner shell layer configured to conform to a human head;"

Dotsuko discloses 1[c]. Dotsuko's inner liner 50 is configured to conform to a human head with "overall shape" to "cover part or all of the head of the occupant (wearer) when fitted onto the head." Ex.1041[Dotsuko], [0014]. Ex.1002, ¶300.

e) 1[d]: "a chin strap attached to the inner shell layer to maintain the position of the inner shell layer on the human head during rotational force impact while the outer shell layer is allowed to slide."

Dotsuko discloses 1[d]. Dotsuko discloses **chin-strap 90** is "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, ¶301.

"[S]ince the chin strap 90 is attached to the liner 30, it becomes 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, "inner liner 50[] remains in place while the shell[] alone relatively rotates in the direction of the force, thereby absorbing the impact energy Ea." *Id.* Ex.1002, ¶301.

Thus, Dotsuko anticipates claim 1. Ex.1002, ¶302.

2. Claim 2

Dotsuko discloses claim 1. Section X.D.1. Dotsuko discloses "the shear mechanism may be a shear layer" as Section X.D.1.c) discusses. Ex.1002, ¶303.

Thus, Dotsuko anticipates claim 2. Ex.1002, ¶304.

3. Claim 3

Dotsuko discloses claim 2. Section X.D.2. As discussed, Dotsuko's shear layer of elastic straps and the elastic body each "connect" the outer and inner shell layers and "include[] a first absorptive/dissipative material to allow the outer shell layer to slide relative to the inner shell layer" and "absorb energy" as claimed. Section X.D.1.c), X.D.2. Ex.1002, ¶305.

Thus, Dotsuko anticipates claim 3. Ex.1002, ¶306.

4. Claim 9

Dotsuko anticipates claim 9 for the same reasons as claim 1. Section X.D.1. Claim 9 differs in two respects taught by the combination. First, Dotsuko's helmets are "protective gear." Ex.1001[USP635], 1:30. Second, Dotsuko's inner liner is an "inner shell layer" and also an "inner conforming layer" as it is a layer that conforms to the user's head. *See* Sections X.D.1.c)-X.D.1.d). Ex.1002, ¶¶307-312.

5. Claim 10

Dotsuko discloses claim 9. Section X.D.4. Dotsuko anticipates claim 10 for the same reasons as claim 2. Section X.D.2. Ex.1002, ¶¶313-314.

6. Claim 11

Dotsuko anticipates claim 10. Section X.D.5. Dotsuko anticipates claim 11 for the same reasons as claim 3. Section X.D.3. Ex.1002, ¶¶315-316.

7. Claim 17

Dotsuko anticipates claim 17 for the same reasons as claims 9 and 1. Section X.D.4, Section X.D.1. Ex.1002, ¶¶317-322.

8. Claim 18

Dotsuko discloses claim 17. Section X.D.7. Dotsuko anticipates claim 18 for the same reasons as claim 2. Section X.D.2. Ex.1002, ¶¶323-324.

9. Claim 19

Dotsuko anticipates claim 18. Section X.D.8. Dotsuko anticipates claim 19 for the same reasons as claims 3 and 11. Sections X.D.3, X.D.6. Ex.1002, ¶¶325-326.

E. Ground 5: Claims 8 and 16 are Obvious over Dotsuko Combined With Puchalski

1. Claim 8

Dotsuko discloses claim 1. X.D.1. Dotsuko combined with Puchalski teaches claim 2. Puchalski teaches a "padding or cushioning ['lining 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, ¶327.

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 shell layers/ liners is standard in motorcycle helmets. Ex.1031[Bosch], 2. Puchalski's helmets are likewise for "motorcycle or race car driver[s]," and its "strips of resiliently compressible foam cushioning" "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, 13:48-58; *see 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, ¶328.

A POSA would have reasonably expected success using Puchalski's comfort liner in Dotsuko's design. Helmets, including motorcycle helmets, have comfort padding in standard practice. Ex.1031[Bosch], 17; 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, ¶329.

