

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BOSE CORPORATION,
Petitioner,

v.

INGENIOSPEC, LLC,
Patent Owner.

Case No. IPR2025-01547
Patent No. 8,582,789

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.1 *et seq.***

TABLE OF CONTENTS

I.	MANDATORY NOTICES	xv
A.	Real Party-In-Interest – § 42.8(b)(1).....	xv
B.	Related Matters – § 42.8(b)(2)	xv
1.	United States Patent & Trademark Office	xv
2.	District Court Matters	xv
C.	Counsel and Service Information – § 42.8(b)(3) and (b)(4)	xvi
II.	CERTIFICATION OF STANDING	1
III.	TABLE OF GROUNDS	1
IV.	THE '789 PATENT	2
A.	Challenged Claims	4
B.	Person of Ordinary Skill in the Art	5
C.	Prosecution History	5
V.	CLAIM INTERPRETATION	5
VI.	UNPATENTABILITY GROUNDS.....	6
A.	Ground 1: Cheung Anticipates or Renders Obvious Claims 1-82	6
1.	Patent Owner Cannot Meets Its Burden to Show Priority.....	7
a.	The Priority Application Demonstrates Possession of Only a Specific Type of Speaker, One that Does <u>Not</u> Go in the User’s Ear.	8
b.	The Priority Application Does Not Provide Written Description Support for the Challenged Claims.....	13
2.	Claim 1	15
a.	[1PRE]	15
b.	[1A]: “audio system...;”	15
c.	[1B]: “wireless receiver...”	16
d.	[1C]: “a down-converter...”	16
e.	[1D]: “a modifier configured to modify the down- converted signals into modified signals based on at least one hearing characteristic of the user...; and”	17

a.	[1E]: “a speaker...”	17
3.	Dependent Claims 2-12.....	18
a.	Claim 2: “...WiFi.”.....	18
b.	Claim 3: “...audio system is selected from the list consisting a television, a stereo system, a CD player and a radio.”.....	18
c.	Claim 4: “....a phone.”	18
d.	Claim 5: “....audio system receives the input signals from a microphone.”.....	18
e.	Claim 6: “....the down-converted signals are modified such that a portion of the audio output signals has an increased power to enhance the hearing of the user.”.....	18
f.	Claim 7: “...the portion with increased power is selected based on frequency, and wherein a higher frequency portion has increased power.”	19
g.	Claim 8.....	19
(1)	[8PRE]	19
(2)	[8A] wherein the at least one hearing characteristic of the user is determined via calibrating the user's hearing,.....	19
(3)	[8B] wherein the power of the audio output signals can be changed as a function of frequency, and	19
(4)	[8C] wherein the user can change the power of the audio output signals.”.....	19
h.	Claim 9: “...ultrasonic signals....”	19
i.	Claim 10: “...directional speaker.”	20
j.	Claim 11: “...an ear speaker.”	20
k.	Claim 12: “...the speaker is in a headset.”	20
4.	Independent Claim 13	21
5.	Dependent Claims 14-82.....	21

B.	Ground 2A: Enzmann Anticipates or Renders Obvious Claims	
	1-2, 4-8, 11-23, 27-30, 43, 46-50, 52-54, 62, 75, 77, 81-82	31
1.	Enzmann (EX1008).....	31
2.	Claim 1	31
	a. [1PRE]	31
	b. [1A]: “an audio system...”	31
	c. [1B]: “wireless receiver...”	32
	d. [1C]: “down-converter...”	33
	e. [1D]: “modifier...”	33
	f. [1E]: “speaker...”	35
3.	Dependent Claims 2, 4-8, 11-12	36
	a. Claim 2: “...WiFi.”.....	36
	b. Claim 4: “...audio system is a phone”	36
	c. Claim 5: “....audio system receives the input signals from a microphone”.....	36
	d. Claim 6: “....the down-converted signals are modified such that a portion of the audio output signals has an increased power to enhance the hearing of the user.”.....	37
	e. Claim 7: “...the portion with increased power is selected based on frequency, and wherein a higher frequency portion has increased power.”	37
	f. Claim 8.....	37
	(1) [8PRE]	37
	(2) [8A] ...hearing characteristic of the user is determined via calibrating the user's hearing,.....	37
	(3) [8B] wherein the power of the audio output signals can be changed as a function of frequency, and	40
	(4) [8C] wherein the user can change the power of the audio output signals.	40
	g. Claim 11: “...an ear speaker.”	40

