

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

REVELYST SALES LLC
Petitioner

v.

BRAINGUARD TECHNOLOGIES INC.
Patent Owner

IPR2025-001031
U.S. Patent No. 9,271,536

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 9,271,536
CHALLENGING CLAIMS 1, 5-10, 12, and 16-20
UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104**

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. MANDATORY NOTICES	2
A. Real Parties-in-Interest	2
B. Related Matters	2
C. Counsel	2
D. Service Information	3
III. LEVEL OF ORDINARY SKILL	3
IV. CERTIFICATION OF GROUNDS FOR STANDING	4
V. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED	4
A. Prior Art	4
B. Grounds on which the Challenge is Based	6
VI. TECHNOLOGY BACKGROUND	7
A. Rotational Motion from Impact	7
B. Helmets to Reduce Rotational Motion	9
VII. '536 PATENT	10
A. Specification	10
B. Prosecution History	12
VIII. PRIOR ART PATENTS AND PUBLICATIONS	12
A. US2012/0198604 (“Weber”)	12
B. WO01/45526 (“Von Holst”)	15
C. WO2011/139224 (“Halldin”)	17
D. US2013/012,256 (“Kleiven”)	18
E. US2004/0250340 (“Piper”)	20
F. US2004/0117896 (“Madey”)	21
IX. CLAIM CONSTRUCTION	23

X.	SPECIFIC GROUNDS FOR UNPATENTABILITY	23
A.	Ground 1: Weber Anticipates Claims 1, 5, 7-10, and 16-19.....	23
1.	Dynamic Drinkware Analysis: Weber.....	24
2.	Claim 1	27
3.	Claim 5.....	34
4.	Claim 7.....	35
5.	Claim 8.....	36
6.	Claim 9.....	36
7.	Claim 10.....	37
8.	Claim 16.....	41
9.	Claim 17.....	42
10.	Claim 18.....	42
11.	Claim 19.....	43
B.	Ground 2: Claim 20 is Obvious over Weber Combined with Piper ...	44
1.	Claim 20.....	44
C.	Ground 3: Von Holst Anticipates Claims 1, 5-10, 12, and 16-20.....	46
1.	Claim 1	47
2.	Claim 5.....	55
3.	Claim 6.....	55
4.	Claim 7.....	56
5.	Claim 8.....	56
6.	Claim 9.....	57
7.	Claim 10.....	58
8.	Claim 12.....	65
9.	Claim 16.....	65
10.	Claim 17.....	66
11.	Claim 18.....	66
12.	Claim 19.....	68
13.	Claim 20.....	68
D.	Ground 4: Claims 1, 5-10, 12, and 16-20 are Obvious over Von Holst Combined with Halldin	68
1.	Dynamic Drinkware Analysis: Halldin.....	68
2.	Claim 1	70
3.	Claim 5.....	76
4.	Claim 6.....	76
5.	Claim 7.....	77

Petition for *Inter Partes Review*
of U.S. Patent No. 9,271,536

6.	Claim 8	77
7.	Claim 9	77
8.	Claim 10	78
9.	Claim 12	79
10.	Claim 16	79
11.	Claim 17	79
12.	Claim 18	80
13.	Claim 19	82
14.	Claim 20	82
E.	Ground 5: Claims 1, 5, 7-8, and 18 are Anticipated by Kleiven.....	82
1.	Claim 1	82
2.	Claim 5	90
3.	Claim 7	90
4.	Claim 8	90
5.	Claim 18	91
F.	Ground 6: Claims 9-10, 16-17, and 19-20 are Obvious Over Kleiven Combined with Piper.....	92
1.	Claim 9	92
2.	Claim 10	94
3.	Claim 16	97
4.	Claim 17	97
5.	Claim 19	97
6.	Claim 20	98
G.	Ground 7: Madey Anticipates Claims 10, 16, and 17	98
1.	Claim 10	98
2.	Claim 16	102
3.	Claim 17	103
XI.	CONCLUSION.....	104

I. INTRODUCTION

Revelyst Sales LLC (“Petitioner”) respectfully requests *inter partes* review (“IPR”) of claims 1, 5-10, 12, and 16-20 (the “Challenged Claims”) of U.S. Patent No. 9,271,536 (the “’536 patent”) (Ex.1001[USP536]) pursuant to 35 U.S.C. §§ 311-19 and 37 C.F.R. § 42.1 *et seq.*

The ’536 Patent is directed to helmets with layers that can slide relative to each other to increase protection for a wearer upon impact. The safety issues the ’536 Patent seeks to address, including related to rotational acceleration, were known long before the patent. So too were the proffered solutions, which were the subject of extensive prior art analyzing the problem and describing techniques, including directed to relative movement of helmet layers and absorption/dissipation of energy, to protect wearers. The ’536 Patent received no substantive prosecution; minimal art was identified beyond Patent Owner’s sparse disclosures, and the claims received no anticipation or obviousness rejection beyond obviousness-type double patenting. As this Petition demonstrates, however, the concepts and structures of the Challenged Claims were widely known, and the Challenged Claims are anticipated or would have been obvious. For instance, Weber, Von Holst, and Kleiven’s disclosure of helmets with outer, middle, and inner layers separated by energy transformers that allow relative sliding between layers and absorption of energy anticipates and/or renders obvious the Challenged Claims.

This Petition, supported by the declaration of Dr. Stefan Duma (Ex.1002), demonstrates that there is a reasonable likelihood Petitioner will prevail with respect to cancellation of at least one of the Challenged Claims. *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 ’536 Patent, in *BrainGuard Technologies, Inc. v. Revelyst Sales LLC*, No. 8:24-cv-2652-JWH-ADS (C.D. Cal.) (the “-652 Action”).

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

C. Counsel

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

Petition for *Inter Partes Review*
of U.S. Patent No. 9,271,536

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

III. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art (“POSA”) at the time of the earliest claimed priority date of the ’536 Patent (July 21, 2011) 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 also would have two or more years' 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 '536 Patent claims are supported by the declaration of Dr. Duma, an expert in helmet-safety design with almost 30 years' experience. Ex.1002, ¶¶1-11.

IV. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies under 37 C.F.R. §42.104(a) that the '536 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 '536 Patent claims 1, 5-10, 12, and 16-20.

A. Prior Art

The '536 Patent claims priority to July 21, 2011,¹ the filing date of U.S. Provisional No. 61/510,401. Ex.1001[USP536], 1. Petitioner relies on Exhibits including:

- U.S. Patent Application Publication No. US2012/0198604 to Weber et al. (“Weber”) (Ex.1004[Weber]), filed February 8, 2012, and published August 9, 2012, which claims the benefit of U.S. Provisional Application Nos. 61/462,914 (filed February 9, 2011) (“*Weber Provisional*”) (Ex.1014[WeberProv]), as §102(e) prior art.
- International Patent Application Publication Number WO01/45526 to Von Holst et al. (“Von Holst”) (Ex.1005[VonHolst]), filed December 21, 1999, and published June 28, 2001, as §102(a), (b) prior art.
- International Patent Application Publication No. WO2011/139224 to Halldin (“Halldin”) (Ex.1006[Halldin]), filed May 3, 2011, and published November 10, 2011, which claims the benefit of U.S. Provisional Application No. 61/333,817 (filed May 12, 2010) (“*Halldin Provisional*”) (Ex.1015[HalldinProv]), as §102(e) prior art.

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

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

B. Grounds on which the Challenge is Based

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

Ground	Basis	Claims	References
1	§102	1, 5, 7-10, 16-19	Weber
2	§103	20	Weber combined with Piper

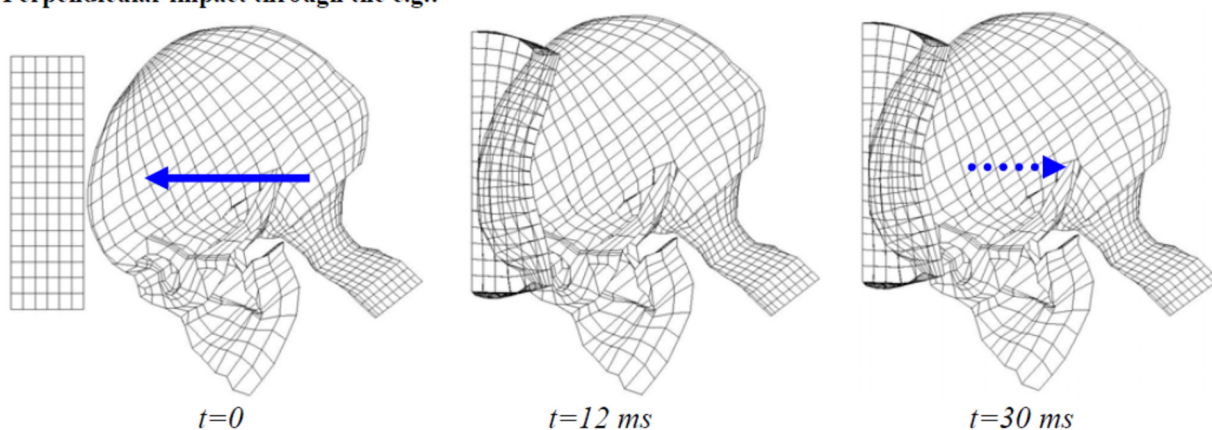
3	§102	1, 5-10, 12, 16-20	Von Holst
4	§103	1, 5-10, 12, 16-20	Von Holst combined with Halldin
5	§102	1, 5, 7-8, 18	Kleiven
6	§103	9-10, 16-17, 19-20	Kleiven combined with Piper
7	§102	10, 16-17	Madey

VI. TECHNOLOGY BACKGROUND

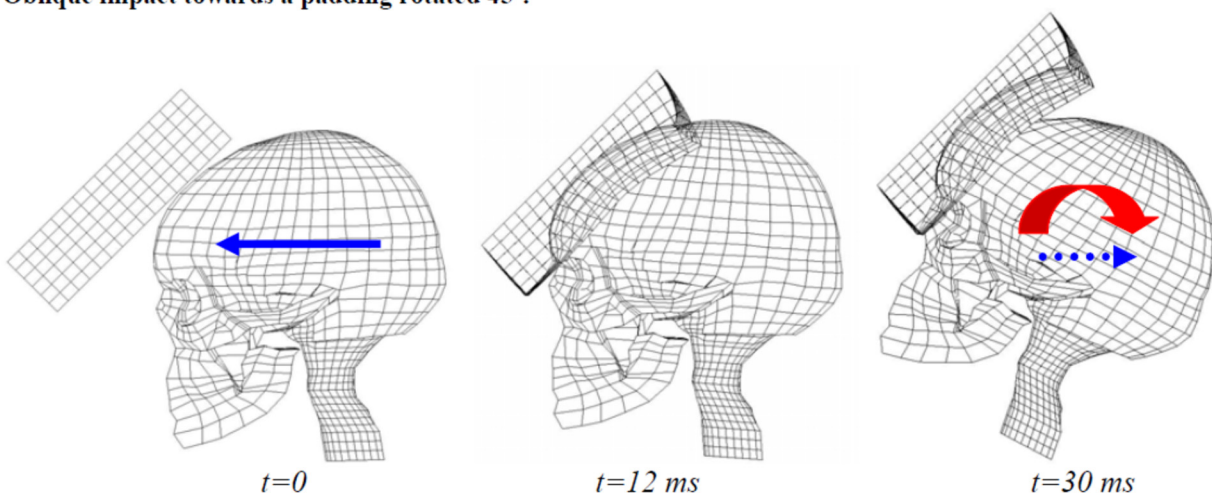
A. Rotational Motion from Impact

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

Perpendicular impact through the c.g.:



Oblique impact towards a padding rotated 45°:



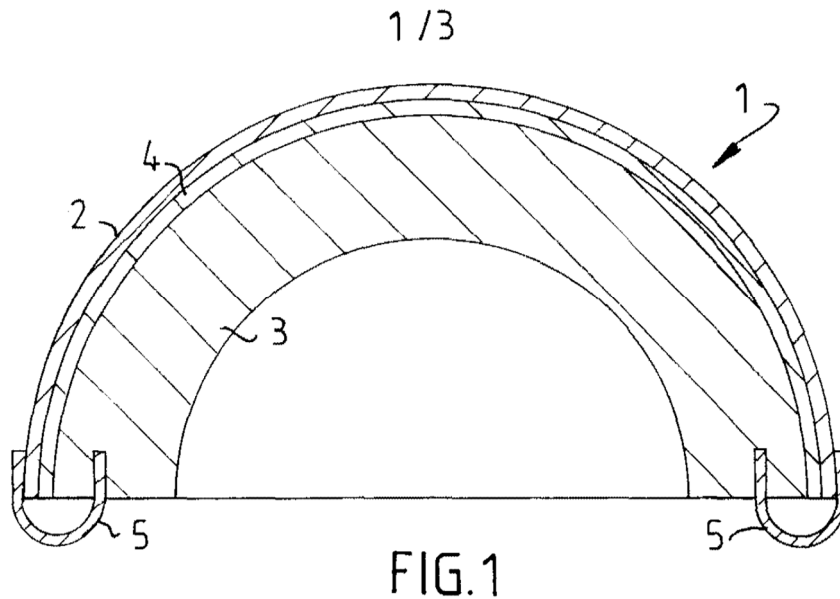
Ex.1026[Kleiven-2007], Fig. 3. “Rotational acceleration” in turn “result[s] in shear strains inside the brain.” Ex.1031[Bosch], 55. “Shearing” results from “shear forces,” which refers to forces from parallel translation in different or opposing directions exerted on the helmet or brain. Ex.1002, ¶¶37-38.

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

acceleration” causes injuries); Ex.1022[Kis-2003], 502 (“[R]otational acceleration is more damaging than linear....”). Ex.1002, ¶¶39-41.

B. Helmets to Reduce Rotational Motion

As of 2011, publications described reducing rotational motion using sliding between multiple helmet layers. For example, Von Holst described outer (2) and inner (3) shells/layers with an intermediate “sliding layer 4” for “displacement between” them:



Ex.1005[VonHolst], 4:10-17, Fig. 1.

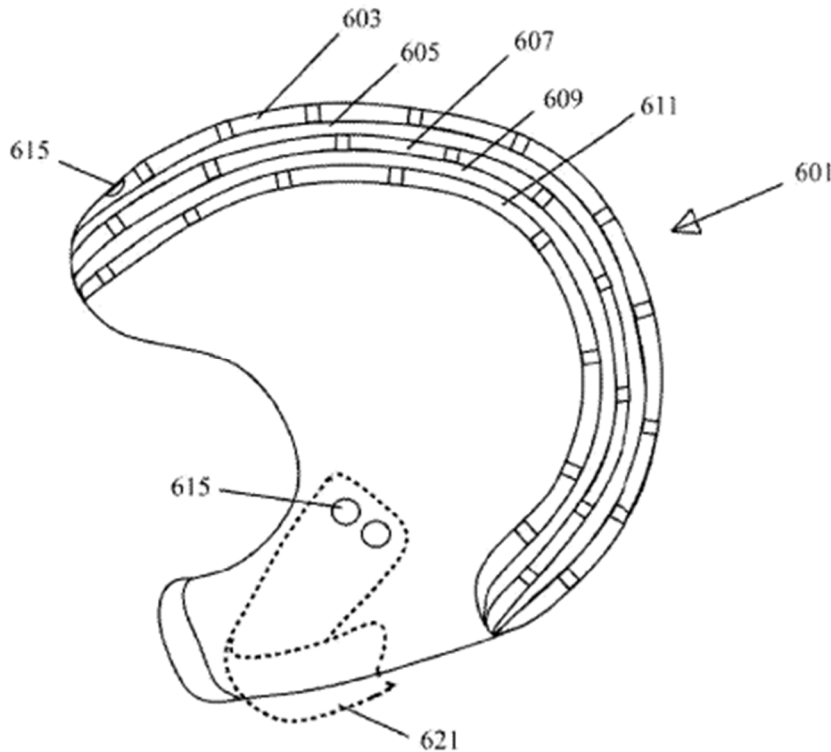
Von Holst taught this arrangement reduces “injurious forces” when the outer shell/layer is “displaced relative to the inner” layer to absorb rotational energy. *Id.*, 2:34-38, 8:12-18; Ex.1032[Mills-2006], 173-174 (“low friction layers” to reduce “rotational acceleration”). By 2011, multi-layered helmets with sliding layers were

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

VII. '536 PATENT

A. Specification

The '536 Patent is directed to preventing damage from “rotational” and other forces. Ex.1001[USP536], 2:43-46. 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[USP536], 6:36-38. Figure 6 depicts three helmet layers (603, 607, 611) joined by “energy and impact transformer” layers (605, 609):



Ex.1001[USP536], 9:66-10:3, Fig. 6. The layers are connected (directly or indirectly) through transformer layers, 10:37-39, which transfer or “transform” energy—e.g., impact or rotational force—via sliding into, e.g., heat or rotational energy. *Id.*, 9:5-22, 6:19-29, 10:37-58, Fig. 5 (shell 501 “mov[ing] and/or slid[ing]”² relative to middle shell 503). Ex.1002, ¶¶49-50.

The Patent identifies several materials—in various combinations—that may make up a transformer layer. Ex.1001[USP536], Abstract, 2:40-46, 6:30-7:50, 9:27-

² The '536 Patent uses “move relative to” and “slide relative to” synonymously.

See, e.g., Ex.1001[USP536], Abstract, 2:36-46, 6:36-39, 10:47-58. Ex.1002, ¶51.

65, 11:1-3, 8:57-61 (fluid or gel alone or with mechanical spacers). Ex.1002, ¶¶49-51.

The '536 Patent further describes typical prior-art helmet components like lining layers, Ex.1001[USP536], 8:7-10, 10:3-5, and chin-straps. *Id.*, 10:5-7, 10:20-22. Ex.1002, ¶52.

B. Prosecution History

The '536 Patent issued from U.S. Patent Application 14/714,093. Its prosecution was abbreviated, with only double-patenting rejections, which were overcome by terminal disclaimers. Ex.1003[Knight-536-FH], 57-62, 72, 77-80; Ex.1002, ¶53.

With the '536 Patent prosecution pending, Applicant prosecuted U.S. application No.13/554,563, claiming priority to same provisional application. A different examiner rejected similar claims *five times* before allowing significantly narrower claims. *See generally* Ex.1013[Knight-162-FH]; Ex.1002, ¶¶54-55.