Thus, Dotsuko combined with Puchalski renders claim 8 obvious. Ex.1002, ¶330.

2. Claim 16

Dotsuko discloses claim 9. Section X.D.4. Dotsuko combined with Puchalski renders claim 16 obvious for the same reasons as claim 8. Section X.F.2. Ex.1002, ¶¶331-332.

F. Ground 6: Madey Anticipates Claims 1-3, 8-11, and 16-19

Madey discloses Claims 1-3, 8-11, and 16-19 arranged as in each Challenged Claim for the reasons below. Ex.1002, ¶333.

1. Claim 1

a) 1[preamble]: "A helmet comprising:"

Madey discloses "a helmet." Ex.1047[Madey], Abstract, [0025] (helmet), [0037] (helmet with alternative interface layer), claim 1, Fig. 4. Ex.1002, ¶¶334.

b) 1[a]: "an outer shell layer;"

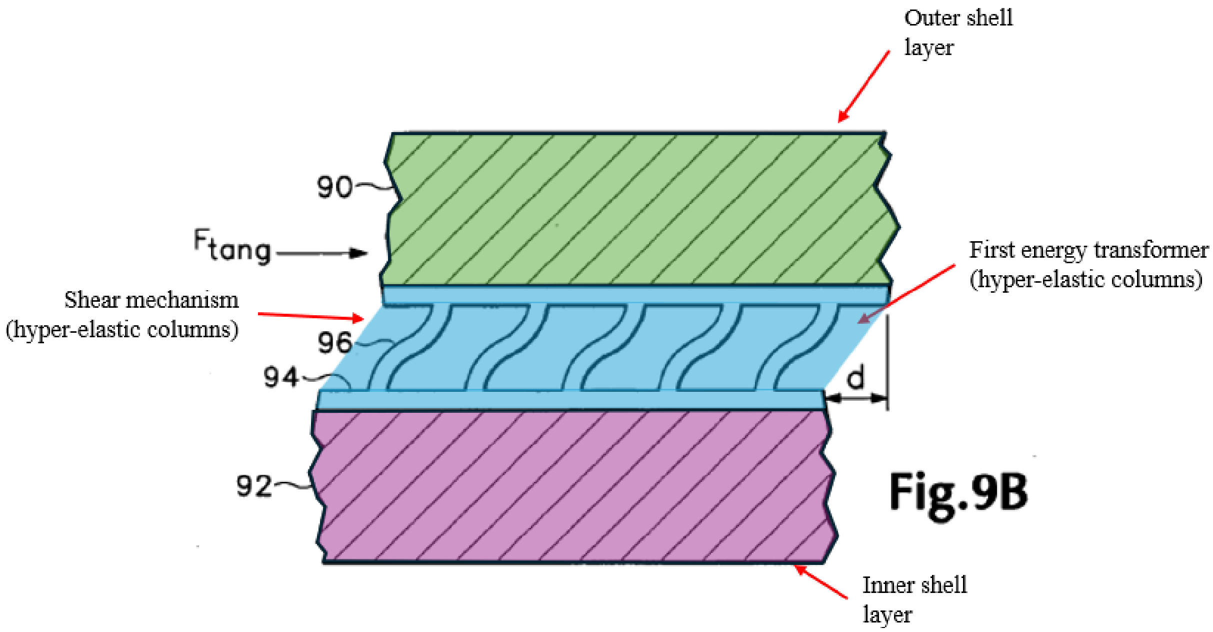
Madey discloses 1[a]. Madey's helmet has "outer helmet layer" comprising "a hard shell." Ex.1047[Madey], Abstract, claims 1- 2, Fig. 4. Ex.1002, ¶¶335-336.

c) 1[b]: "an inner shell layer connected to the outer shell layer through a shear mechanism allowing the outer shell layer to slide relative to the inner shell layer, wherein the

shear mechanism includes a first energy transformer having a first absorptive/dissipative material,"

Madey discloses 1[b]. Madey's "inner helmet layer" made of, *e.g.*, expanded polystyrene foam, is an inner shell layer. Ex.1047[Madey], Abstract, [0025], [0037], [005]; *see* n.5. Madey also discloses inner and outer shell layers connected through a shear mechanism, which also includes a first energy transformer. Madey discloses components between its **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" (shear mechanism). Ex.1047[Madey], Abstract, [0037]. In Madey's Figure 9B embodiment of Figure 4, the components in **interface layer 94** include (e.g.) **hyper-elastic columns 96** (energy transformer), which connect the inner and outer shell layers.[18]

[18] As Ground 1 discusses, connection can be indirect. Ex.1002, ¶¶103, 337.