h.	Claim 12: "...in a headset."	41
4.	Independent Claim 13	41
5.	Dependent Claims 14-20, 22-23, 27-30, 43, 46-50, 52-54, 62, 75, 77 and 81-82.	41
C.	Ground 2B: Enzmann in View of Eaton Renders Claims 24, 31, 33-35, 39-41, and 79 Obvious.	45
1.	Eaton (EX1010)	46
2.	The Enzmann-Eaton Combination	47
3.	Claims 24, 31, 33-35, 39-41, and 78-79	48
a.	Claim 24: "...hearing characteristic...is wirelessly received and stored...."	48
b.	Claim 31: "...calibrate the user's hearing via a computing device."	49
c.	Claim 33	49
d.	Claim 34	49
e.	Claim 35: "...a computing device that is wearable."	49
f.	Claim 39	49
g.	Claim 40	49
h.	Claim 41	50
i.	Claim 78: "...hearing enhancement apparatus assists in measuring the user's hearing."	50
j.	Claim 79	50
D.	Ground 2C: Enzmann in View of Sauer Renders Obvious Claims 45 and 63-77.	50
1.	Sauer (EX1012)	51
2.	The Enzmann-Sauer Combination	51
3.	Claims 45 and 63-77	52
a.	Claim 45: "...a volume control that is configured to respond to a voice command of the user."	52
b.	Claim 63	53

c.	Claim 64.....	53
d.	Claim 65: "...hearing characteristic...is identified via measuring the user's hearing at least across a plurality of frequencies."	53
e.	Claim 66.....	54
f.	Claim 67.....	54
g.	Claim 68.....	54
h.	Claim 69.....	54
i.	Claim 70.....	56
j.	Claim 71.....	56
k.	Claim 72.....	56
l.	Claim 73.....	56
m.	Claim 74.....	56
n.	Claim 76.....	56
o.	Claim 77.....	56
E.	Ground 2D: Enzmann in View of Hagen Renders Claim 51 Obvious.	57
1.	Hagen (EX1014)	57
2.	The Enzmann-Hagen Combination	57
3.	Claim 51	58
F.	Ground 2E: Enzmann in View of Fretz Renders Claims 10 and 26 Obvious.	59
1.	Fretz (EX1013)	59
2.	The Enzmann-Fretz Combination.....	60
3.	Claims 10 and 26.....	60
G.	Ground 3A: Berger Anticipates and/or Renders Obvious Claims 1-8, 11-15, 18-20, 23, 25, 27-30, 46-48, 52, 62, 75-76, and 80.....	60
1.	Berger (EX1011).....	60
2.	Claim 1	62
a.	[1PRE]	62

b.	[1A]: “audio system...;”	62
c.	[1B]: “...wireless receiver...”	63
d.	[1C]: “...down-converter...”	64
e.	[1D]: “a modifier...”	64
f.	[1E]: “a speaker...”	65
3.	Dependent Claims 2-8 and 11-12	65
a.	Claim 2: “...WiFi...”	65
b.	Claim 3: “...television...”	66
c.	Claim 4: “...phone”	66
d.	Claim 5.....	66
e.	Claim 6: “...down-converted signals are modified such that a portion of the audio output signals has an increased power to enhance the hearing of the user.”	67
f.	Claim 7: “...wherein the portion with increased power is selected based on frequency, and wherein a higher frequency portion has increased power.”	67
g.	Claim 8.....	67
(1)	[8PRE]	67
(2)	[8A] ...hearing characteristic...is determined via calibrating the user’s hearing, ...	67
(3)	[8B] wherein the power of the audio output signals can be changed as a function of frequency, and	68
(4)	[8C] wherein the user can change the power of the audio output signals.	68
h.	Claim 11: “...ear speaker.”	69
i.	Claim 12: “...headset.”	69
4.	Independent Claim 13	69
5.	Dependent Claims 14-15, 18-20, 23, 25, 27-30, 46-48, 52, 62, 75-76, and 80	69