VIII. PRIOR ART PATENTS AND PUBLICATIONS

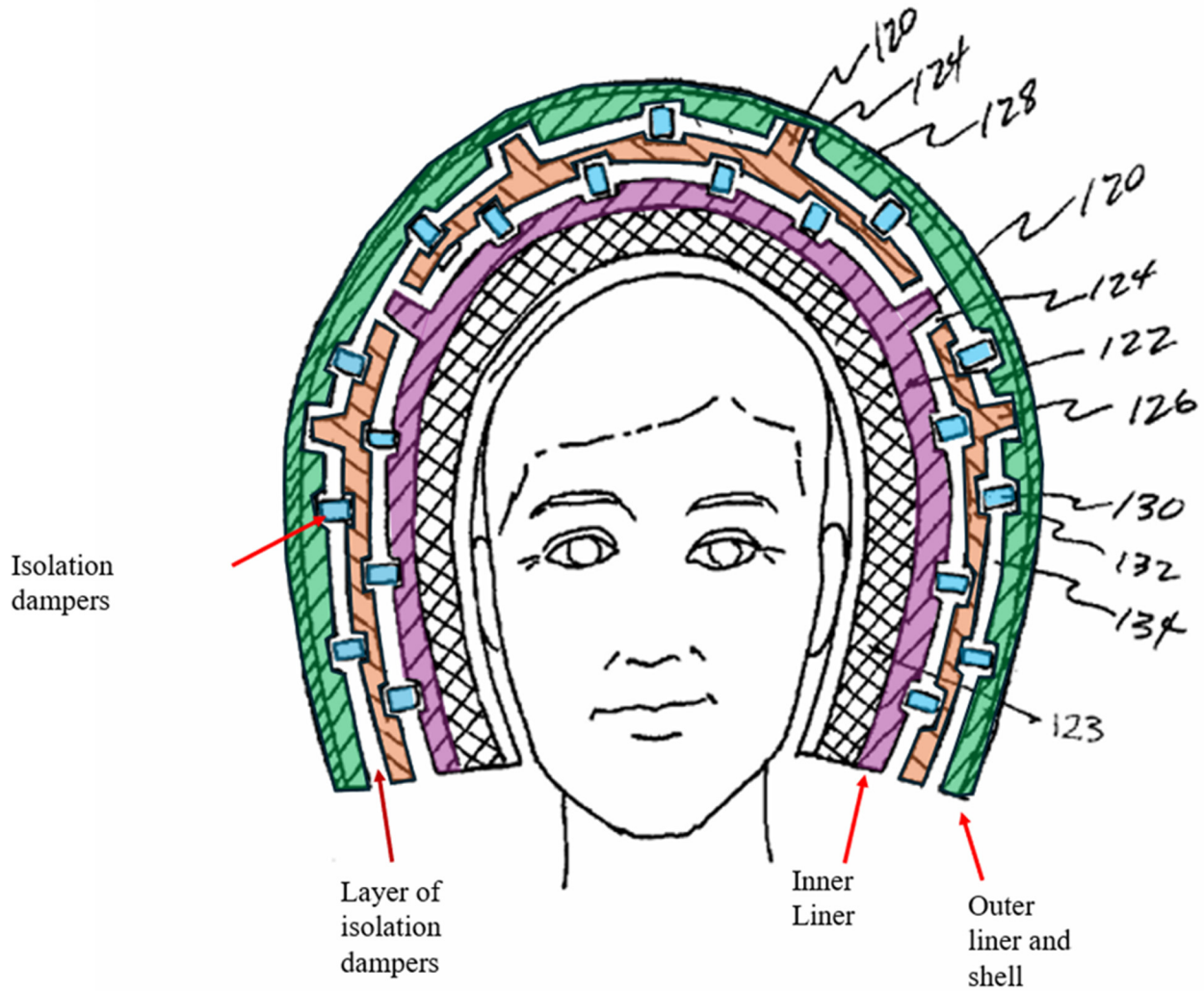
The following references are pertinent to the Grounds:

A. US2012/0198604 (“Weber”)

Weber recognizes “rotational acceleration” risks “shearing brain tissue.” Ex.1004[Weber], [0006]. Weber’s multi-layered helmets “significantly reduce both

rotational and linear forces” from impacts. Ex.1004[Weber], [0009]. Ex.1002, ¶¶61-62.

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



Ex.1004[Weber], Fig. 4³, [0045-46]. Ex.1002, ¶63.

Weber’s “isolation dampers 130” “disposed between” liners “dissipate” impact energy, *id.*, e.g., “enabl[ing] the inner and intermediate liners 122 and 126 to move relative to each other and/or the outer liner 128.” Ex.1004[Weber], [0045-46]. Ex.1002, ¶64.

³ All annotations and emphases added unless stated.

B. WO01/45526 (“Von Holst”)

Von Holst discloses helmets with layers that slide relative to one another upon impact: “outer shell...can be displaced relative to the inner shell during simultaneous absorption of rotational energy....” Ex.1005[VonHolst], 2:34-39; Ex.1002, ¶¶65-66.

Figure 1’s helmet has **outer shell 2**, **inner shell 3**, and **intermediate sliding layer 4** that allows displacement between outer and inner shells. Ex.1005[VonHolst], 4:10-21, 5:39-4:2. A **connecting member 5** further connects the shells and absorbs energy. Ex.1005[VonHolst], 4:38-5:2, 4:10-21. Ex.1002, ¶67.

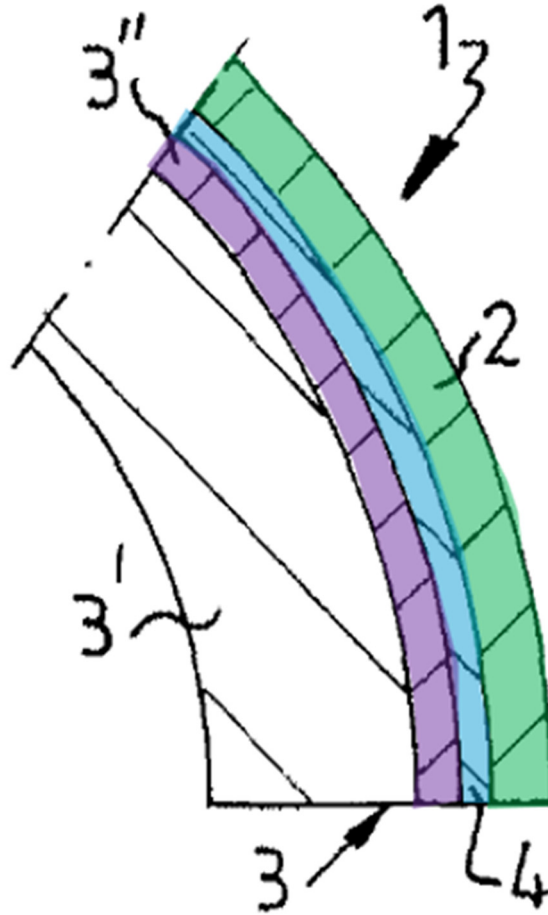


FIG.3a

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

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

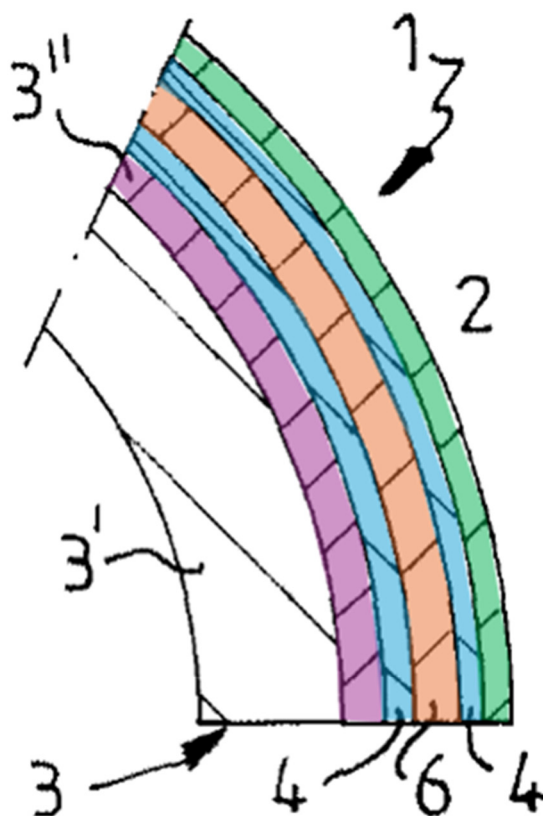


FIG.3b

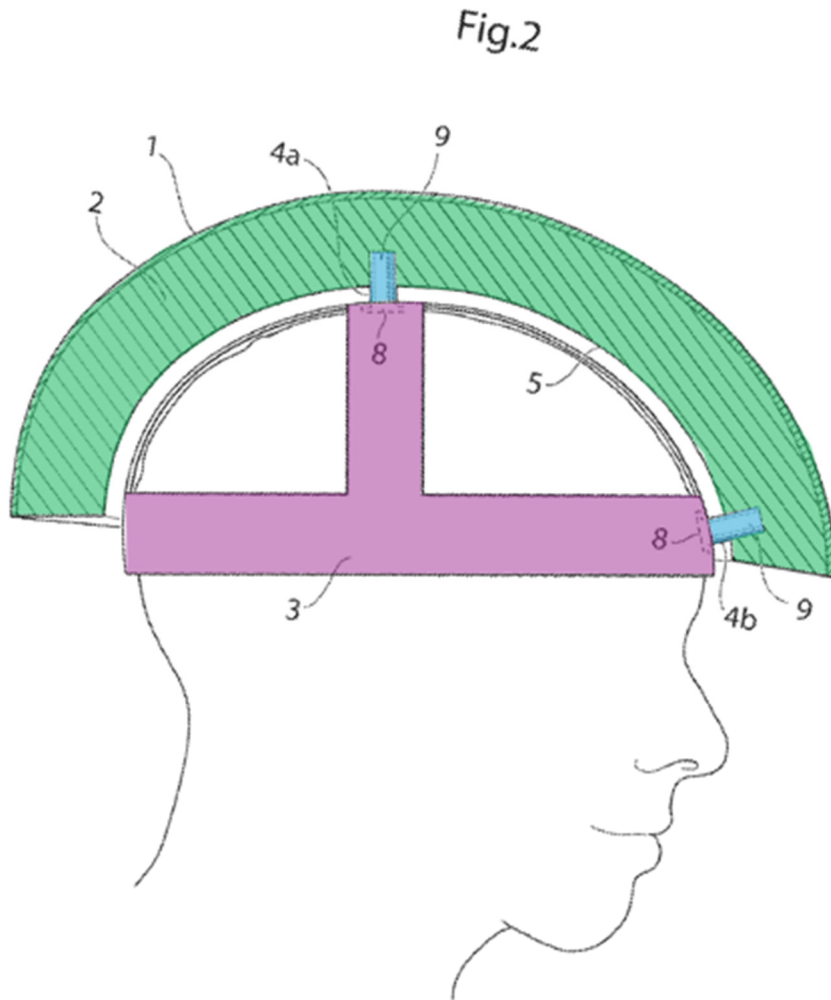
Ex.1005[VonHolst], Fig. 3b. Ex.1002, ¶¶68-69.

C. WO2011/139224 (“Halldin”)

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

Ex.1006[Halldin], [0013]. Halldin’s helmet has **outer shell 1**, **energy absorbing layer 2**, and **inner attachment device 3**. Ex.1006[Halldin], [0046-47]. **Fixation members 4a and 4b** fix **attachment device 3** to the **energy absorbing layer**, and

upon impact allow “energy absorbing layer 2 to slide in relation to” attachment device 3. Ex.1006[Halldin], [0046-47].



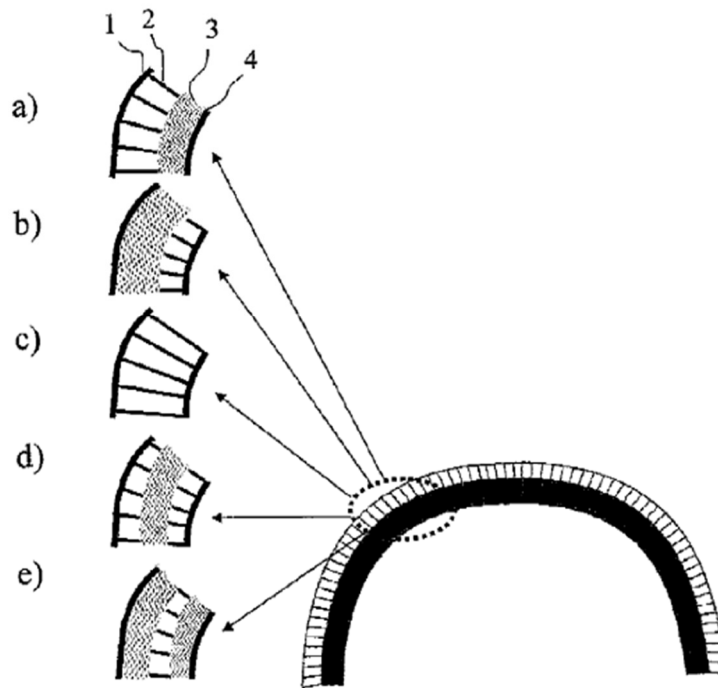
Ex.1006[Halldin], Fig. 2. Ex.1002, ¶¶70-71.

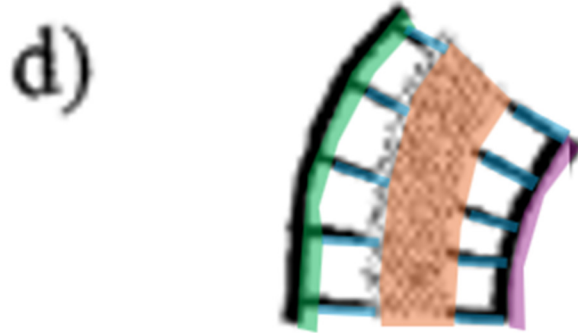
D. US2013/012,256 (“Kleiven”)

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, ¶¶72-73.

Figures 1 and 2 disclose **outer layer 1**, **inner layer 4**, **spikes 2**, and **energy absorbing foam 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], Figs. 2, 2(d). Ex.1002, ¶¶74-75.

E. US2004/0250340 (“Piper”)

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

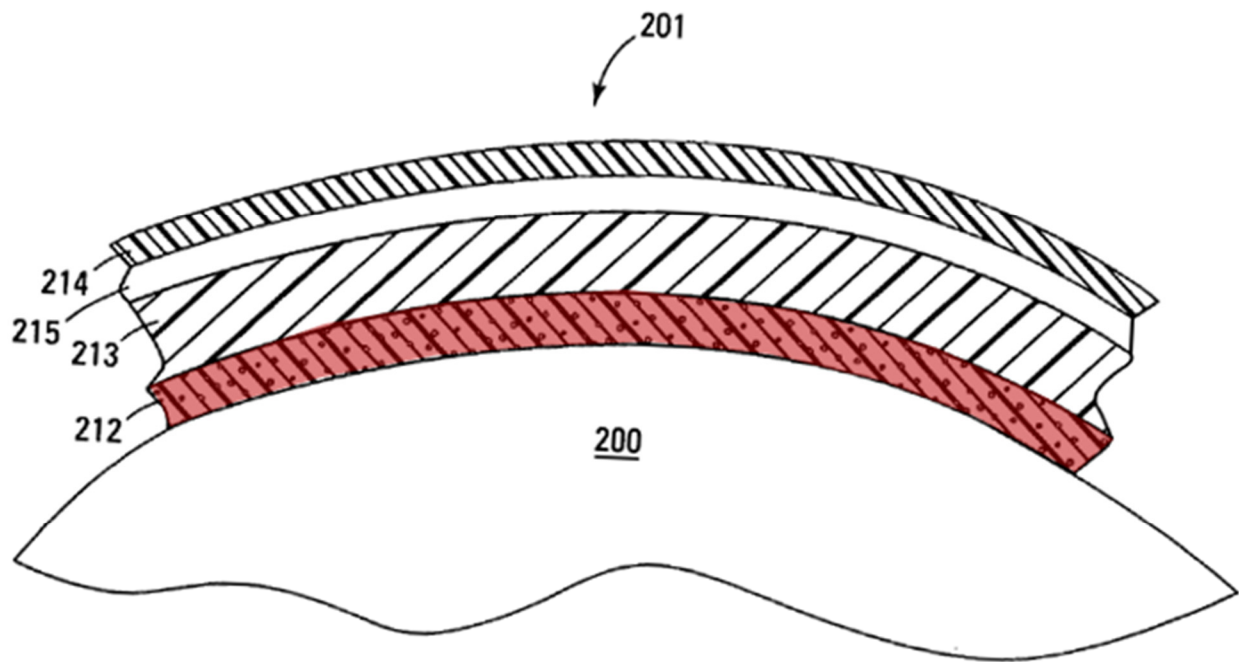
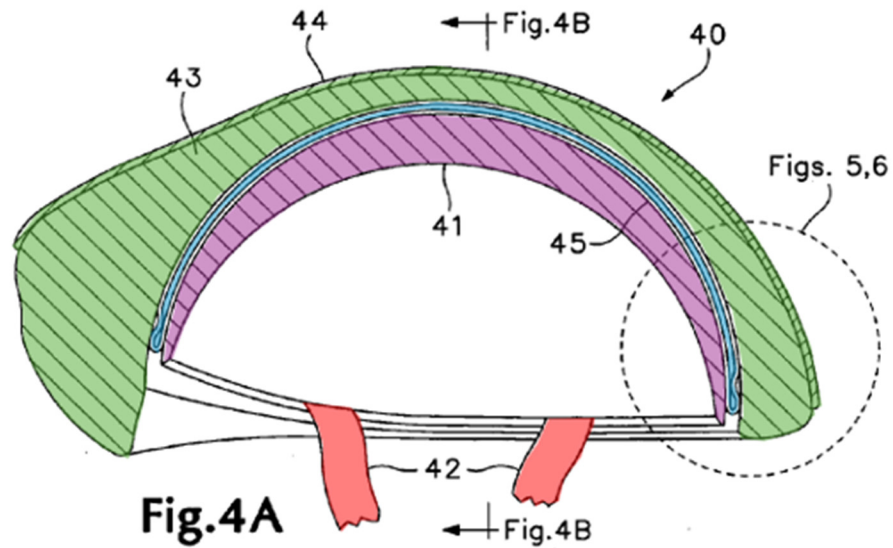


Fig. 3

Ex.1009[Piper], Fig. 3. Ex.1002, ¶¶76-78.

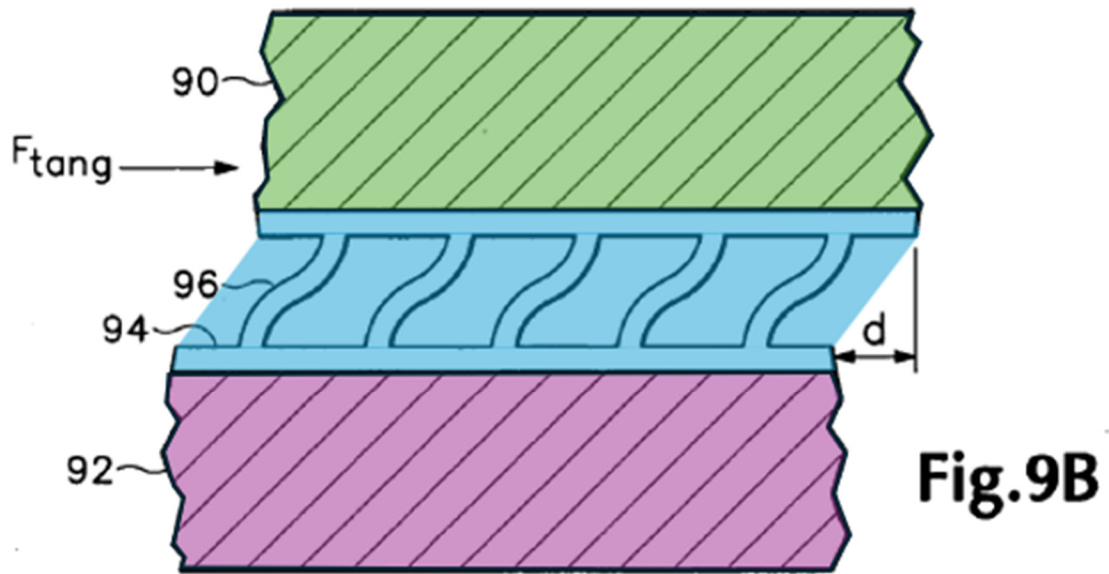
F. US2004/0117896 (“Madey”)

Madey’s helmets have **outer helmet layer 43/44**, **inner helmet layer 41**, and **interface layer 45**, which allows “outer helmet layer to displace with respect to the inner helmet layer, thereby absorbing and/or diverting forces.” Ex. 1047[Madey], Abstract, Figs. 4A, 5. Ex.1002, ¶¶79-80.



Ex.1047[Madey], Fig. 4A. Ex.1002, ¶80.

Figure 9B describes an embodiment where “**interface layer 94** disposed between [outer and inner] layers 90 and 92...comprises a lamellar structure of **hyper-elastic columns 96**,” that bend and stretch upon impact, thereby deflecting and absorbing it. Ex.1047[Madey], [0037]. Ex.1002, ¶80.



Ex.1047[Madey], Fig. 9B. Ex.1002, ¶80.

IX. CLAIM CONSTRUCTION

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

X. SPECIFIC GROUNDS FOR UNPATENTABILITY

Under 37 C.F.R. § 42.104(b)(4)-(5), and as Dr. Duma confirms (Ex.1002, ¶¶81–343), the prior art anticipates and/or renders obvious the Challenged Claims.