Ex.1047[Madey], Fig. 9B. Ex.1002, ¶337.

Madey discloses 1[b] in as much, if not more detail, as the ’635 Patent. For example, to a POSA, Madey discloses a shear mechanism that includes first energy transformer (**hyper-elastic columns in interface layer 94**) located 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, ¶¶338-339.

Madey also, for example, discloses hyper-elastic columns in interface layer 94 (first energy transformer) shear and allow the outer helmet layer (shell layer) to slide relative to the inner helmet layer (shell layer). For example, Madey's hyper-elastic columns 96 "bend[] and stretch[] in response to tangential force" and thereby allow "relative displacement" between outer and inner layers. Ex.1047[Madey], [0037], Fig. 9B. Ex.1002, ¶340.

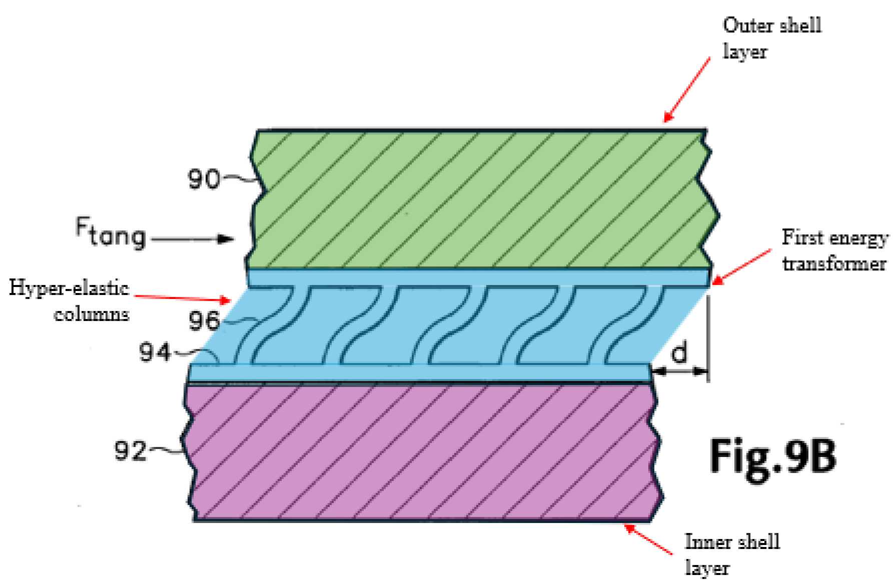


Fig.9B

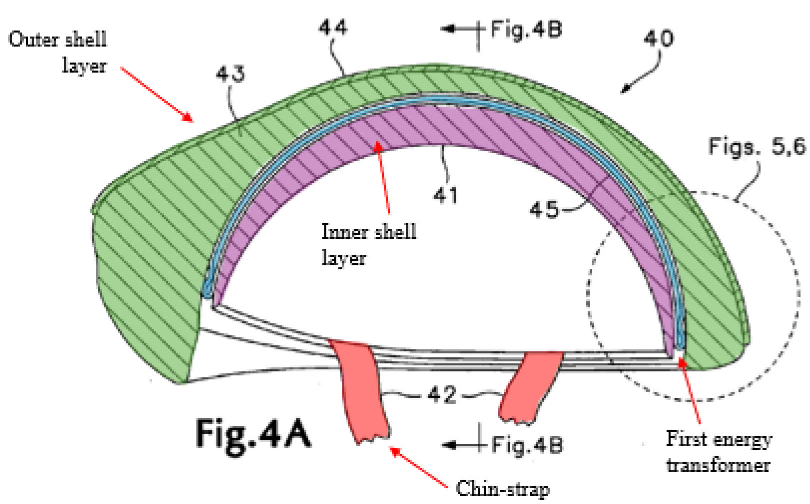
Madey's hyper-elastic columns are made of absorptive/dissipative (hyper-elastic) material that "bend and stretch in response to the tangential force, thereby ***deflecting*** and partially ***absorbing*** the tangential force." Ex.1047[Madey], [0037]. As Section X.F.1 further discusses, Madey's hyper-elastic columns allow translational movement, and, as Dr. Duma explains, such movement dissipates (deflects) energy. Ex.1002, ¶340.