a.	Claim 14.....	69
b.	Claim 15.....	70
c.	Claim 18.....	70
d.	Claim 19.....	70
e.	Claim 20.....	70
f.	Claim 23.....	70
g.	Claim 25: "...hearing characteristic...is retrieved from a portable media storage device....".....	70
h.	Claim 27.....	71
i.	Claim 28.....	71
j.	Claim 29.....	71
k.	Claim 30.....	71
l.	Claim 46.....	71
m.	Claim 47.....	71
n.	Claim 48: "...audio output signals are changed in view of a preference of the user stored in the apparatus."	72
o.	Claim 52.....	72
p.	Claim 62: "...head-mounted electronic device."	72
q.	Claim 75.....	72
r.	Claim 76: "...wherein based on at least a preference of the user, the power of a first range of frequencies of the audio output signals is increased, and the power of a second range of frequencies of the audio output signals is not increased."	73
s.	Claim 80.....	73
H.	Ground 3B: Berger in View of Eaton Renders Claims 24, 31, 33-35, 39-41, and 77-79 Obvious.	73
1.	Eaton	73
2.	The Combination.....	73
3.	Claims 24, 31, 33-35, 39-41, and 77-79	75

a.	Claim 24: "...hearing characteristic...is wirelessly received and stored...."	75
b.	Claim 31: "...calibrate the user's hearing via a computing device."	75
c.	Claim 33.....	75
d.	Claim 34.....	75
e.	Claim 35: "...a computing device that is wearable."	76
f.	Claim 39.....	76
g.	Claim 40.....	76
h.	Claim 41.....	76
i.	Claim 77.....	76
j.	Claim 78: "...hearing enhancement apparatus assists in measuring the user's hearing."	77
k.	Claim 79.....	77
I.	Ground 3C: Berger-Eaton in View of DeJaco Renders Claims 16-17, 22, 43-44, 49-50, 53-54, and 81-82 Obvious.....	77
1.	DeJaco (EX1015).....	77
2.	The Combination.....	78
3.	Claims 16-17, 22, 43-44, 49-50, 53-54, and 81-82.....	80
a.	Claim 16: "...down-converted signals are further modified based on the noise level of the environment of the apparatus."	80
b.	Claim 17.....	80
c.	Claim 22.....	80
d.	Claim 43: "...alter a power level of the audio output signals based on a noise level of the environment of the apparatus."	80
e.	Claim 44: "...configured not to further increase the power of the audio output signals if the noise level is beyond a certain predetermined threshold."	80
f.	Claim 49.....	81

g.	Claim 50.....	81
h.	Claim 53.....	81
i.	Claim 54.....	81
j.	Claim 81.....	82
k.	Claim 82.....	82
J.	Ground 3D: Berger-Eaton-DeJaco in View of Sauer Renders Obvious Claims 45 and 63-74.....	82
1.	Sauer.....	82
2.	The Combination.....	82
3.	Claims 45 and 63-74	83
a.	Claim 45.....	83
b.	Claim 63.....	83
c.	Claim 64.....	83
d.	Claim 65.....	83
e.	Claim 66.....	83
f.	Claim 67.....	83
g.	Claim 68.....	84
h.	Claim 69.....	84
i.	Claim 70.....	84
j.	Claim 71.....	84
k.	Claim 72.....	84
l.	Claim 73.....	84
m.	Claim 74.....	84
K.	Ground 3E: Berger in view of Willis Renders Claims 10 and 26 Obvious.	84
1.	Willis (EX1016).....	85
2.	The Combination.....	85
3.	Claims 10 and 26.....	86
L.	Ground 3F: Berger-Eaton-DeJaco in view of Miles Renders Claim 51 Obvious.....	86

1.	Miles (EX1017).....	86
2.	The Combination.....	86
3.	Claim 51	87
VII.	CONCLUSION.....	87
VIII.	CLAIM LISTING.....	88

TABLE OF AUTHORITIES

CASES

<i>Anascape v. Nintendo</i> , 601 F.3d 1333 (Fed. Cir. 2010)	14, 15
<i>Arthrex v. Smith & Nephew</i> , 35 F.4th 1328 (Fed. Cir. 2020)	14, 15
<i>Dynamic Drinkware v. Nat’l Graphics</i> , 800 F.3d 1375 (Fed. Cir. 2015)	7
<i>Tronzo v. Biomet, Inc.</i> , 156 F.3d 1154 (Fed. Cir. 1998)	6, 13, 15