A. Ground 1: Weber Anticipates Claims 1, 5, 7-10, and 16-19

Weber discloses Claims 1, 5, 7-10, and 16-19 arranged as in each
Challenged Claim for the reasons below.

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

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

<i>Weber</i>	<i>Weber Provisional</i>
FIG. 2	FIG. 2
FIG. 4	FIG. 3
[0002]	p. 3: helmets to e.g. “reduce...rotational brain injury [and] shearing of brain matter...”
[0004]	pp.3, 4, 5: linear and rotational translation and acceleration, injuries 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]	p.4: “omni-directional impact energy management system...to significantly reduce the rotational and linear forces...from impacts”
[0036]	pp.4, 5, 6: helmet layers including inner comfort liner contacting wearer’s head
[0037]	pp.4, 5: engagement between liners and allowance of movement to reduce force and acceleration from outer shell
[0038]	p.5: multiple layers with omni-directional control using components with or without air gaps
[0039]	p.5: outer liner fixed to inside of helmet shell
[0040]	p.5: “inner and outer liners” and their engagement using isolation dampers; Figure 2 embodiment
[0041]	
[0042]	pp.4, 5: outer liner affixed to outer shell
[0043]	pp.5, 6: “inner and outer liners” and their engagement using isolation dampers, Figure 2 embodiment, and flex bumpers and their properties
[0044]	p.5: “inner liner” and engagement by head through “comfort liner”; “restraint” “managed by the chin-strap

	or neck security device commonplace on all helmets” p.6: stops to prevent over-rotation
[0045]	pp. 4, 5, 6: intermediate liners and their materials and comfort liner
[0046]	p.6: “flex bumpers” ⁴ (isolation dampers) and their makeup and properties, including absorbing energy
[0047]	pp.6, 5: lugs and the control of the relative movement of the inner and outer layer through “various means of suspension, dampening, and motion controlling components”
[0048]	p.6: lugs and “flex bumpers” (isolation dampers), their properties, and use in multiple layers
[0049]	pp.3, 4: air-filled bladders and managing forces, air gaps and relative movement of layers
[0050]	pp.5, 7: relative movement of layers and use of “flex bumpers” (isolation dampers) in such movement
[0056]	pp.4, 6: properties and operation of liners and layers (including “flex bumpers” (isolation dampers)) to allow relative movement and absorb energy
[0062]	p.6: materials for “flex bumpers” (isolation dampers)

Ex.1002 ¶¶84-85.

⁴ Weber Provisional uses “flex bumpers” and “isolation dampers” interchangeably.

Ex.1014[WeberProv], 3. Ex.1002, ¶85 n.6.

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

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

Ex.1002, ¶86.

2. Claim 1

a) 1[preamble]: “Protective gear comprising:”

Weber discloses “*helmets* that *protect* the human head” against impacts “to significantly reduce the likelihood of both translational and rotational brain injury and concussions.” Ex.1004[Weber], [0002], Fig. 4. The ’536 Patent specifies “helmets” are “protective gear.” Ex.1001, 2:43. Ex.1002, ¶87.

b) 1[a]: “a first layer;”

Weber discloses 1[a]. Weber’s “outer shell” and “outer liner” “affixed directly to the inside surface of the outer shell,” Ex.1004[Weber], [0039], [0042], Figs. 2, 4, is a “first layer.” See Ex.1001[USP536], 1:29-35. Weber equates “layers” and “liners.” See, e.g., Ex.1004[Weber], [0036], [0038]. Ex.1002, ¶¶88-89.

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

Weber discloses 1[b]. Weber’s “one or more additional layers or liners” “inserted between an inner liner and outer liner” and made of, e.g., EPS, are a “second layer.” Ex.1004[Weber], [0045]. Ex.1002, ¶¶90-91.

Weber further discloses a “first energy transformer,” i.e., **isolation dampers** or air gaps between the outer liner and intermediate liner. Ex.1004[Weber], [0045-46], Fig. 4. Dampers and surrounding air gaps are distributed throughout the helmet, as seen in Figure 4. *Id.*, [0038], [0045-46]. Ex.1002, ¶¶92-93.

The ’536 Patent explains “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[USP536], 2:22-25. It thus explains “connections” may be “indirect” (i.e., “through” an energy and impact transformer) or layers may be “loosely connected.” *See, e.g.*, Ex.1001[USP536], 8:42-48, 10:40-47. In this way, Weber’s **second layer** and **first layer** are connected through **dampers** and air gaps as shown below.

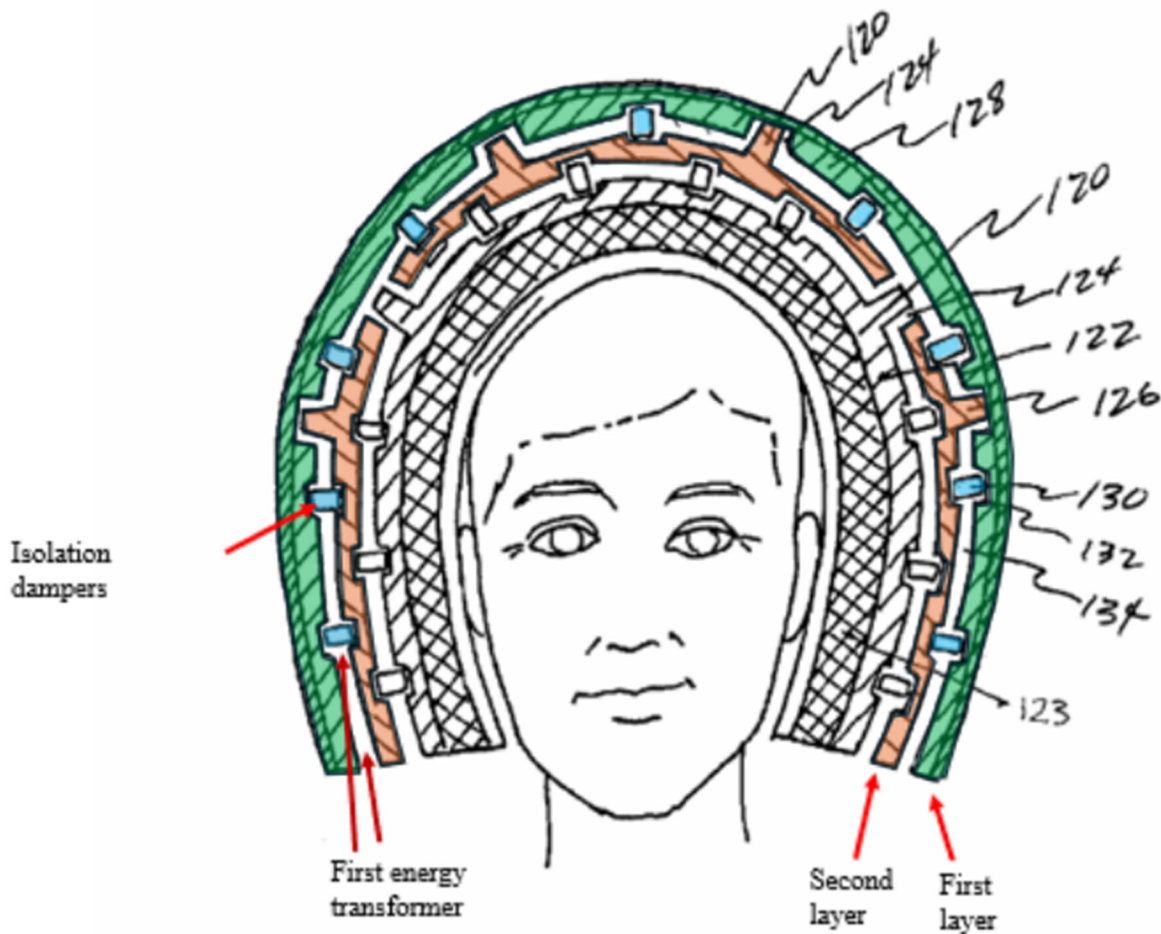


Fig. 4

Ex.1004[Weber], Fig. 4; *see also id.*, [0037], [0046]; Ex.1002, ¶¶94-95.

As Weber explains and Dr. Duma confirms, these dampers and air transform energy from impact force to movement and heat. *E.g.*, Ex.1004[Weber], [0034] (“[O]mnidirectional impact energy management systems...significantly reduce both rotational and linear forces generated from impacts imparted to the helmets.”); *see also* Ex.1001[USP536], 6:57-63 (fluids, gels absorptive/dissipative materials). Isolation dampers 130, disposed between the “*outer liner*[...]128 and/or the

intermediate liner 126,” “*dissipate*” impact energy. Ex.1004[Weber], [0045]. Isolation dampers 130 “flex, bend, and/or compress to *absorb* the energy of impacts to the helmet...and thereby enable the...*intermediate liner*...126 to move relative to...the outer liner 128.” Ex.1004[Weber], [0046]. Weber’s air gaps also facilitate relative movement between the outer and inner liners. Ex.1004[Weber], [0049], [0046]. Ex.1002, ¶¶92-96.

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

Weber discloses 1[c]. Weber discloses isolation dampers “*dissipate*” or “*absorb the energy of impacts* to the helmet.” Ex.1004[Weber], [0044-46]. Weber’s air gaps also facilitate relative movement between the outer and other liners. Ex.1004[Weber], [0049], [0046]. Weber recognizes, consistent with the ’536 Patent, Ex.1001[USP536], 9:10-13, Fig. 5, that relative sliding allowed by isolation dampers and air gaps absorbs energy from forces imparted onto the outer shell/liner (first layer). Ex.1004[Weber], [0037] (relative movement/displacement “reduce[s] the transfer of forces and resulting accelerations originating from the hard outer shell of the helmet to the head and brain of a wearer”); *id.* [0046] (isolation dampers “absorb the energy of impacts”). See Section X.A.2.c). Ex.1002, ¶97.

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

Weber discloses 1[d]. Weber's isolation dampers are made of materials that absorb and/or dissipate energy. Weber discloses isolation dampers made of "elastomeric materials, including MCU (micro-cellular urethane)," that "flex, bend, and/or compress to absorb the energy of impacts to the helmet from all directions." Ex.1004[Weber], [0062], [0046], [0050], [0043]. Ex.1002, ¶98.

Weber's isolation dampers "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].⁵ Dr. Duma explains that this mechanical deformation dissipates energy, and the lateral/rotational movement of the liners in Weber's helmet is relative sliding between the outer and inner liners allowed by isolation dampers 130 as 1[d] requires. Ex.1002, ¶99.

⁵ 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 ¶¶64 n.3, 99.

In addition, Dr. Duma explains that air gaps allow the, e.g., fluid (air) to absorb and dissipate energy from impact force through compression, displacement, and fluid flow, which generates heat. Ex.1004[Weber], [0049]. As also recognized by the specification, fluids and gels are absorptive/dissipative materials. Ex.1001[USP536], 6:42-44. Air is a type of fluid. Ex.1002, ¶¶100-102.

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

Weber discloses 1[e]. Weber describes “one or more additional layers or liners” “between an *inner liner* and outer liner.” Ex.1004[Weber], [0045]. Weber also describes a second energy transformer, *i.e.*, **isolation dampers** or air gaps between the inner and intermediate liners. *See* Ex.1004[Weber], [0045]; Section X.A.2.c). Figure 4 shows **inner** (third layer) and **intermediate** (second layer) liners connected through the **isolation dampers** with surrounding air gaps. Ex.1004[Weber], [0038], [0045-46], Fig. 4. Ex.1002, ¶103.

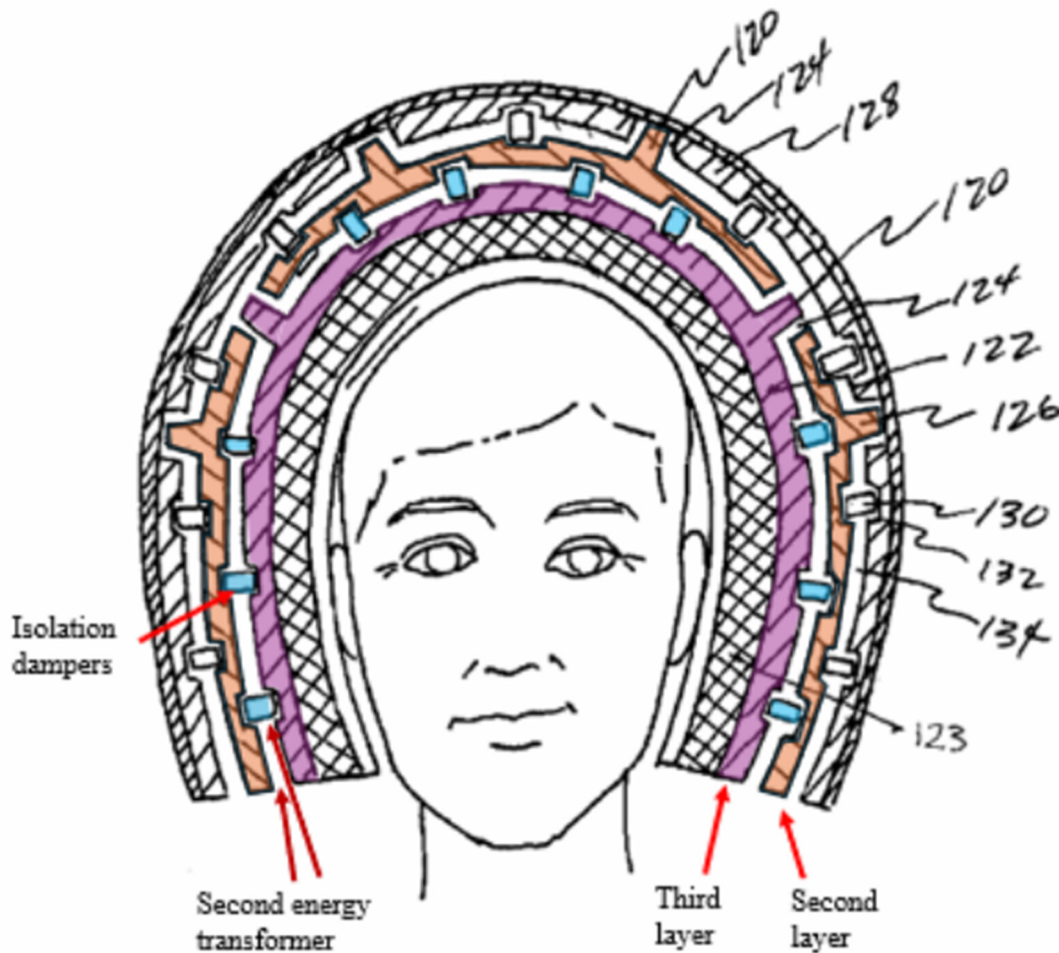


Fig. 4

Ex.1004[Weber], Fig. 4

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

Each of Weber’s inner dampers and air gaps disclose 1[f] for the same reasons as 1[d]. Section X.A.2.e). Ex.1004[Weber], [0046], [0048], [0062]. Ex.1002, ¶104.

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

Weber discloses 1[g] for the same reasons as 1[c]. 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 (first layer) through the first dampers/air at least to the intermediate liner (second layer). Weber also discloses additional inner isolation dampers/air between the intermediate and inner liners allow relative movement to further absorb energy, like their operation between the outer and intermediate liners. Ex.1004[Weber], [0056] (isolation dampers used to control “impact force” and “how it is transferred from one liner to another liner”). Weber further confirms isolation dampers and surrounding air gaps are “*disposed between*, e.g., the *inner* and outer liners 122 and 128 *and/or the intermediate liner 126 to further dissipate the energy of impacts.*” Ex.1004[Weber], [0045]. See Section X.A.2.f). Ex.1002, ¶105.

Thus, Weber anticipates claim 1. Ex.1002, ¶106.

3. Claim 5

“The protective gear of claim 1, wherein the first layer is a first shell layer and the second layer is a second shell layer.”

Weber discloses claim 1. Section X.A.2. Weber discloses the additional limitation of claim 5. Weber’s outer liner affixed directly to the inside surface of the outer shell, *id.* [0039], [0042], Figs. 2, 4, is a “first shell layer.” Weber’s “one or

more additional layers or liners” “inserted between an inner liner and outer liner” and made of, e.g., EPS, is a “second shell layer.”⁶ Ex.1004[Weber], [0045]. Ex.1002, ¶¶107-109.

Thus, Weber anticipates claim 5. Ex.1002, ¶¶110.

4. Claim 7

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

Weber discloses claim 1. Section X.A.2. Weber discloses the additional limitation of claim 7. Weber discloses, e.g., isolation dampers 130 “**absorb** the energy of impacts to the helmet.” Ex.1004[Weber], [0046]; *id.*, [0009], [0056]. Sections X.A.2.d)-X.A.2.e). Ex.1002, ¶111.

⁶ The ’536 Patent does not define “shell,” but states outer, middle, and inner “shells” “may vary in weight and strength,” “may” have certain characteristics, and may be constructed using a non-limiting set of materials including “plastics, resins, metal, composites,” and others denoted with “etc.” Ex.1001[USP536], 10:12-14, 11:3-10. Weber’s outer and intermediate “liners” disclose to a POSA “shell layers” because they, for example, span the entirety of the helmet and are made of EPS (a plastic constructed from a plastic resin). Ex.1049[Epssole]; *see also* Ex.1031[Bosch], 2 (standard for different materials at outer and inner layers). Ex.1002, ¶¶108-109.

Thus, Weber anticipates claim 7. Ex. 1002, ¶112.

5. Claim 8

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

Weber discloses claim 1. Section X.A.2. Weber discloses the additional limitation of claim 8. Weber’s helmets “significantly reduce the likelihood of both translational and **rotational** brain injury and concussions,” and “engagement between the inner and outer liners enables a controlled, omnidirectional **relative movement** between the two liners to reduce the transfer of **forces** and resulting accelerations originating from the hard outer shell of the helmet to the head and brain of a wearer.” Ex.1004[Weber], [0002], [0037], [0045-46] (isolation dampers between inner/intermediate and intermediate/outer liners “further dissipate” and “absorb the energy of impacts”); [0038] (air gaps). Weber recognizes impact forces addressed by its helmets include “both **rotational** and linear **forces**” and “**shear forces**.” Ex.1004[Weber], [0006], [0009]. Thus, Weber’s helmet is operable to absorb energy from rotational acceleration and shearing upon impact. Ex.1002, ¶113.

Thus, Weber anticipates claim 8. Ex.1002, ¶114.

6. Claim 9

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

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

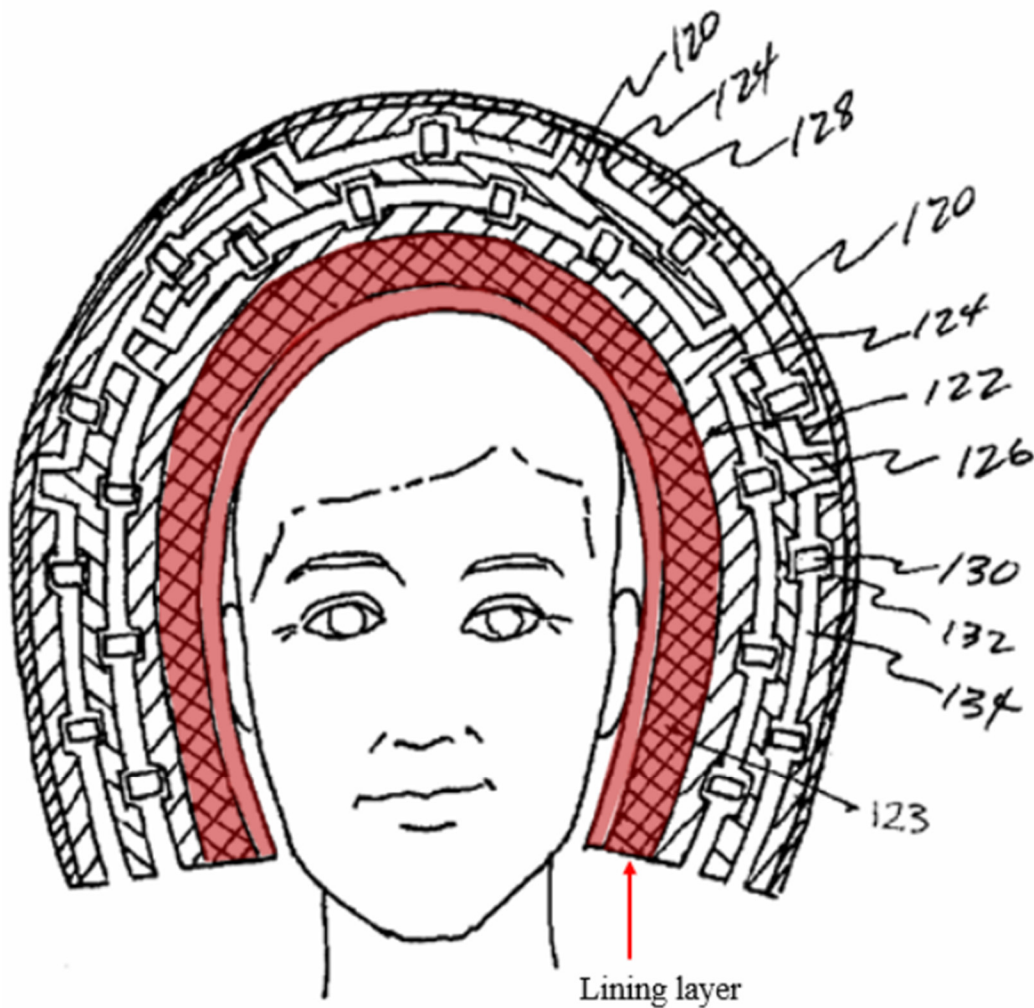


Fig. 4

Ex.1004[Weber], Fig. 4. Ex.1002, ¶115.