d) 1[c] "the inner shell layer configured to conform to a human head;"

Madey discloses 1[c]. 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]. Ex.1002, ¶341.

e) 1[d]: "a chin strap attached to the inner shell layer to maintain the position of the inner shell layer on the human head during rotational force impact while the outer shell layer is allowed to slide."

Madey discloses 1[d]. 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 ***chinstrap***").



Ex.1047[Madey], Fig. 4A. Madey's chinstrap 42 is affixed to the "inner helmet layer" securing it to the head during relative displacement (sliding) of the outer layer discussed in Section X.F.1.c. Ex.1047[Madey], [0037], Fig. 9B. Ex.1002, ¶342.

Thus, Madey anticipates claim 1. Ex.1002, ¶343.

2. Claim 2

Madey discloses claim 1. Section X.F.1. As Section X.F.1.c discusses, Madey's "hyper-elastic columns" are a layer of materials that shear ("shear layer"). Ex.1047[Madey], [0037], Fig. 9B. Ex.1002, ¶344.

Thus, Madey anticipates claim 2. Ex.1002, ¶345.

3. Claim 3

Madey discloses claim 1. Section X.F.1. Madey discloses claim 3's additional limitations. As Sections X.F.1.c and X.F.2 discuss, Madey's interface layer of "hyper-elastic columns" (shear layer) is connected to the outer helmet layer (outer shell layer) through hyper elastic columns (first energy transformers) made of "absorptive/dissipative material" that allow relative sliding and "absorb energy from forces imparted onto the outer shell layer." Ex.1002, ¶346.

Thus, Madey anticipates claim 3. Ex.1002, ¶347.

4. Claim 8

Madey discloses claim 1. Section X.F.1. Madey's helmets include "a helmet retention system (e.g., straps 42 and ***foam padding inserts***, not shown) ["lining layer"] to affix inner helmet layer 41 to a wearer's head…." Ex.1047[Madey], [0025]; [0051] ("head cushioning"). Ex.1002, ¶348.

Thus, Madey anticipates claim 8. Ex.1002, ¶349.

5. Claim 9

Madey anticipates claim 9 for the same reasons as claim 1. Section X.F.1. Claim 9 differs in two respects disclosed by Madey. First, Madey's helmets are "protective gear." Ex.1001[USP635], 1:30; Ex.1047[Madey], Title ("head protective devices"). Second, Madey's inner helmet layer is an "inner shell layer" and also an "inner conforming layer" as it is a layer that conforms to the user's head. Sections X.F.1.c)-X.F.1.d). Ex.1002, ¶¶350-354.

Thus, Madey anticipates claim 9. Ex.1002, ¶355.

6. Claim 10

Madey discloses claim 9. Section X.F.5. Madey anticipates claim 10 for the same reasons as claim 2. Section X.F.2. Ex.1002, ¶¶356-357.

7. Claim 11

Madey anticipates claim 10. Section X.F.6. Madey anticipates claim 11 for the same reasons as claim 3. Section X.F.3. Ex.1002, ¶¶358-359.

8. Claim 16

Madey anticipates claim 9. Section X.F.5. Madey anticipates claim 16 for the same reasons as claim 8. Section X.F.4. Ex.1002, ¶¶360-361.