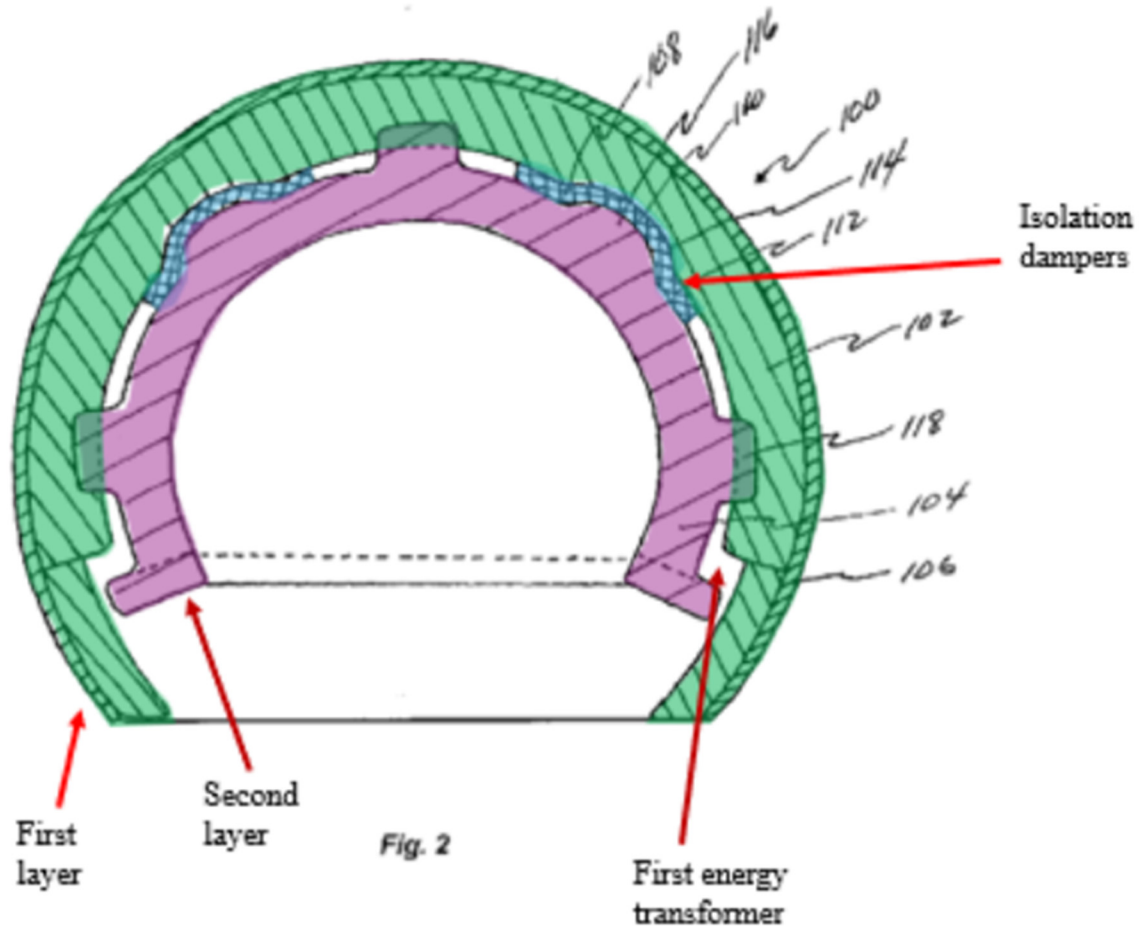
7. Claim 10

a) 10[preamble]: “Protective gear comprising:”

Weber discloses “protective helmets.” Ex.1004[Weber], [0002]. The ’561 Patent specifies “helmets” are “protective gear.” Ex.1001[USP536], 2:43; Ex.1002, ¶116.

b) 10[a]: “a first layer;”

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



Ex.1004[Weber], Fig. 2, [0039-40]; Ex.1002, ¶117.

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

Weber discloses 10[b]. Weber discloses a second layer (**inner liner 104**). Weber states the “outer liner 102 [is] disposed circumferentially around a similarly shaped **inner liner 104**.” Ex.1004[Weber], [0042]. Ex.1002, ¶118.

Weber further discloses a first energy transformer composed of isolation dampers 108 or air gaps between first and second layers (liners 102 and 104), such

that liners 102 and 104 are connected through it. Dampers 108 are “a plurality of resilient, e.g., elastomeric, structures.” Ex.1004[Weber] [0040]. Weber states “isolation dampers 108 are disposed between the inner and outer liners 104 and 102,” Ex.1004[Weber], [0041], and “inner and outer liners 104 and 102 are coupled to each other” through the isolation dampers. Ex.1004[Weber], [0040]. Section X.A.2.c). Ex.1002, ¶¶119-120.

As Section X.A.2.d) discusses, dampers and air gaps transform energy. Ex.1002, ¶97.

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

Weber discloses 10[c]. Weber discloses isolation dampers “dissipate” or “***absorb the energy of impacts*** to the helmet.” Ex.1004[Weber], [0044-46]; *id.*, [0037] (“shock absorbing and dampening components”), [0040] (“plurality of resilient...elastomeric, structures”). As Dr. Duma explains, Weber discloses that its air gaps facilitate relative movement between the outer and inner liners. Ex.1004[Weber], [0049], [0046]. Weber further recognizes, consistent with the ’536 Patent, Ex.1001[USP536], 9:10-13, Fig. 5, that relative sliding allowed by isolation dampers absorbs energy from forces imparted onto the first layer. Ex.1004[Weber], [0037] (relative movement/displacement “reduce[s] the transfer of forces and resulting accelerations originating from the hard outer shell of the helmet”); *id.*

[0046] (dampers “absorb the energy of impacts”). Section X.A.2.c)-X.A.2.d).
Ex.1002, ¶121.

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

Weber discloses 10[d]. As Section X.A.2.e) discusses, Weber’s isolation dampers and air gaps are made of material that absorbs and/or dissipates energy.
Ex.1002, ¶¶122-123.

As Section X.A.2.e) also discusses, Weber’s isolation dampers and air gaps allow relative sliding of layers. Ex.1002, ¶99.

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

Weber discloses 10[e]. Weber’s inner liners, including Figure 2 inner liner/second layer 104, are “disposed in contact with the wearer’s head, either directly or via a fitment or so-called ‘comfort liner.’” Ex.1004[Weber], [0036]; *id.*, [0044] (describing “‘comfort’ liner (not illustrated)”), [0050]. This “comfort liner” is connected to the second layer and configured to conform to a human head. Section X.A.6. Ex.1002, ¶124.

Thus, Weber anticipates claim 10. Ex. 1002, ¶125.

8. Claim 16

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

Weber discloses claim 10. Section X.A.7. Weber discloses the additional limitation of claim 16 for the reasons discussed for 10[c] and claim 7 and anticipates it. *See* Sections X.A.7.d), X.A.4. Ex.1002, ¶¶126-127.

9. Claim 17

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

Weber discloses claim 10. Section X.A.7. Weber discloses the additional limitation of claim 17 for the reasons discussed for 10[c] and claim 8 and anticipates it. *See* Sections X.A.7.d), X.A.5. Ex.1002, ¶¶128-129.

10. Claim 18

Weber discloses claim 18 for the same reasons as claim 1. Section X.A.2; Ex.1002, ¶130. Further:

a) 18[preamble]: “A helmet comprising:”

Weber discloses the preamble. *See* Section X.A.2.a); Ex.1002, ¶131.

b) 18[a]: “a first layer;”

Weber discloses 18[a] for the same reasons as 1[a]. Section X.A.2.b). Ex.1002, ¶132.

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

Weber discloses 18[b] for the same reasons as 1[b]. Section X.A.2.c). Ex.1002, ¶133.

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

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

Ex.1002, ¶134.

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

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

Ex.1002, ¶135.

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

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

Ex.1002, ¶136.

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

Weber discloses element 18[f] for the same reasons as 1[f]. Section X.A.2.g).

Ex.1002, ¶137.

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

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

Ex.1002, ¶138.

Thus, Weber anticipates claim 18. Ex.1002, ¶139.

11. Claim 19

a) “The helmet of claim 18, wherein a lining layer is connected to the third layer, wherein the lining layer is configured to conform to a portion of a human body.”

Weber discloses claim 18. Section X.A.7. Weber discloses the additional limitation of claim 19 for the same reasons as claim 9 and anticipates it. Section X.A.6. Ex.1002, ¶¶140-141.

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

1. Claim 20

a) “The helmet of claim 18, wherein the lining layer comprises foam.”⁷

Weber discloses claims 18 and 19. Section X.A.10-X.A.11. Weber combined with Piper discloses the additional limitation of claim 20. Piper discloses a “**comfort liner 212** next to the head 200 of the wearer” that is, e.g., “lower density, open-cell *foam* material that easily conforms to the head.” Ex.1009[Piper], [0109].

⁷ Claim 18 does not recite “lining layer,” but claim 19, which depends from claim 18, does. Solely for this IPR, and for all grounds, Petitioner addresses claim 20 as if dependent on claim 19. Ex.1002, n.14.

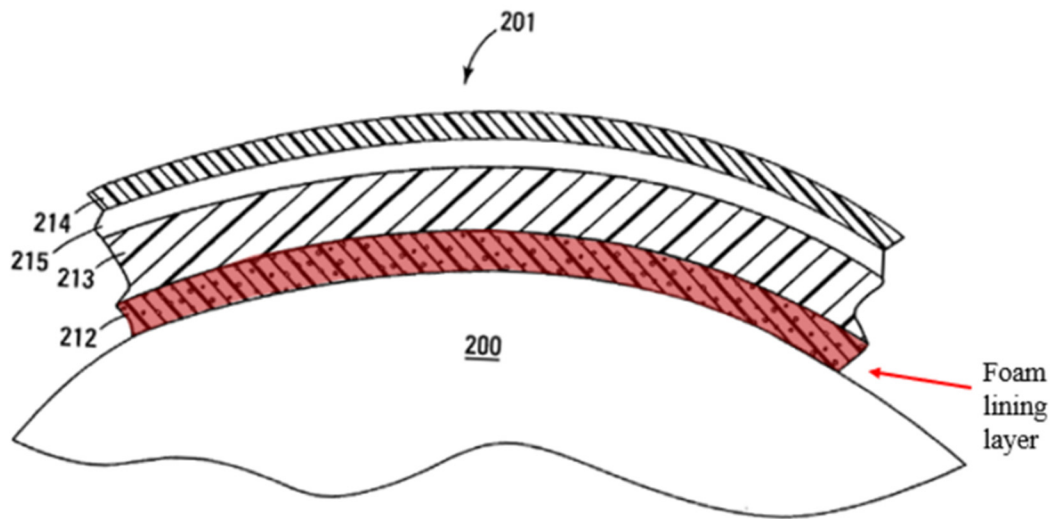


Fig. 3

Ex.1009[Piper] Fig. 3. Ex.1002, ¶142.

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

motivated to incorporate Piper’s more-specific comfort liner 212 in Weber’s helmet to not only provide comfort and improve fit, but achieve heat and sweat management. This heat-reducing characteristic would enhance helmet safety by reducing risks of heat stress and lowering the temptation to remove or omit a helmet due to heat. Indeed, foam comfort liners were standard in many helmets. Ex.1025[Newman], 47 (“[C]ycling helmets have typically used small polyester *foam* pads” as “comfort padding”). A POSA would have found it obvious to combine these elements as a matter of routine implementation, as it is a straightforward and predictable combination of known elements according to known methods to yield predictable results, and Weber’s general comfort liner is ready for improvement through incorporation of Piper’s liner. This known technique of using a foam comfort liner would improve Weber’s helmet in a similar way to Piper. Ex.1002, ¶¶143-147.

A POSA would have reasonably expected success using Piper’s comfort liner in Weber’s design. Weber generally teaches a “comfort liner” without explicitly describing details, and a POSA would have, as a matter of routine implementation, been able to configure Piper’s comfort liner to fit into Weber’s design. Ex.1002, ¶148.

C. Ground 3: Von Holst Anticipates Claims 1, 5-10, 12, and 16-20

Von Holst discloses Claims 1, 5-10, 12, and 16-20 arranged as in each Challenged Claim for the reasons below. Ex.1002, ¶150.

1. Claim 1

a) 1[preamble]: “Protective gear comprising:”

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

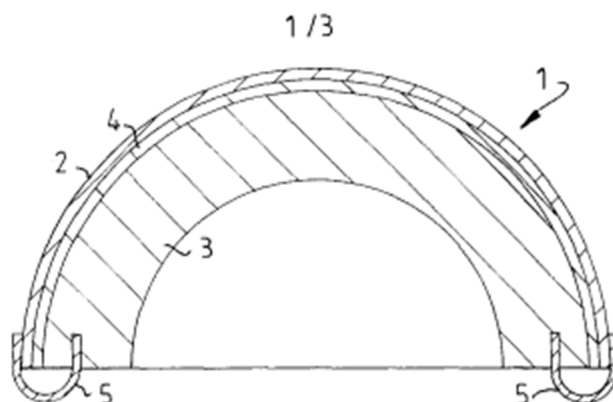


FIG. 1

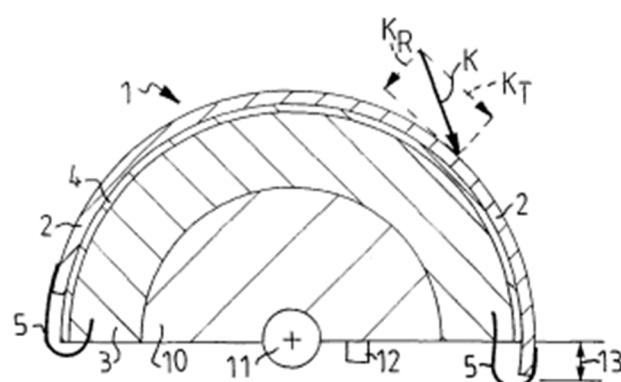


FIG. 2

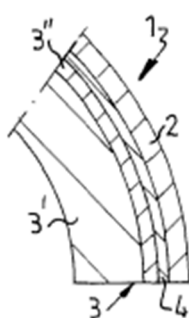


FIG. 3a

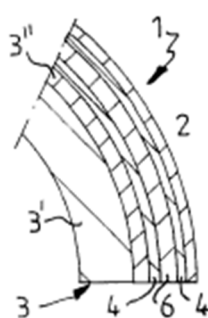


FIG. 3b

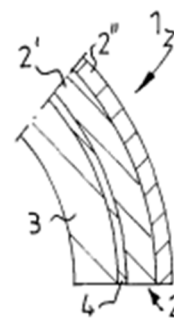


FIG. 3c

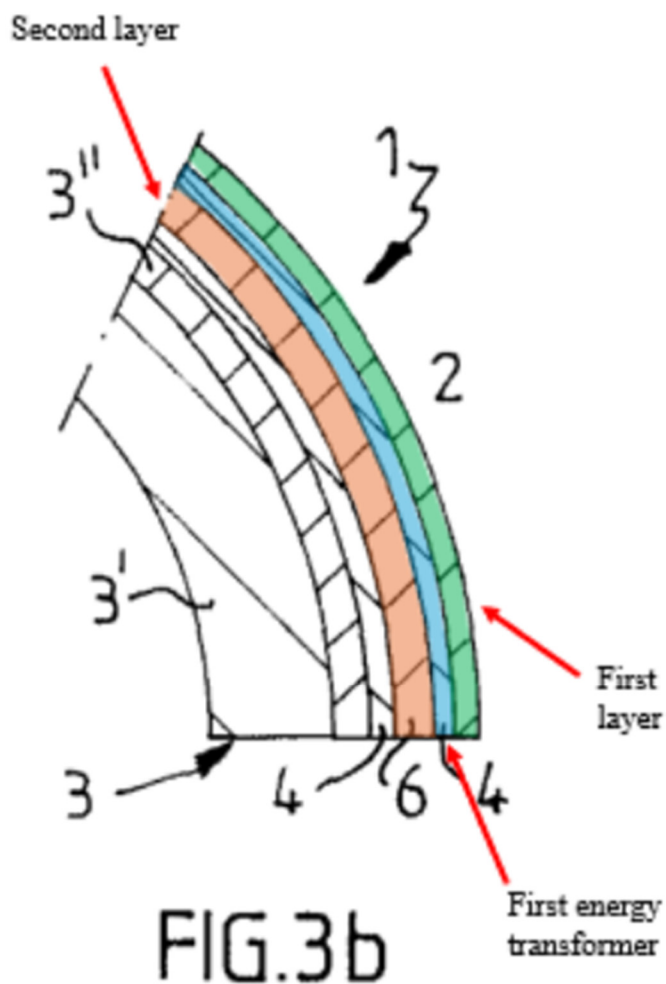
Ex.1005[VonHolst], 3:22-30, 4:10-14, Figs. 1-3, cls. 1-10. The '536 Patent specifies “helmets” are “protective gear.” Ex.1001[USP536], 2:43. Ex.1002, ¶151.

b) 1[a]: “a first layer;”

Von Holst discloses 1[a]. Von Holst discloses a helmet “constructed from an *outer shell 2*,” (a first layer). Ex.1005[VonHolst], 4:10-12, Figs. 1-3, cl. 1. Ex.1002, ¶152.

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

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

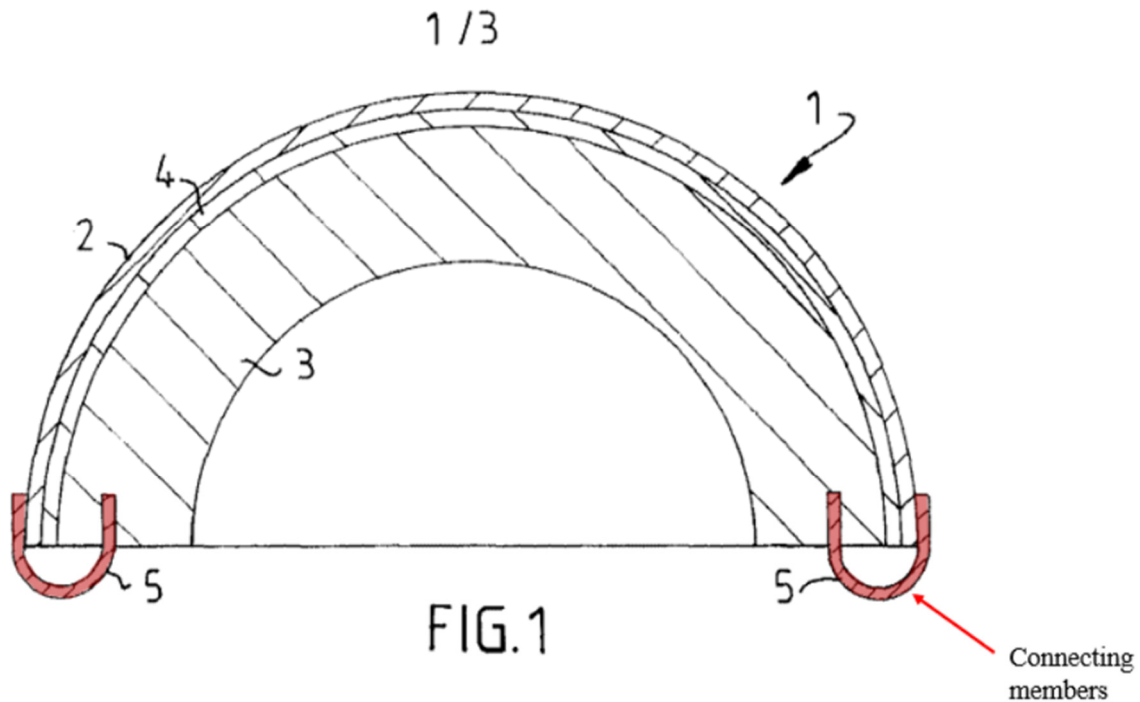


Ex.1005[VonHolst], Fig. 3b; *id.*, cls. 1, 4. Ex.1002, ¶153.

Von Holst's **intermediate shell 6** (second layer) and **outer shell 2** (first layer) are connected through **outer sliding layer 4** (first energy transformer), positioned between them. *See* Ex.1001[USP536], 2:18-22, 10:26-36. Ex.1002, ¶154.

Von Holst additionally includes “**connecting members**” that “absorb[] energy.” Ex.1005[VonHolst], 4:17-21; *id.*, 5:36-39 (Figure 3 “variant” of Figure 1

includes connecting members). As Figure 1 shows (as applicable to Figure 3), this “connecting member” connects outer and inner layers and layers in between.



Ex.1005[VonHolst], Fig. 1. Ex.1002, ¶¶155-156.

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

Von Holst discloses 1[c]. Both of Von Holst’s sliding layers 4 (made of “oil, Teflon, microspheres, air, rubber etc.”) absorb energy from forces imparted on the outer (first) layer. Ex.1005[VonHolst], 4:32-34, 6:8-10. Specifically, Von Holst’s sliding layers 4 absorb energy through relative sliding. Ex.1005[VonHolst], Abstract, 4:15-17, 5:31-34, 6:35-7:10, Figs. 3-6, cls. 1, 4. These layers further absorb energy as friction between the outer layer and sliding layer.

Ex.1005[VonHolst], 4:32-34, 6:8-10; 7:38-8:2 (describing friction between layers). Thus, outer sliding layer 4 (first energy transformer) absorbs energy from forces imparted onto the outer (first) layer. In Figure 3b, this energy absorption applies to both (inner and outer) sliding layers 4. *Id.*, 5:31-34, 6:35-7:10, Figs. 3-6, cls. 1, 4. Outer sliding layer 4 made of, e.g., oil, is a first energy transformer. Ex.1002, ¶¶157-158.

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

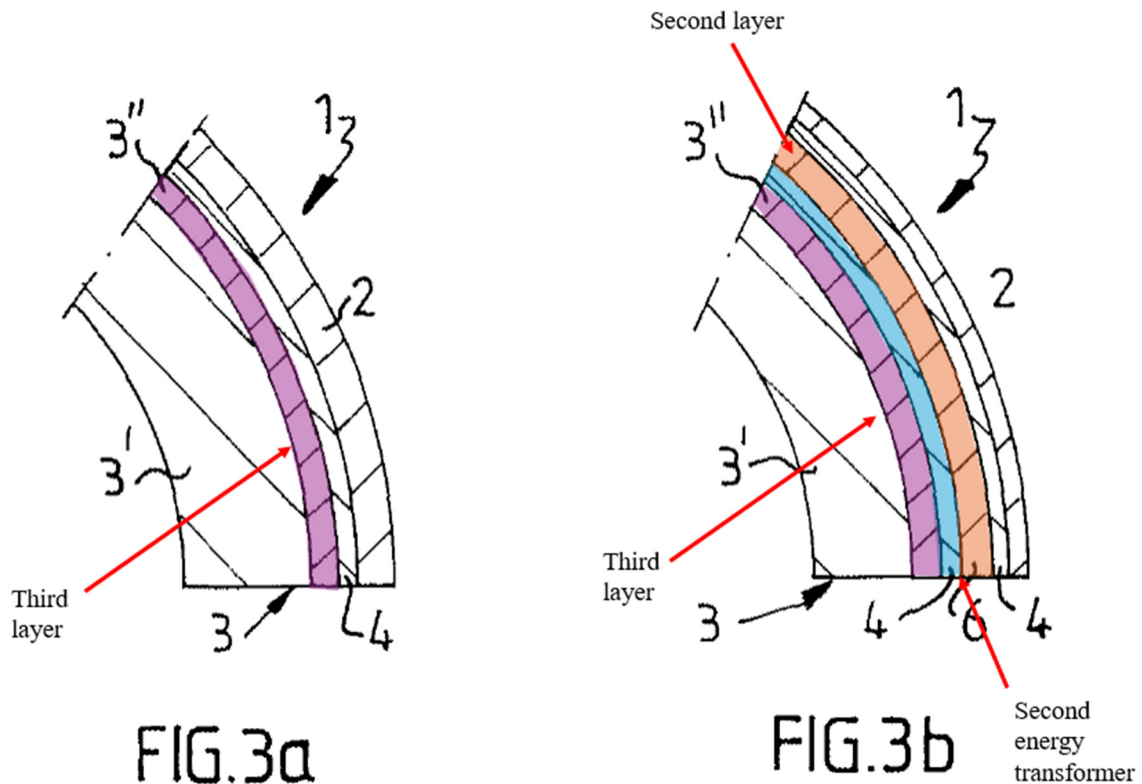
Von Holst discloses 1[d]. Von Holst’s inner and outer sliding layers (energy transformers) are made of, e.g., “oil, Teflon, microspheres, air, rubber etc.,” Ex.1005[VonHolst], 4:32-36, which are materials that absorb and/or dissipate energy via sliding and through the creation of heat from friction. *See* Ex.1001[USP536], 6:44-46. For example, Von Holst discloses “a significant improvement (lower force) of roughly 25% is obtained with an embodiment according to the invention” using “an oil film as the sliding layer.” Ex.1005[VonHolst], 5:21-34. Ex.1002, ¶160.

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

allowing the outer layer and intermediate layer to have “mutual displacement...by sliding.” Ex.1005[VonHolst], 8:12-14; *id.*, 6:2-10, Fig. 3b. Ex.1002, ¶161.

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

Von Holst discloses 1[e]. Von Holst discloses a helmet with **intermediate shell 6** (second layer) connected to an **outer layer 3** of inner shell 3 (third layer) through the **inner sliding layer 4** (second energy transformer). Between outer shell 2 and inner shell 3 Von Holst describes “two sliding layers 4, between which there is an intermediate shell 6.” Ex.1005[VonHolst], 5:38-6:6. In the Figure 3a-3b variants, “inner shell 3 is constructed from a **harder, relatively thin outer layer 3** and a softer, relatively thick inner layer 3'.” Ex.1005[VonHolst], 5:39-6:4. As shown below, intermediate and inner shells (6, 3) are connected through sliding layer 4. Section X.C.1.c). Ex.1002, ¶162.



Ex.1005[VonHolst], Figs. 3a-b. Ex.1002, ¶162.

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

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

Ex.1005[VonHolst], 4:32-36, 5:21-34. Ex.1002, ¶163.

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

Von Holst discloses 1[g] for the same reasons as 1[d] and 1[f]. Sections X.C.1.e), X.C.1.g). Ex.1005[VonHolst], 4:32-36, 5:21-34. At least some force imparted onto an outer helmet layer would travel through outer sliding layer 4 of,

e.g., oil (first energy transformer), to intermediate shell layer 6 (second layer). Inner sliding layer 4 would work like outer sliding layer 4 to absorb and/or dissipate energy from such force through relative sliding using absorptive/dissipative materials. Ex.1005[VonHolst], 4:32-36, 5:21-34. Inner sliding layer 4 of, e.g., oil (second energy transformer) is thus operable to absorb energy from forces imparted onto intermediate shell layer 6 (second layer) through outer sliding layer 4 (first energy transformer). Ex.1002, ¶164.

2. Claim 5

a) “The protective gear of claim 1, wherein the first layer is a first shell layer and the second layer is a second shell layer.”

Von Holst discloses claim 1. Section X.C.1. Von Holst discloses the additional limitation of claim 5. As Section X.C.1 discusses, Von Holst discloses a first layer of outer shell 2 (first shell layer) and a second layer of intermediate shell 6 (second shell layer). *See, e.g.*, Ex.1005[Von Holst], 1:5-7, 1:15-18, 2:34-35, 3:6, 4:10-21, Figs 1, 3. Ex. 1002, ¶¶166-168.

3. Claim 6

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

Von Holst discloses claim 1. Section X.C.1. Von Holst discloses the additional limitation of claim 6 and anticipates it. Von Holst discloses “two sliding

layers 4” “embodied differently and made of different materials,” including “lower friction in the outer sliding layer than in the inner.” Ex.1005[VonHolst], 6:6-10. Ex.1002, ¶¶169-170.

4. Claim 7

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

Von Holst discloses claim 1. Section X.C.1. Von Holst discloses the additional limitation of claim 7 and anticipates it. Von Holst’s helmets’ sliding layers allow relative displacement upon “oblique ***impact*** against the protective helmet.” Ex.1005[VonHolst], cl. 1. “In this way, impact ***energy from*** an oblique ***impact*** against the helmet can be absorbed during displacement between the outer shell and the inner shell.” Ex.1005[VonHolst], Abstract, 5:11-13. Sections X.C.1.d), X.C.1.g). Ex.1002, ¶¶171-172.

5. Claim 8

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

Von Holst discloses claim 1. Section X.C.1. Von Holst discloses the additional limitation of claim 8 and anticipates it. Von Holst’s helmets cause “***reduction in the rotational acceleration.***” Ex.1005[VonHolst], 6:30-33, 7:1-5. As Dr. Duma explains, reduction of rotational acceleration reduces shear. Ex.1002, ¶¶173-175.

6. Claim 9

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

Von Holst discloses claim 1. Section X.C.1. Von Holst discloses the additional limitation of claim 9 and anticipates it. Von Holst discloses in Figures 3a-3b “inner shell 3 is constructed from a harder, relatively thin outer layer 3” and a softer, relatively thick **inner layer 3'**.” Ex.1005[VonHolst], 5:39-6:4, cl. 6. Inner shell 3 “*contact[s]... the head of the wearer,*” Ex.1005[VonHolst], 9:13-15, and includes softer **inner layer 3'** (lining layer) made of “polyurethane *foam* or [expanded] polystyrene.” Ex.1005[VonHolst], 4:26-29.

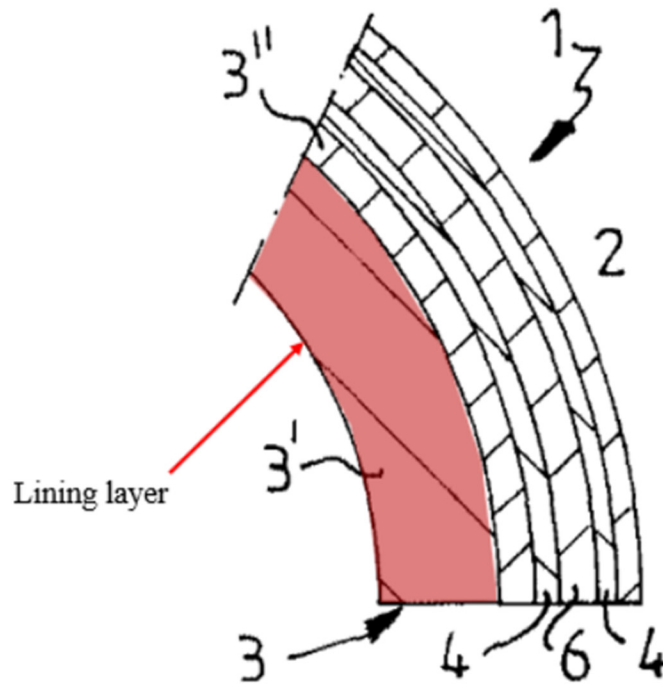


FIG.3b

Ex.1005[VonHolst], Fig. 3b. Ex.1002, ¶¶176-177.

7. Claim 10

a) 10[preamble]: “Protective gear comprising:”

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

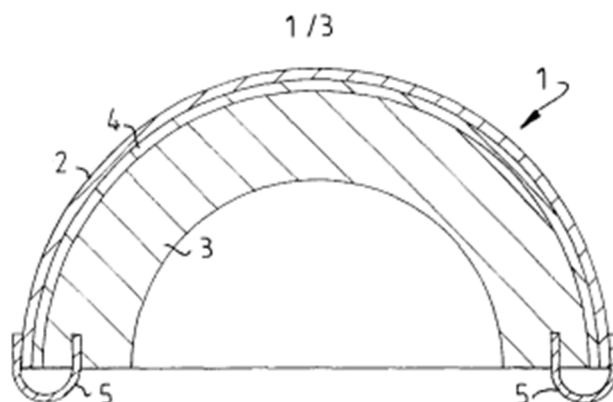


FIG. 1

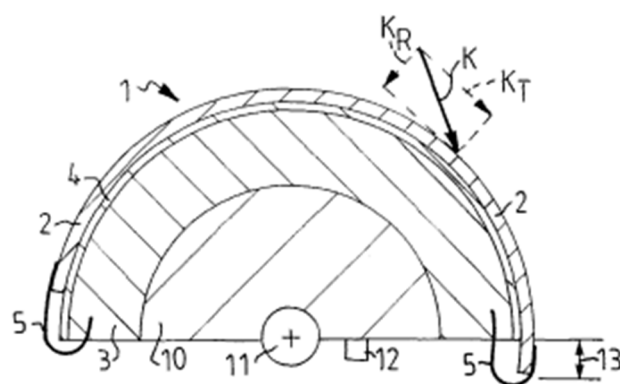


FIG. 2

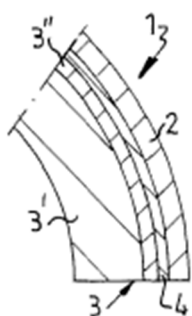


FIG. 3a

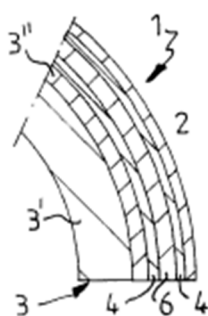


FIG. 3b

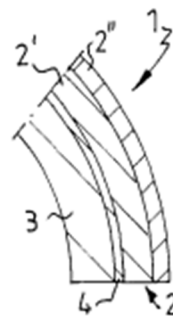


FIG. 3c

Ex.1005[VonHolst], Figs. 1-3. Section X.C.1.a). The '536 Patent specifies “helmets” are “protective gear.” Ex.1001[USP536], 2:43. Ex.1002, ¶178.

b) 10[a]: “a first layer;”

Von Holst discloses 10[a]. In, e.g., Figure 3a, Von Holst discloses a helmet “constructed from an *outer shell 2*,” which is a first layer. Ex.1005[VonHolst], 4:10-12, 5:36-6:2. Section X.C.1.b). Ex.1002, ¶179.

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

Von Holst discloses 10[b]. In Figure 3a, Von Holst discloses a second layer, **outer layer 3** of inner shell 3. Ex.1005[VonHolst], 4:15. Von Holst discloses second layer 3" is connected to the first layer 2 through a first energy transformer 4. Von Holst discloses that “sliding layer 4” of, e.g., oil “makes possible displacement between the outer shell 2 and the inner shell 3.” Ex.1005[VonHolst], 4:14-17, 5:38-6:2. The **sliding layer 4** (energy transformer), **outer layer 3** of inner shell 3 (second layer), and **outer shell 2** (first layer) are depicted below:

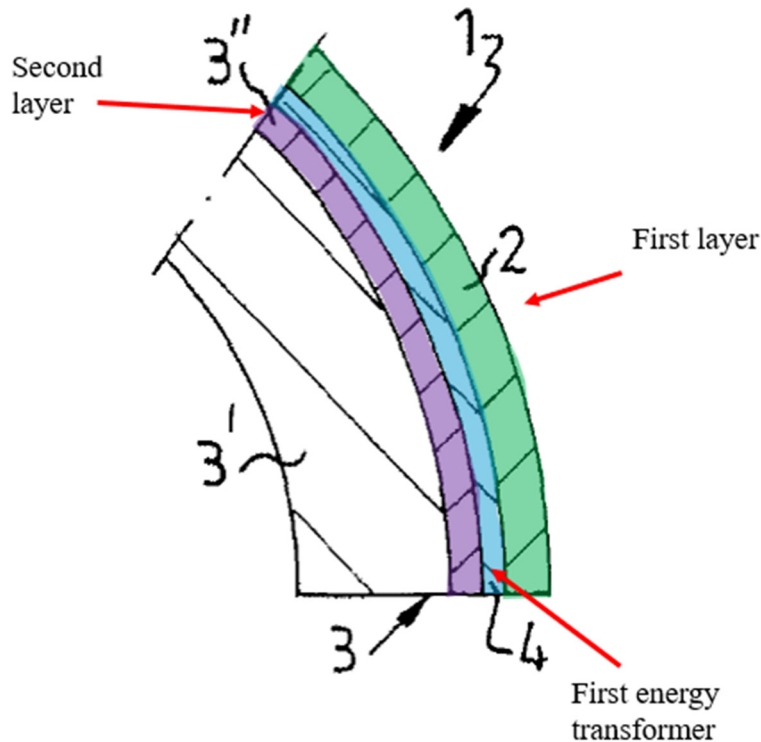


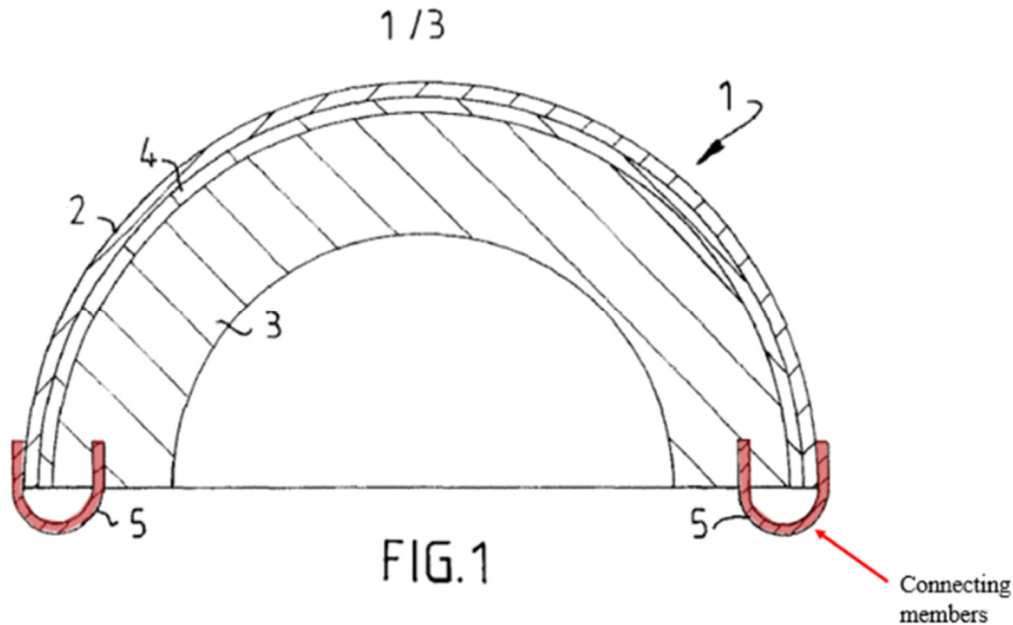
FIG. 3a

Ex.1005[VonHolst], Fig. 3a. Ex.1002, ¶¶180-181.