9. Claim 17

Madey discloses claim 17 for the same reasons as claims 9 and 1. Sections X.F.5, X.F.1. Ex.1002, ¶¶362-367.

10. Claim 18

Madey discloses claim 17. Section X.F.9. Madey anticipates claim 18 for the same reasons as claim 2. Section X.F.2. Ex.1002, ¶¶368-369.

11. Claim 19

Madey anticipates claim 18. Section X.F.10. Madey anticipates claim 19 for the same reasons as claim 3. Section X.F.3. Ex.1002, ¶¶370-371.

XI. CONCLUSION

Petitioner requests institution of *inter partes* review of and cancellation of ’635 Patent claims 1-4, 6, 8-12, 14, and 16-20.

Respectfully Submitted,

Dated: July 9, 2025

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

TABLE OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 9,414,635 (USP635)
1002	Declaration of Dr. Stefan Duma
1003	Prosecution History for U.S. Patent No. 9,414,635 (Knight-635-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)

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, *The Vierendeel Truss: Past And Present Of An Innovative Typology*, 15 Arquitetura Revista 193 (2019) (Pons-Poblet)
1022	Kis et al., *Rotational Acceleration Measurements –Evaluating Helmet Protection*, 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, *Modern Sports Helmet – Their History, Science, and Art* (2007) (Newman)
1026	Kleiven, *A Parametric Study of Energy Absorbing Foams For Head Injury Prevention*, Technical Paper Number 07-0385, 20th Int'l

Exhibit	Description
	Tech. Conf. on Enhanced Safety of Vehicles (June 18-21, 2007) (Kleiven-2007)
1027	Reserved
1028	Aare, *A New Laboratory Rig for Evaluating Helmets Subject to Oblique Impacts*, 4 Traffic Injury Prevention 240 (2003) (Aire-2003)
1029	U.S. Provisional App. No. 61/510,401 (401Prov)
1030	U.S. Patent No. 8,863,319 (USP319)
1031	Bosch, *Crash helmet testing and design specifications* (Jan. 1, 2006) (Ph.D. Thesis, Eindhoven University of Technology) (Bosch)
1032	Mills & Gilchrist, *Bicycle Helmet Design*, 220 Proceedings of the Institution of Mechanical Engineers Part L Journal of Materials Design and Applications 167 (2006) (Mills-2006)
1033	Smith, *Diffuse Axonal Injury in Head Trauma*, 18 J. Head Trauma Rehab. 307 (2003) (Smith-2003)
1034	Jans, *Bike Helmet Anatomy*, https://www.jans.com/anatomy-of-a-bike-helmet?srsltid=AfmBOooriodHXEC54CbWtD0foK5WSXu8-gN0vaAh1lq96kCKdGHJ68FJ (Jans)

Exhibit	Description
1035	Reserved
1036	International Polymer Solutions Inc., *Polycarbonate*, 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, *Analysis of Real-time Head Accelerations in Collegiate Football Players*, 15 Clin. J. Sports Med. 3 (2005) (Duma-2005)
1039	Ommaya, *Chapter 13: Biomechanics of Head Injury: Experimental Aspects, in* The Biomechanics of Trauma 245 (1985) (Ommaya-1985)
1040	Viano, *Injury Biomechanics Research: An Essential Element in the Prevention of Trauma*, 22 J. Biomechanics 403 (1989) (Viano-1989)
1041	English Translation of Japanese Unexamined Patent Application Publication No. JP2006-016740 (Dotsuko)

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, *What Is EPS Material: The Complete Guide to EPS Material* (April 15, 2024), https://epsole.com/what-is-eps-material/ (Epsole)
1050	U.S. Patent 9,516,909 (USP909)

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 13,985, 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. 9,414,635 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. 9,414,635 (Exs.1001-1007, 1009-1026, 1028-1034, 1036-1050)
- 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:

david.schumann@foliolaw.com
cris.leffler@foliolaw.com
alden.lee@foliolaw.com
mike.saunders@foliolaw.com
pross@rossllp.la

DATED: July 9, 2025

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