Von Holst's **outer layer 3''** of inner shell 3 (second layer) and **outer shell 2** (first layer) are connected through **sliding layer 4** of, e.g., oil (first energy transformer), positioned between them. *See* Ex.1001, 2:16-25, 10:37-47. Section X.C.1.c). Ex.1002, ¶182.

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

layers) and the sliding layer (energy transformer) in between. Ex.1005[VonHolst], Fig. 1.



Ex.1005[VonHolst], Fig. 1. Ex.1002, ¶183.

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

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

absorbs energy from mechanical forces imparted onto the outer (first) layer. *Id.*, 5:31-34, 6:35-7:10, Figs. 1, 3-6, cls. 1, 4. Section X.C.1.c)-X.C.1.d). Ex.1002, ¶184.

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

Von Holst discloses 10[d] for the reasons in 1[d] above. Section X.C.1.e). Von Holst’s sliding layer 4 is made of, e.g., “*oil*, Teflon, microspheres, *air*, rubber etc.,” Ex.1005[VonHolst], 4:32-36, which absorb or dissipate energy via sliding and through the creation of heat from friction. Ex.1001[USP536], 6:46 (“[A]bsorptive/dissipative material such as *fluids* and gels.”). For example, Von Holst discloses that “significant improvement (lower force) of roughly 25% is obtained with an embodiment” using “oil film as the sliding layer.” Ex.1005[VonHolst], 5:21-34.⁸ Ex.1002, ¶185.

Sliding layer 4 also allows outer shell 2 (first layer) to slide relative to **outer layer 3** of inner shell 3 (second layer). Ex.1005[Von Holst], 4:14-17; *id.*, 8:12-14 (“sliding layer...facilitates mutual displacement [between layers]...by sliding”). Section X.C.1.e). Ex.1002, ¶186.

⁸ Further, connecting members 5, e.g., made of “deformable strips of plastic or metal,” Ex.1005[VonHolst], 4:38-39, deform to absorb energy. Ex.1002, ¶185 n.18.

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

Von Holst discloses 10[e] for the reasons in claim 9. Section X.C.6. Further, Von Holst discloses “[i]n Fig. 3a, the inner shell 3 is constructed from a harder, relatively thin outer layer 3'' [second layer] and a softer, relatively thick inner layer 3' [lining layer].”

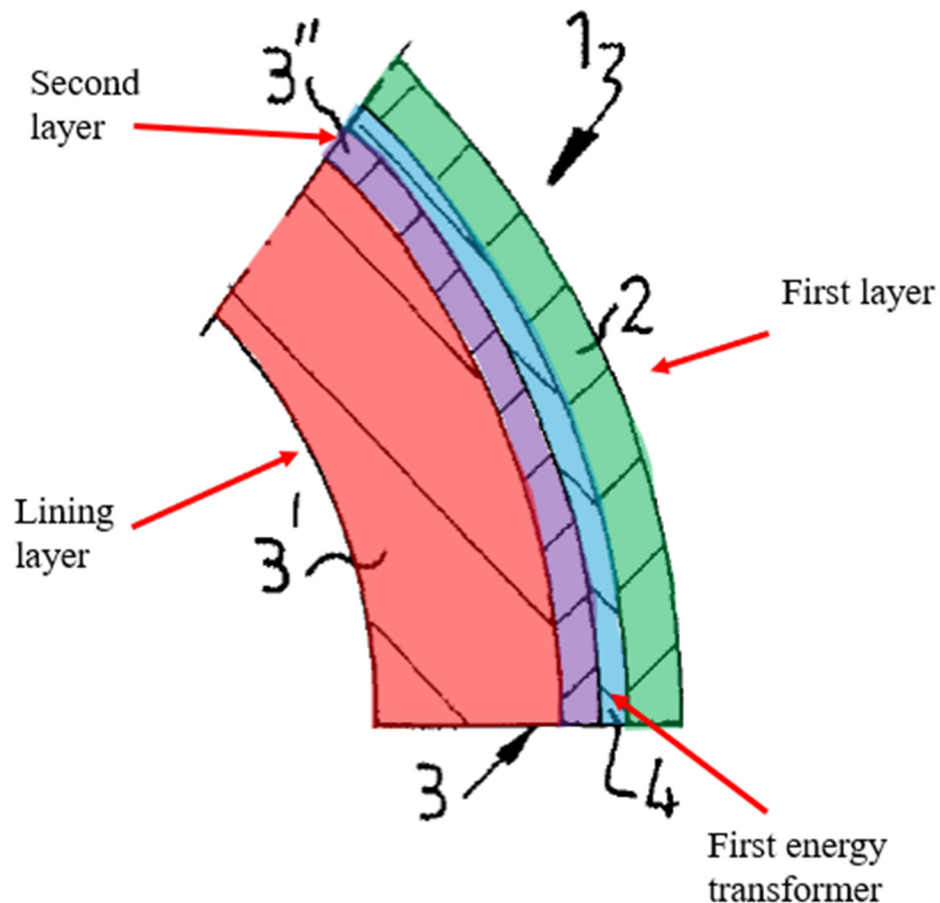


FIG. 3a

Ex.1005[VonHolst], 5:36-6:2, Fig. 3a. “[I]nner shell 3...is intended for contact with the head of the wearer.” Ex.1005[VonHolst], 4:12-13, 9:13-15. Von Holst’s inner shell 3, with softer inner layer 3', is “made of...polyurethane foam or expanded polystyrene.” Ex.1005[VonHolst], 4:26-29. Thus, the inner shell’s inner layer 3' is configured to conform to a human wearer’s head. Section X.C.6. Ex.1002, ¶¶187-188.

Thus, Von Holst anticipates claim 10. Ex.1002, ¶189.

8. Claim 12

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

Von Holst discloses claim 10. Section X.C.7. Von Holst discloses the additional limitation of claim 12 and anticipates it. Von Holst’s sliding layer 4 comprises, e.g., “oil” or “air,” which are fluids. Ex.1005[VonHolst], 4:32-34. Ex.1002, ¶¶190-191.

9. Claim 16

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

Von Holst discloses claim 10. Section X.C.7. Von Holst discloses the additional limitation of claim 16 for the same reasons as claim 7 and claim 10 (i.e., forces imparted onto the first layer and addressed by Von Holst’s Figure 1 and 3a

helmets include mechanical forces) and anticipates it. *Id.*; Section X.C.4. Ex.1002, ¶¶192-193.

10. Claim 17

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

Von Holst discloses claim 10. Section X.C.7. Von Holst discloses the additional limitation of claim 17 for the same reasons as claim 8 and claim 10 (i.e., forces imparted onto the first layer and addressed by Von Holst’s Figure 1 and 3a helmets include rotational and shear forces) and anticipates it. *Id.*; Section X.C.5. Ex.1002, ¶¶192-193.

11. Claim 18

Von Holst discloses claim 18 for the same reasons as claim 1. Section X.C.1; Ex.1002, ¶196. Further:

a) 18[preamble]: “A helmet comprising:”

Von Holst discloses 18[preamble] for the same reasons as 1[preamble]. Section X.C.1.a). Ex.1002, ¶197.

b) 18[a]: “a first layer;”

Von Holst discloses 18[a] for the same reasons as 1[a]. Section X.C.1.b). Ex.1002, ¶198.

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

Von Holst discloses 18[b] for the same reasons as 1[b]. Section X.C.1.c).

Ex.1002, ¶199.

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

Von Holst discloses 18[c] for the same reasons as 1[c]. Section X.C.1.d).

Ex.1002, ¶200.

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

Von Holst discloses 18[d] for the same reasons as 1[d]. Section X.C.1.e).

Von Holst’s sliding layer 4 of, e.g., oil is an absorptive/dissipative mechanism.

Ex.1002, ¶201.

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

Von Holst discloses 18[e] for the same reasons as 1[e]. Section X.C.1.f).

Ex.1002, ¶202.

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

Von Holst discloses 18[f] for the same reasons as 1[d], 1[f], and 18[d].

Sections X.C.1.e), X.C.1.g), X.C.11.e). Ex.1002, ¶203.

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

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

Thus, Von Holst anticipates claim 18. Ex.1002, ¶205.

12. Claim 19

a) “The helmet of claim 18, wherein a lining layer is connected to the third layer, wherein the lining layer is configured to conform to a portion of a human body.”

Von Holst discloses claim 18. Section X.C.11. Von Holst discloses the additional limitation of claim 19 for the same reasons as claim 9 and anticipates it. Section X.C.6. Ex.1002, ¶¶206-207.

13. Claim 20

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

Von Holst discloses claims 18 and 19. Sections X.C.11-X.C.12. Von Holst discloses the additional limitation of claim 20 and anticipates it. Von Holst discloses inner shell 3 with softer **inner layer 3'** “made of...polyurethane *foam*.” Ex.1005[VonHolst], 4:26-29. Ex.1002, ¶¶208-209.

D. Ground 4: Claims 1, 5-10, 12, and 16-20 are Obvious over Von Holst Combined with Halldin

1. Dynamic Drinkware Analysis: Halldin

The relied-upon subject matter in *Halldin* has 35 U.S.C. §112, first paragraph, support from *Halldin Provisional* (Ex.1015[HalldinProv]); Ex.1002, ¶¶210-211.

<i>Halldin</i>	<i>Halldin Provisional</i>
----------------	----------------------------

Fig. 1	Fig. 1
Fig. 2	Fig. 2
Fig. 3	Fig. 3
Fig. 4	Fig. 4
Fig. 11	Fig. 11
[Title]	[0001]
[0001]	[0001]
[0005]	[0005]
[0012]	[0011]
[0013]	[0012]
[0042]	[0040]
[0043]	[0041]
[0044]	[0041]
[0046]	[0042]
[0047]	[0043]
[0048]	[0044]
[0050]	[0046]
[0052]	[0048]
[0057]	[0053]
[0059]	[0055]
[0064]	[0060]
[0065]	[0060]
[0066]	[0061]

At least *Halldin* claims 1 and 7 have written-description support from *Halldin Provisional* (Ex.1015[HalldinProv]); Ex.1002, ¶¶210, 212.

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

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

2. Claim 1

a) 1[preamble]: “Protective gear comprising:”

Von Holst discloses the preamble. Section X.C.1.a). Halldin does also. Ex.1006[Halldin], [Title] (“Helmet...”). The ’536 Patent specifies “helmets” are “protective gear.” Ex.1001[USP536], 2:43. Ex.1002, ¶213.

b) 1[a]: “a first layer;”

Von Holst discloses 1[a]. Section X.C.1.b). Halldin does also. Ex.1006[Halldin], [0012] (“outer shell”), [0001], [0013], [0042-0043], Fig. 1, cls. 1-2. Ex.1002, ¶214.

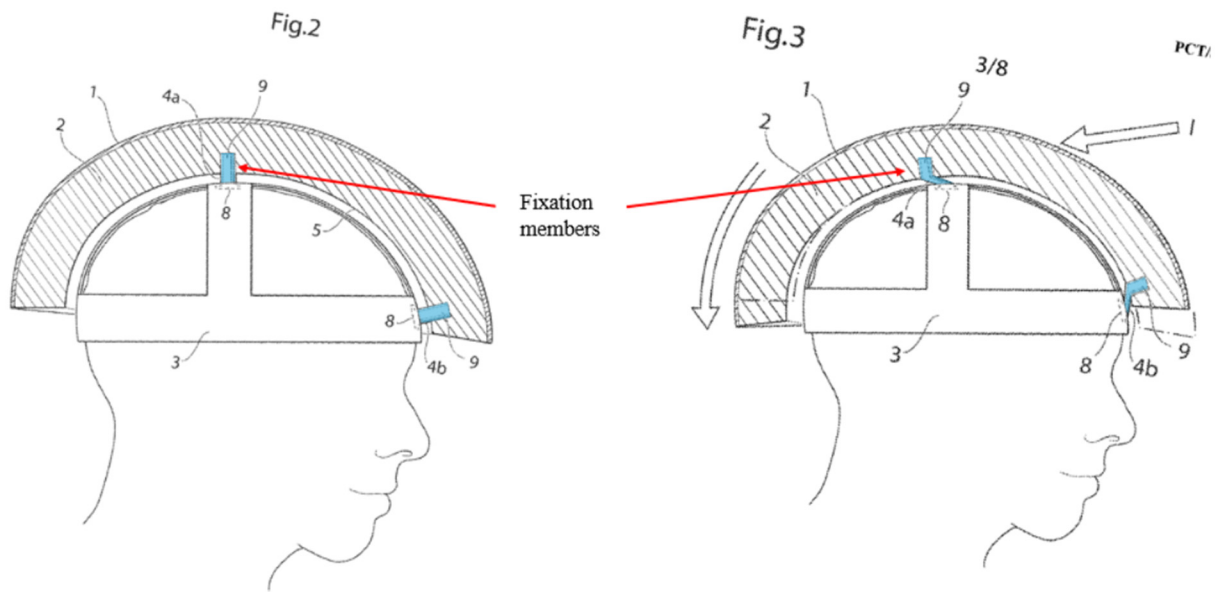
c) 1[b]: “a second layer connected to an first layer through a first energy transformer,”

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

to incorporate Halldin's fixation members as first energy transformers to "connect" Von Holst's middle (second) and outer (first) layers. Ex.1002, ¶215.

Halldin teaches helmets with an outer layer connected to an attachment device by "fixation members." Ex.1006[Halldin], [0013]. Halldin teaches multiple fixation members, including members 4a-4d, that "absorb energy by deforming in an elastic, semi-elastic or plastic way." Ex.1006[Halldin], [0043], Fig. 3. Ex.1002, ¶215.

Halldin's **fixation members** (e.g., 4a and 4b) connect helmet layers while allowing relative sliding between them and energy absorption. Ex.1006[Halldin], [0047] (Figure 3, with fixation members, allows "energy absorbing layer 2 to slide in relation to the attachment device 3" and "[t]he fixation absorbs the rotational forces by deforming elastically or semi-elastically"), Figs. 2-3 (outer layer 2 connected at 9 and inner attachment device 3 connected at 8):



Ex.1006[Halldin], Figs. 2, 3. Ex.1002, ¶¶216-217.

A POSA would have been motivated to modify Von Holst to incorporate Halldin's fixation members. Von Holst and Halldin are analogous to the challenged claims: both are directed to the same field (helmet safety design), and address the same problem of rotational impact with the same solution of sliding mechanisms. They also share a common inventor. While Von Holst describes layers connected through energy transformers and a connecting member, Halldin teaches additional energy transformers to connect layers while maintaining desired sliding to address impact forces. While Von Holst describes layers connected through energy transformers and a connecting member, Halldin teaches additional energy transformers to connect layers while maintaining desired sliding to address impact forces. A POSA would have been motivated to include Halldin's fixation connections, which connect layers and also "absorb energy" by "deforming," Ex.1006[Halldin], [0043], thereby supplementing energy absorption from sliding layers 4. Ex.1002, ¶¶218-221.

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

“additional fixation members”). A POSA would have been motivated to improve Von Holst with internal fixation connections to increase connection throughout the helmet and provide additional mechanisms to absorb energy. A POSA would have found it obvious to combine these elements as a matter of routine implementation, as their combination is a straightforward and predictable combination of known elements according to known methods to yield predictable results, and Von Holst’s helmet with sliding layers is ready for improvement through incorporating internal fixation members that additionally transform/absorb energy. The known technique of using fixation members from Halldin to absorb energy would improve Von Holst’s helmet in a similar way to Halldin. Ex.1002, ¶¶222-223.

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

members fixated to the outer energy absorbing layer via an “adhesive.” Ex.1006[Halldin], [0052]. Thus, a POSA would have reasonably expected to be able to implement Halldin’s fixation members as additional energy transformers to connect Von Holst’s intermediate (second) layer to the outer (first) layer. Ex.1002, ¶224.

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

Von Holst discloses 1[c]. Section X.C.1.d). Halldin discloses 1[c] also, teaching “energy absorbing layer” (first layer) with “fixation members,” *i.e.*, energy transformers operable to absorb energy. Ex.1006[Halldin], [0013] (“absorbed rotational energy” reduces “rotational acceleration affecting the brain”); *id.* [0043]. Ex.1002, ¶225.

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

Von Holst discloses 1[d]. Section X.C.1.e). Halldin also discloses fixation members made of elastic, semi-elastic, or plastic material that “absorb energy and forces by deforming in an elastic, semi-elastic or plastic way.” Ex.1006[Halldin], [0013]; *id.*, [0043], [0046]. Dr. Duma explains this mechanical deformation dissipates energy. Halldin’s fixation members therefore are made of material that

absorbs and/or dissipates energy and allows displacement and relative sliding of outer and inner layers. *Id.*, [0013], [0043], [0047-48], Fig. 4. Ex.1002, ¶226.

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

Von Holst discloses 1[e]. Section X.C.1.f). If PO argues Von Holst does not disclose a “second energy transformer” connecting third and second layers, a POSA would have been motivated to modify Von Holst to connect inner (third) and middle (second) layers using Halldin’s fixation members as second energy transformers for the same reasons as 1[b]. A POSA would have reasonably expected to be able to implement a second set of Halldin’s fixation members. Multi-layered helmets, including with multiple connections across multiple layers, were well-known, including Weber’s connection points through multiple layers. Section X.D.2.c); Ex.1007[Kleiven] [0031], Figs. 1d, 2d; Ex.1018[Ferrara-2007] [0086], [0097-98], Fig. 19; Ex.1017[Nichols], 3:32-4:6, Figs. 6-8; Ex.1019[Hawkins], [0050], Figs. 4-7, 16. Ex.1002, ¶227.

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

Von Holst discloses 1[f]. Section X.C.1.g). Halldin also discloses fixation members that absorb and dissipate energy and allow displacement and relative sliding of outer and inner layers. Ex.1006[Halldin] [0013], [0043], [0047-48], Fig. 4. A POSA would have been motivated to and reasonably expected to be able to

implement a second set of Halldin's fixation members. Section X.D.2.g). Ex.1002, ¶228.

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

Von Holst and Halldin teach 1[g] for the same reasons as 1[c]. Section X.D.2.d). As Section X.C.1.h) discusses, the second energy transformer (Von Holst's inner sliding layer 4 with Halldin's fixation members) would absorb energy not fully absorbed when arriving at the middle shell layer. Ex.1002, ¶¶229-230.

Thus, Von Holst combined with Halldin renders claim 1 obvious. Ex.1002, ¶231.

3. Claim 5

a) "The protective gear of claim 1, wherein the first layer is a first shell layer and the second layer is a second shell layer."

Von Holst combined with Halldin discloses claim 1. Section X.D.2 The combination discloses the additional limitation of claim 5 and renders it obvious. Section X.C.2. Ex.1002, ¶¶232-233.

4. Claim 6

a) "The protective gear of claim 1, wherein the first absorptive/dissipative material and the second absorptive/dissipative material are different."

Von Holst combined with Halldin teaches claim 1. Section X.D.2. The combination teaches the additional limitation of claim 6 and renders it obvious. Section X.C.3. Ex.1002, ¶¶234-235.

5. Claim 7

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

Von Holst combined with Halldin teaches claim 1. Section X.D.2. The combination teaches the additional limitation of claim 7 and renders it obvious. Section X.C.4; Ex.1006[Halldin], [0005], [0065-66]. Ex.1002, ¶¶236-237.

6. Claim 8

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

Von Holst combined with Halldin teaches claim 1. Section X.D.2. The combination teaches the additional limitation of claim 8 and renders it obvious. Section X.C.5; Ex.1006[Halldin], [0005], [0065-66]. Ex.1002, ¶¶238-239.

7. Claim 9

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

Von Holst combined with Halldin teaches claim 1. Section X.D.2. The combination teaches the additional limitation of claim 9 and renders it obvious. Section X.C.6. Ex.1002, ¶¶240-241.

8. Claim 10

a) 10[preamble]: “Protective gear comprising:”

Von Holst discloses the preamble. Section X.C.7.a). Halldin does also. Ex.1006[Halldin], [Title] (“Helmet...”). Ex.1002, ¶242.

b) 10[a]: “a first layer;”

Von Holst discloses 10[a]. Section X.C.7.b). Halldin does also. Ex.1006[Halldin], [0012] (“outer shell”), [0001], [0013], [0042-0043], Fig. 1, cls. 1-2. Ex.1002, ¶243.

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

Von Holst discloses 10[b]. Section X.C.7.c). If PO argues Von Holst does not disclose a “first energy transformer” that “connect[s]” the second layer to the first, Von Holst’s sliding intermediate layer incorporating Halldin’s fixation members teaches this element. Section X.D.2.c). Ex.1002, ¶244.

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

Von Holst discloses 10[c]. Section X.C.1.d). Halldin also discloses 10[c]. Section X.D.2.d). Ex.1002, ¶245.

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

Von Holst discloses 10[d]. Section X.C.1.e). Halldin also discloses 10[d].
Section X.D.2.e). Ex.1002, ¶246.

*f) 10[e]: “a lining layer connected to the second layer,
wherein the lining layer is configured to conform to a portion
of a human body.”*

Von Holst discloses 10[e]. Section X.C.1.f). Ex.1002, ¶247.

Thus, Von Holst combined with Halldin renders claim 10 obvious. Ex.1002,
¶248.

9. Claim 12

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

Von Holst combined with Halldin teaches claim 10. Section X.D.8. Von
Holst teaches the additional limitation of claim 12 and renders it obvious. Section
X.C.8. Ex.1002, ¶¶249-250.

10. Claim 16

*a) “The protective gear of claim 10, wherein mechanical
forces include impact forces.”*

Von Holst combined with Halldin teaches claim 10. Section X.D.8. The
combination teaches the additional limitation of claim 16 and renders it obvious.
Section X.D.5. Ex.1002, ¶¶251-252.

11. Claim 17

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

Von Holst combined with Halldin teaches claim 10. Section X.D.8. The combination teaches the additional limitation of claim 17 and renders it obvious. Section X.D.6. Ex.1002, ¶¶253-254.

12. Claim 18

Von Holst combined with Halldin discloses claim 18 for the same reasons as claim 1. Section X.D.2. Ex.1002, ¶255.

Further:

a) 18[preamble]: “A helmet comprising:”

Von Holst combined with Halldin discloses 18[preamble] for the same reasons as 1[preamble]. Section X.D.2.a). Ex.1002, ¶256.

b) 18[a]: “a first layer;”

Von Holst combined with Halldin discloses 18[a] for the same reasons as 1[a]. Section X.D.2.b). Ex.1002, ¶257.

c) 18[b]: “a second layer connected to a first layer through a first energy transformer;”

Von Holst combined with Halldin discloses 18[b] for the same reasons as 1[b]. Section X.D.2.c). Ex.1002, ¶258.

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

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

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

Von Holst combined with Halldin discloses 18[d] for the same reasons as 1[d]. Section X.D.2.e). Halldin’s “elastic” fixation members are an absorptive/dissipative mechanism. Halldin [0013], [0043], [0047-48], Fig. 4; Section X.D.2.e). Ex.1002, ¶260.

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

Von Holst discloses 18[e]. Section X.C.11.f). Von Holst combined with Halldin discloses 18[e] for the same reasons as 1[e]. Section X.D.2.f). Ex.1002, ¶261.

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

Von Holst discloses 18[f]. Section X.C.11.g). Von Holst combined with Halldin discloses 18[f] for the same reasons as 1[d], 1[f], and 18[d]. Sections X.D.2.e), X.D.2.g), X.D.12.e). Ex.1002, ¶262.

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

Von Holst discloses 18[g]. Section X.C.11.h). Von Holst combined with Halldin discloses 18[g] for the same reasons as 1[g]. Section X.D.2.h). Ex.1002, ¶263.

Thus, Von Holst combined with Halldin renders claim 18 obvious. Ex.1002, ¶264.

13. Claim 19

a) “The helmet of claim 18, wherein a lining layer is connected to the third layer, wherein the lining layer is configured to conform to a portion of a human body.”

Von Holst combined with Halldin teaches claim 18. Section X.D.12. The combination discloses the additional limitation of claim 19 and renders it obvious. Section X.C.12. Ex.1002, ¶¶265-266.

14. Claim 20

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

Von Holst combined with Halldin discloses claims 18 and 19. Sections X.D.12-X.D.13. The combination discloses the additional limitation of claim 20 and renders it obvious. Section X.C.13. Ex.1002, ¶¶267-268.

E. Ground 5: Claims 1, 5, 7-8, and 18 are Anticipated by Kleiven

Kleiven discloses Claims 1, 5, 7-8, and 18 arranged as in each Challenged Claim for the reasons below. Ex.1002, ¶269.

1. Claim 1

a) 1[preamble]: “Protective gear comprising:”

Kleiven discloses “a *helmet*.” Ex.1007[Kleiven], [0031]. The ’536 Patent specifies “helmets” are “protective gear.” Ex.1001, 2:43. Ex.1002, ¶270.

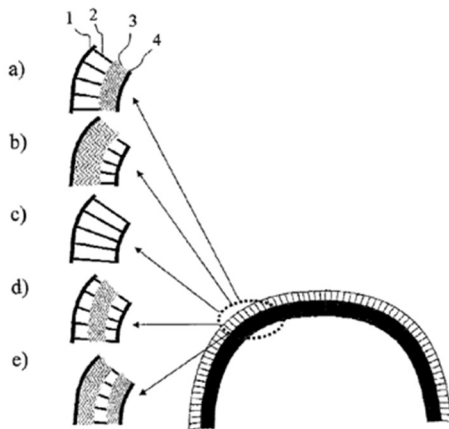
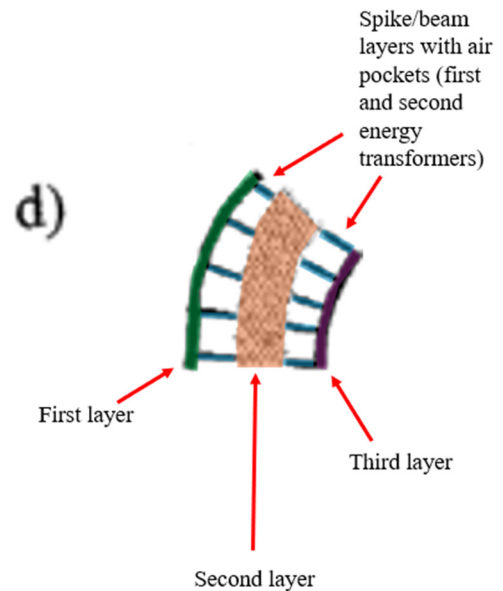
b) 1[a]: “a first layer;”

Kleiven discloses 1[a]. Kleiven Figure 2 includes, as a “layer[],” “outer...shell” 1. Ex.1007[Kleiven], [0031], Fig. 2. Ex.1002, ¶271.

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

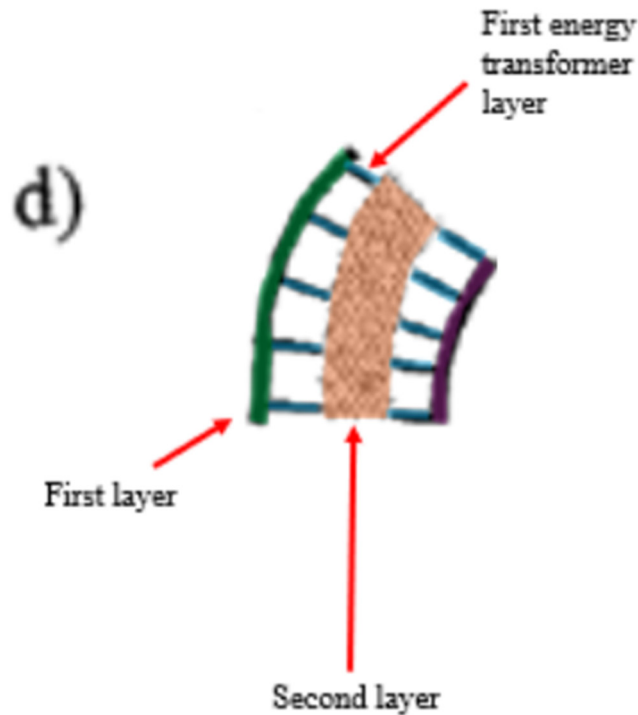
Kleiven discloses 1[b]. Kleiven Figure 2(d) discloses “**layer of standard energy absorbing foam 3**” (second layer) situated between **outer layer 1** (first layer) and **inner layer 4** (third layer), and between two layers of **spike/beams 2** with air pockets (first and second energy transformers).

Fig. 2.



Ex.1007[Kleiven], [0031], [0039-41], Fig. 2; *id.*, [0020], [0048] (“intermediate layers”). Ex.1002, ¶272.

The middle foam layer 3 is connected to the outer layer through outer spikes/beams 2 with air pockets, which are between foam layer 3 and outer layer 1.



Ex.1007[Kleiven], [0031], [0039-41], Fig. 2(d). Ex.1002, ¶¶273-274.

This connection is through a first energy transformer. The spikes are “flexible, plasticizing, yielding or frangible in order to absorb/reduce the force of an impact,” and they allow “[o]ne or several intermediate layers [to] move relative to each other or to the inner or outer layer.” Ex.1007[Kleiven], [0048], [0020], [0062], [0002]. Similarly, the '536 Patent describes its “outer and inner energy and impact transformer layers” as “flexibly connect[ing] the...layers to absorb impact forces,

rotational forces, shear forces, etc., and allow the various shell layers to move and slide relative to the other shell layers.” Ex.1001[USP536], 2:31-42. Kleiven also discloses fluid compartments between spikes in the spike layer filled with fluid (e.g., air) that also allow the outer protective shell to slide relative to the inner protective shell to shear and transform energy through translational movement via fluid flow. Ex.1007[Kleiven], [0039-41] (“fluid/air layer *shears*”), [0047], [0065], Figs.10-12. Ex.1002, ¶¶274-277.

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

Kleiven discloses 1[c]. Kleiven’s spikes/beams are “flexible, plasticizing, yielding or frangible in order to *absorb/reduce the force of an impact* towards the material.” Ex.1007[Kleiven], [0048], Fig. 2. Kleiven’s “design of the material/structure and the outer and inner layers enables the spikes to give way more easily after a *tangential/rotational impact* and thereby efficiently *reduce the negative effects of such an impact* on [e.g.] the brain. The spikes or beams are so constructed and connected to the shells that they permit *displacement of the outer shell relative to the inner shell* in the event of an oblique impact...through *shearing and bending* of the spikes/beams, during *simultaneous absorption of rotational energy in the material*, it is possible to *reduce the injurious forces....*” Ex.1007[Kleiven], [0062]; *id.* [0002], [0020-27], [0064], Fig. 9. The “fluid/air”

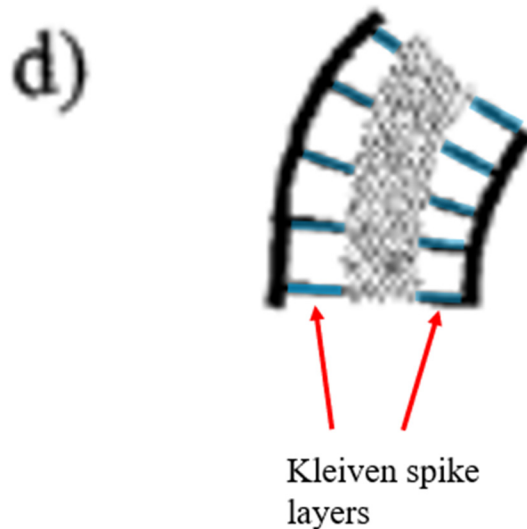
surrounding the spikes further “*shears* with little resistance...[and] *distributes* the pressure.” *Id.*, [0039-40]. As Dr. Duma explains, air absorbs and dissipates impact energy through compression, displacement, and fluid flow, which generates heat. *See* Ex.1001[USP536], 6:44-46 (fluid/gel absorptive/dissipative materials). Ex.1002, ¶278.

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

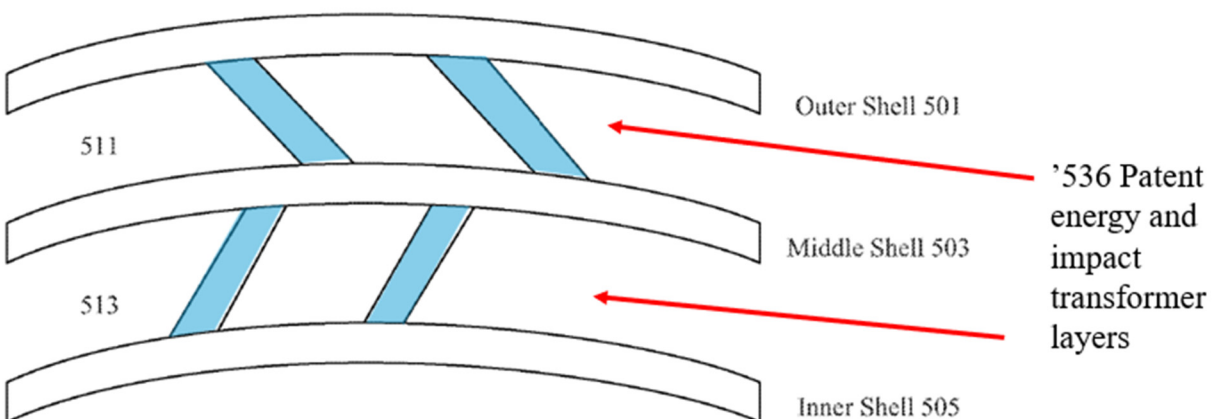
Kleiven discloses 1[d]. Kleiven’s outer spike/beams with air (first energy transformer) includes absorptive/dissipative material because spikes/beams are “flexible polymer materials such as plastics, rubber or fibers” and are “flexible, plasticizing, yielding or frangible *in order to absorb/reduce the force of an impact.*” Ex.1007[Kleiven], [0020], [0048], Fig. 2; *id.*, [0011]. The spike layer also includes “fluid/air” that “shears with little resistance...[and] distributes the pressure in the radial direction.” *Id.*, [0039-40]. Ex.1002, ¶279.

Moreover, Kleiven’s spikes/beams with air allow the first layer to slide relative to the second layer. Kleiven’s spikes allow a middle layer (second layer), i.e., “[o]ne or several intermediate layers,” to “*move relative* to each other or *to the inner or outer layer.*” Ex.1007[Kleiven], [0048]. And surrounding fluid/air layer “shears” to allow relative movement of surrounding layers. *Id.*, [0039-40], Figs. 10-11. Ex.1002, ¶280.

Kleiven's **spikes** are similar to the '536 Patent's "mechanical transformer element," a "shear truss-like structure connecting" layers that "dampen[] any force or impact" and allow the layers to "slide relative" to each other. Ex.1001[USP536], 6:30-46; *id.*, Fig. 5, 9:25-31 ("elastomeric trusses"). The **spikes 2** in Kleiven's Figure 2(d) have similar structure as '536 Patent **energy and impact transformer layers 511 and 513**.



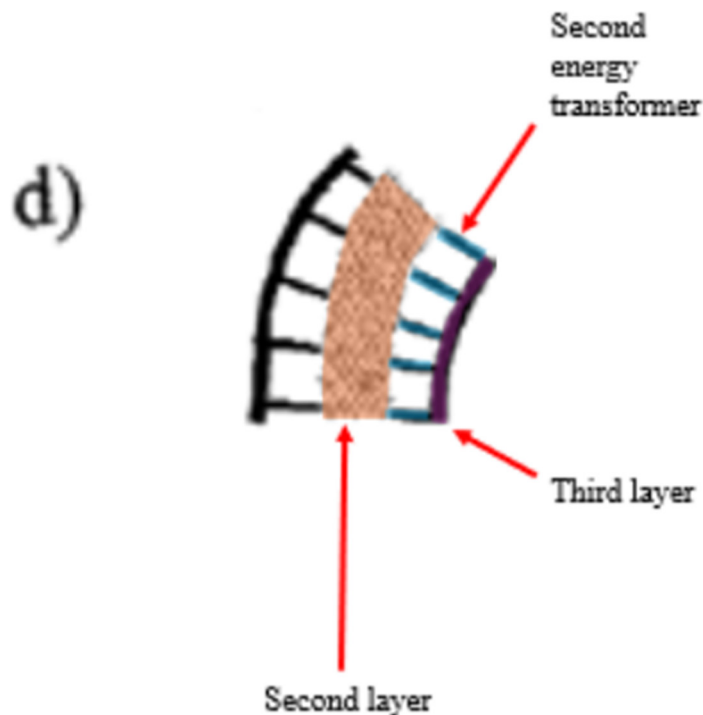
Ex.1007[Kleiven], Fig. 2(d).



Ex.1001[USP536], Fig. 5. Like Kleiven's spikes surrounded by fluid/air, the '536 Patent's trusses are also surrounded by fluid. *Id.*, 9:15-17, 9:29-31. Thus, Kleiven's spikes/beams allow the first layer to slide relative to the second layer in a manner similar to '536 patent Figure 5. Ex.1002, ¶281.

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

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



Ex.1007[Kleiven], [0031], Fig. 2(d). Ex.1002, ¶282.

Inner layer 4 is connected to **middle layer 3** through **inner spike/beams 2** and air pockets in the same way middle layer 3 is connected to outer layer 1 through outer spike/beams 2 and air in 1[b]. Ex.1002, ¶283.

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

Kleiven discloses 1[f]. Kleiven Figure 2(d)’s inner spikes/beams 2 and air (second energy transformer) includes absorptive/dissipative material in the same way the outer spikes/beams and air pockets do, as discussed in 1[d]. Ex.1002, ¶284.

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

Kleiven discloses 1[g]. Kleiven Figure 2(d)’s inner spikes 2 with air pockets (second transformer) absorb energy from forces imparted on middle (second) layer 3 through outer (first) layer 1 and outer spikes 2 (first transformer) in the same way outer spikes 2 and air absorb energy imparted onto outer layer 1 in 1[c]. Kleiven recognizes that some energy originating from the outer layer passes through the outer spikes and air such that it may be further absorbed by the inner spikes and air depicted in Figure 2(d). Ex.1007[Kleiven], [0038] (describing brain strain “reduced” with spike design), Fig. 9. Indeed, the spikes’ purpose is “to absorb/reduce the force of an impact.” Ex.1007[Kleiven], [0048]. Ex.1002, ¶285.

Thus, Kleiven anticipates claim 1. Ex.1002, ¶285.

2. Claim 5

a) “The protective gear of claim 1, wherein the first layer is a first shell layer and the second layer is a second shell layer.”

Kleiven discloses claim 1. Section X.E.1. Kleiven discloses the additional limitation of claim 5. Kleiven’s “outer...shell” and energy-absorbing foam made of, e.g., “expanded polystyrene and expanded polypropylene,” are shell layers. Ex.1007[Kleiven], [0031]; *supra* n.6. Ex.1002, ¶¶286-287.

3. Claim 7

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

Kleiven discloses claim 1. Section X.E.1. Kleiven discloses the additional limitation of claim 7 and anticipates it. Kleiven’s helmet “reduc[es] the *force* transmitted to the outer surface of the body in a *collision/impact* situation.” Ex.1007[Kleiven], [0020]; *id.*, [0061], [0032] (“*impact* sequence”), Fig. 3. Ex.1002, ¶¶288-290.

4. Claim 8

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

Kleiven discloses claim 1. Section X.E.1. Kleiven discloses the additional limitation of claim 8 and anticipates it. For example, Kleiven’s spikes/beams “give way after a *tangential/rotational impact* and thereby efficiently reduce the negative

effects of such an impact.” Ex.1007[Kleiven], [0020]; *id.*, [0062] (“***shearing*** and bending of the spikes/beams”; “***absorption of rotational energy***”), [0039-40] (“fluid/air layer ***shears***” and “distributes...pressure”). As Dr. Duma explains, reduction of forces from rotational impact reduces shear. Ex.1002, ¶¶290-291.

5. Claim 18

Kleiven discloses claim 18 for the same reasons as claim 1. Section X.E.1. Ex.1002, ¶292. Further:

a) 18[preamble]: “A helmet comprising:”

Kleiven discloses 18[preamble] for the same reasons as 1[preamble]. Section X.E.1.a). Ex.1002, ¶293.

b) 18[a]: “a first layer;”

Kleiven discloses 18[a] for the same reasons as 1[a]. Section X.E.1.b). Ex.1002, ¶294.

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

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

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

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

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

Kleiven discloses 18[d] for the same reasons as 1[d]. Section X.E.1.e). Kleiven’s first set of (outer) spikes/beams and air pockets are first absorptive/dissipative mechanisms. Ex.1002, ¶297.

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

Kleiven discloses 18[e] for the same reasons as 1[e]. Section X.E.1.f). Ex.1002, ¶298.

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

Kleiven discloses 18[f] for the same reasons as 1[f]. Section X.E.1.g). Kleiven’s second set of (inner) spikes/beams and air pockets are second absorptive/dissipative mechanisms. Sections X.E.1.e), X.E.1.g). Ex.1002, ¶299.

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

Kleiven discloses 18[g] for the same reasons as 1[g]. Section X.E.1.h). Ex.1002, ¶300.

Thus, Kleiven anticipates claim 18. Ex.1002, ¶301.

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

1. Claim 9

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

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

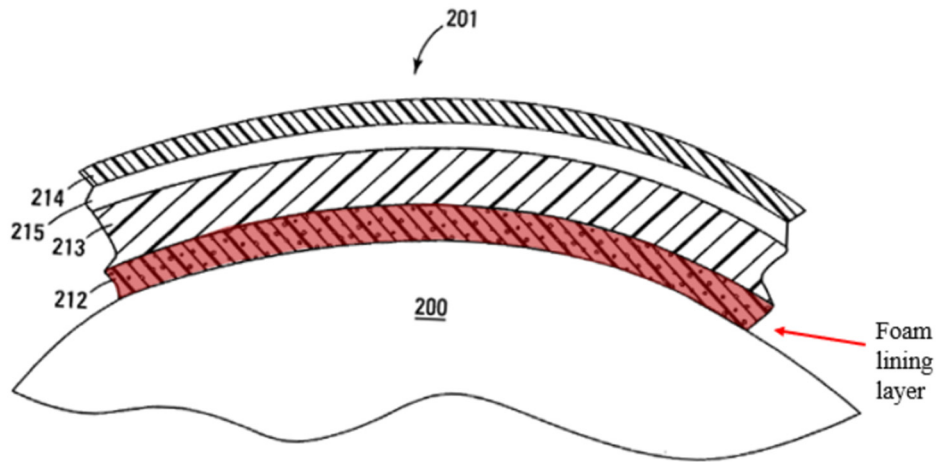


Fig. 3

Ex.1009[Piper], Fig. 3. Ex.1002, ¶302.

A POSA would have been motivated to combine Kleiven and Piper. They are analogous to the challenged claims: they are in the same field and directed to the same problem—and similar solutions—of reducing rotational impact via sliding layers. *E.g.*, Ex.1009[Piper], [0002]; Ex.1007[Kleiven], [0002]. Kleiven recognizes interior foam improves capacity “to conform to the head,” without implementation

details. Ex.1007[Kleiven], [0014]. Piper provides details, including materials (e.g., “lower density, open-cell foam material”) and characteristics of a foam liner (“provides sweat and heat management characteristics”). Ex.1009[Piper], [0109]. A POSA would have been motivated to incorporate Piper’s comfort liner 212 in Kleiven’s helmet to achieve comfort and fit benefits, and heat and sweat management. A POSA would have found it obvious to combine these elements as a matter of routine implementation, as it is a straightforward and predictable combination of known elements according to known methods to yield predictable results, and Kleiven’s helmet is ready for improvement through incorporation of Piper’s liner. This known technique of adding a comfort layer would improve Kleiven’s helmet in a similar way to Piper. Ex.1002, ¶¶303-309.

A POSA would have reasonably expected success using Piper’s comfort liner in Kleiven’s design. Kleiven discloses headgear can be configured to conform to the head and benefits of doing so, Ex.1007[Kleiven], [0014], without further implementation details. A POSA would have, as a matter of routine implementation, easily been able to configure Piper’s comfort liner to fit into Kleiven’s design, including because Piper’s comfort liner is positioned under an inner layer like Kleiven’s. Ex.1002, ¶¶310-312.

2. Claim 10

a) 10[preamble]: “Protective gear comprising:”

Kleiven discloses 10[preamble] for the same reasons as 1[preamble]. Section X.E.1.a). Ex.1002, ¶313.

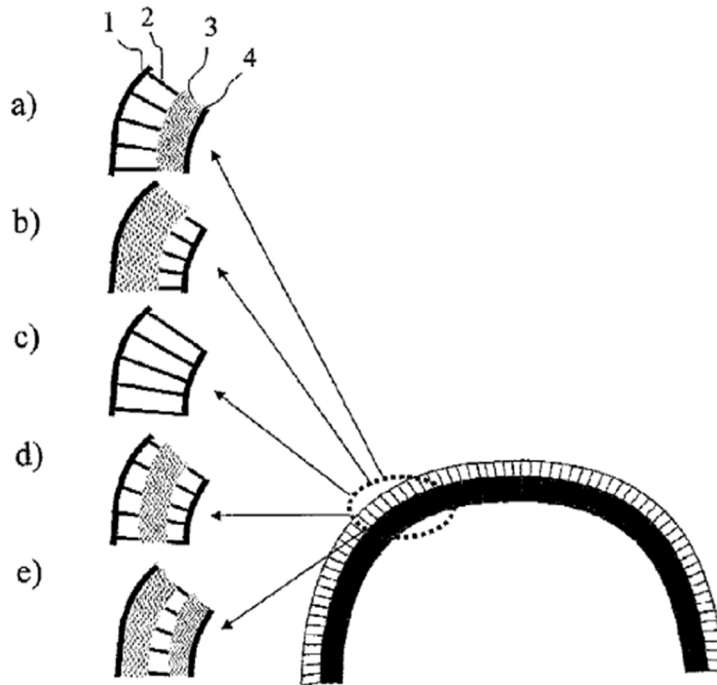
b) 10[a]: “a first layer;”

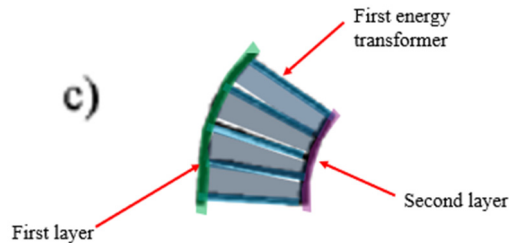
Kleiven discloses 10[a] for the same reasons as 1[a]. Section X.E.1.b). Ex.1002, ¶314.

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

Kleiven discloses 10[b]. For example, Kleiven Figure 2(c) includes **spike/beams 2** and air pockets (first energy transformers) between outer layer 1 (first layer) and inner layer 4 (second layer).

Fig. 2.





Ex.1007[Kleiven], [0031], Fig. 2, Fig. 2(c); *id.*, Fig. 1, [0020], [0030], [0048]. Kleiven’s “spikes can be complemented by trapped fluid such as air in different compartments.” Ex.1007[Kleiven], [0065], Fig. 11; *id.*, [0039-40]. Ex.1002, ¶315.

The second and first layers are connected through the first energy transformer. Spikes/beams 2, with surrounding fluid/air layer, are between outer layer 1 and inner layer 4. Ex.1007[Kleiven], [0031], Fig. 2, [0065], Fig. 11, [0039-40]. Section X.E.1.c). Ex.1002, ¶316.

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

Kleiven discloses 10[c] for the same reasons as 1[c]. Section X.E.1.d). Ex.1002, ¶317.

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

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

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

Kleiven combined with Piper discloses 10[e]. Section X.F.1. Ex.1002, ¶319.

Thus, Kleiven combined with Piper renders claim 10 obvious. Ex.1002, ¶320.

3. Claim 16

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

Kleiven combined with Piper teaches claim 10. Section X.F.2. The combination teaches the additional limitation of claim 16 and renders it obvious. Section X.E.3. Ex.1002, ¶¶321-322.

4. Claim 17

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

Kleiven combined with Piper teaches claim 10. Section X.F.2. The combination teaches the additional limitation of claim 17 and renders it obvious. Section X.E.4. Ex.1002, ¶¶323-324.

5. Claim 19

a) “The helmet of claim 18, wherein a lining layer is connected to the third layer, wherein the lining layer is configured to conform to a portion of a human body.”

Kleiven discloses claim 18. Section X.E.5. Kleiven combined with Piper teaches the additional limitation of claim 19 and renders it obvious. Section X.F.1. Ex.1002, ¶¶325-326.

6. Claim 20

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

Kleiven combined with Piper discloses claims 18 and 19. Sections X.E.5, X.F.5. Kleiven combined with Piper teaches the additional limitation of claim 20 and renders it obvious. Section X.F.1; Ex.1009[Piper], [0109] (“comfort liner 212” comprises “foam material”). Ex.1002, ¶¶327-328.

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

Madey discloses Claims 10, 16, and 17 arranged as in each Challenged Claim for the reasons below. Ex.1002, ¶329.

1. Claim 10

a) 10[preamble]: “Protective gear comprising:”

Madey discloses “head protective devices.” Ex.1047[Madey], Title, [0002], [0037], claim 1, Fig. 4. The ’536 Patent specifies “helmets” are “protective gear.” Ex.1001[USP536], 2:43. Ex.1002, ¶330.

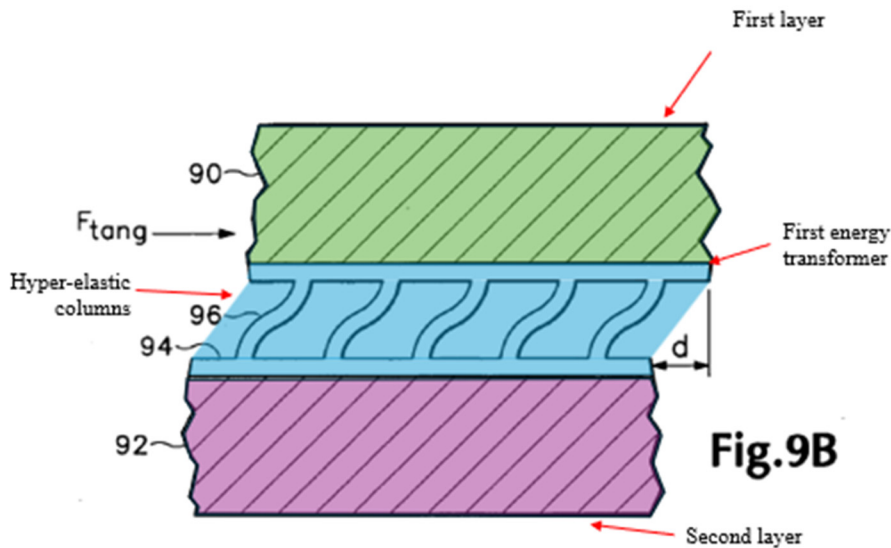
b) 10[a]: “a first layer;”

Madey discloses 10[a]. Madey discloses a helmet with “outer helmet layer” comprising “a hard shell” (first layer). Ex.1047[Madey], Abstract, claims 1-2, Fig. 4, 9B. Ex.1002, ¶¶331-332.

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

Madey discloses 10[b]. Madey’s “inner helmet layer” made of (e.g.) expanded polystyrene foam, is a second layer. Ex.1047[Madey], Abstract, [0025], [0037], [0050], Claim 1, Fig. 4. Ex.1002, ¶333.

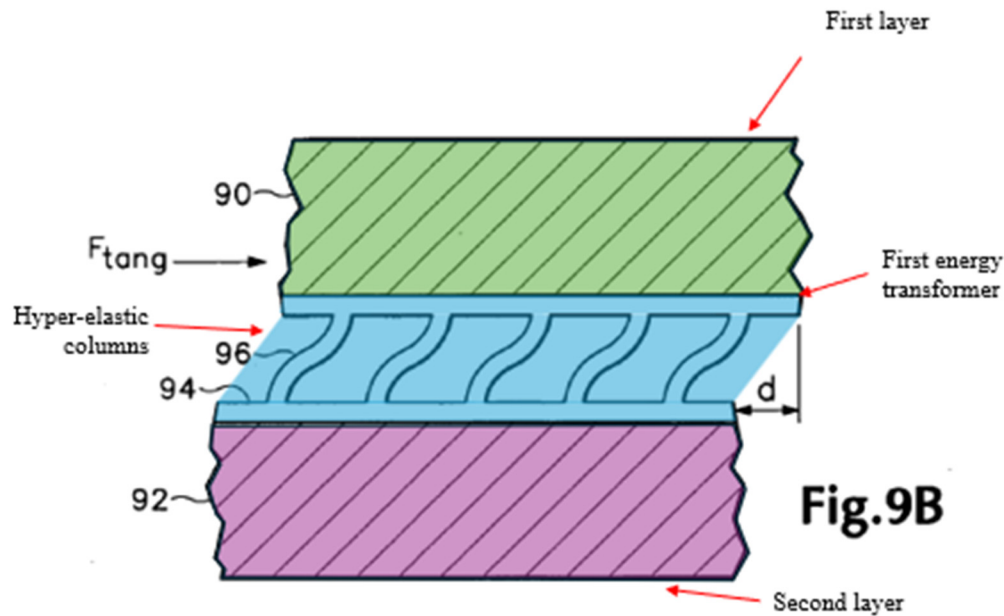
In the Figure 9B embodiment of Madey’s Figure 4 helmet, second and first layers are connected through a first energy transformer. Madey discloses components between its **outer helmet layer 90** and **inner helmet layer 92** in an **interface layer 94** that “allow[] the outer helmet layer to displace with respect to the inner helmet layer, thereby absorbing and/or diverting forces.” Ex.1047[Madey], Abstract; [0037]. In Figure 9B, the components in **interface layer 94** include (e.g.) **hyper-elastic columns 96** (first energy transformer). 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 (“interface layer allows the outer helmet layer to displace with respect to the inner helmet layer, thereby **absorbing and/or diverting forces**”). Ex.1002, ¶333.



Ex.1047[Madey], Fig. 9B. Ex.1002, ¶333.

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

Madey discloses 10[c]. As Section X.G.1.c) discusses, in Figure 9B, Madey discloses a first energy transformer (**hyper-elastic columns 96** in interface layer 94), between **outer** and **inner** helmet layers. Ex.1047[Madey], [0037], Fig. 9B. The hyper-elastic columns permit displacement of the outer layer relative to the inner layer upon impact to the outer layer, and absorb energy from such force. *E.g.*, Ex.1047[Madey], [0037] (“Columns 96 buckle under an impact force to **absorb impact energy.**”), Fig. 9B, Abstract (“interface layer allows the outer helmet layer to displace with respect to the inner helmet layer, thereby **absorbing and/or diverting forces**”). Ex.1002, ¶¶334-336.

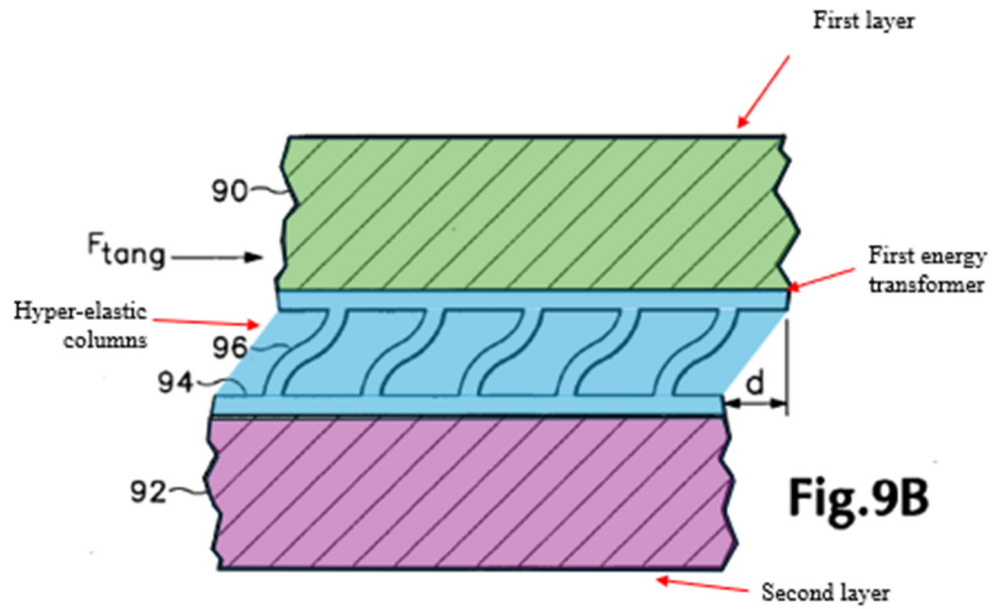


e) 10[d]: “wherein the first energy transformer includes an absorptive/dissipative material to allow the first layer to slide relative to the second layer;”

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

Maydey’s hyper-elastic columns allow the first layer to slide relative to the second layer. Maydey discloses hyper-elastic columns 96 that shear and allow the outer helmet layer (first layer) to slide relative to the inner helmet layer (second layer). For example, Maydey’s hyper-elastic columns 96 “bend[] and stretch[] in

response to tangential force” and allow “relative displacement” between the outer and inner helmet layers. Ex.1047[Madey], [0037], Fig. 9B. Ex.1002, ¶337.



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

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

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

2. Claim 16

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

Madey discloses claim 10. Section X.G.1. Madey discloses the additional limitation of claim 16 and anticipates it. As Madey explains and Dr. Duma confirms, Madey’s 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 (“interface layer allows the outer helmet layer to displace with respect to the inner helmet layer, thereby **absorbing and/or diverting forces**”). Ex.1002, ¶¶340-341.

3. Claim 17

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

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

XI. CONCLUSION

Petitioner requests institution of *inter partes* review and cancellation of '536 Patent claims 1, 5-10, 12, and 16-20.

Respectfully Submitted,

Dated: July 9, 2025

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

TABLE OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 9,271,536 (“Knight ‘536”) (USP536)
1002	Declaration of Dr. Stefan Duma
1003	Prosecution History for U.S. Patent No. 9,271,536 (Knight-536-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)

Petition for *Inter Partes Review*
of U.S. Patent No. 9,271,536

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

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

Exhibit	Description
1035	Reserved
1036	International Polymer Solutions Inc., <i>Polycarbonate</i> , https://www.ipolymer.com/pdf/Polycarbonate.pdf (Intl-Polymer-Solutions)
1037	Universal Foam Products, Physical Properties of Expanded Polystyrene, https://univfoam.com/wp-content/uploads/2015/07/EPS-Data-Sheet.pdf (Universal-Foam-Products)
1038	Duma, <i>Analysis of Real-time Head Accelerations in Collegiate Football Players</i> , 15 Clin. J. Sports Med. 3 (2005) (Duma-2005)
1039	Ommaya, <i>Chapter 13: Biomechanics of Head Injury: Experimental Aspects</i> , in <i>The Biomechanics of Trauma</i> 245 (1985) (Ommaya-1985)
1040	Viano, <i>Injury Biomechanics Research: An Essential Element in the Prevention of Trauma</i> , 22 J. Biomechanics 403 (1989) (Viano-1989)
1041	Reserved
1042	Reserved
1043	Reserved

Petition for *Inter Partes Review*
of U.S. Patent No. 9,271,536

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

CERTIFICATE UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes Review* totals 13,773 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. 9,271,536 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. 9,271,536 (Exs.1001-1007, 1009-1026, 1028, 1030-1034, 1036-1040, 1047, 1049)
- Power of Attorney
- Fee Authorization
- Word Count Certification Under 37 CFR § 42.24(d)

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

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