STATUTES

35 U.S.C. § 102	1, 2
35 U.S.C. § 103	1

REGULATIONS

37 C.F.R. § 42.100(b)	5
37 C.F.R. § 42.104(a)	1

APPENDIX LISTING OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 8,582,789
1002	Prosecution History of U.S. Patent No. 8,582,789
1003	Declaration of Prof. David V. Anderson, Ph.D.
1004	CV of Prof. David V. Anderson, Ph.D.
1005	U.S. Patent No. 7,388,962
1006	U.S. Patent Application Publication No. 2004/0208333 (“Cheung”)
1007	U.S. Patent Appl. No. 10/826,527 (“Priority Application”)
1008	U.S. Patent Application Publication No. 2004/0136555 (“Enzmann”)
1009	Prosecution History of U.S. Patent No. 7,388,962
1010	WIPO Patent Application Publication No. WO 01/54458 A2 (“Eaton”)
1011	U.S. Patent Application Publication No. 2001/0041602 (“Berger”)
1012	U.S. Patent No. 5,636,285 (“Sauer”)
1013	WIPO Patent Application Publication No. WO 98/31193 A1 (“Fretz”)
1014	U.S. Patent No. 6,389,142 (“Hagen”)
1015	WIPO Patent Application Publication No. WO 99/05840 A1 (“DeJaco”)
1016	U.S. Patent No. 3,829,623 (“Willis”)
1017	U.S. Statutory Invention Registration H417 (“Miles”)
1018	<i>IngenioSpec, LLC v. Bose Corp.</i> , 2:24-cv-00822 (E.D. Tex.), Dkt. No. 1-7 (Exhibit 7 to Complaint)
1019	<i>IngenioSpec, LLC v. Sony Corp.</i> , 2:24-cv-00820 (E.D. Tex.), Dkt. No. 1-8 (Exhibit 8 to Complaint)
1020	<i>IngenioSpec, LLC v. Samsung Elecs. Co.</i> , 2:24-cv-00819 (E.D. Tex.), Dkt. No. 1-9 (Exhibit 9 to Complaint)
1021	<i>IngenioSpec, LLC v. LG Elecs., Inc.</i> , 2:24-cv-00823 (E.D. Tex.), Dkt. No. 1-8 (Exhibit 8 to Complaint)
1022	U.S. Patent Application Serial No. 10/826,529

1023	WIPO Patent Application Publication No. WO 1991/015902 A1
1024	U.S. Patent Application Publication No. 2002/0141599 A1
1025	WIPO Patent Application Publication No. WO 2001/028310 A2
1026	U.S. Patent Application Publication No. 2002/0031228 A1
1027	Wayne Tomasi, <i>Electronic Communications Systems: Fundamentals Through Advanced</i> (4th Ed. 2001)
1028	U.S. Patent No. 4,792,977
1029	U.S. Patent Application Publication No. 2002/0176584 A1
1030	U.S. Patent No. 3,946,168
1031	U.S. Patent No. 6,134,334
1032	U.S. Patent Application Publication No. 2002/0067825 A1
1033	U.S. Patent Application Publication No. 2002/0111197 A1
1034	U.S. Patent No. 6,006,115
1035	European Patent No. 1,161,064 B1
1036	Oxford English Reference Dictionary (2nd Ed. 1996)
1037	U.S. Patent No. 2,112,569
1038	U.S. Patent No. 4,335,281
1039	U.S. Patent No. 2,305,905
1040	U.S. Patent No. 2,484,052
1041	European Patent No. 1,372,353 B1
1042	WIPO Patent Application Publication No. WO 02/25906 A2
1043	GB Patent No. 604,357
1044	U.S. Patent No. 2,411,190
1045	European Patent Appl. Publ. No. 0,002,051 A1
1046	U.S. Patent No. 2,744,158
1047	U.S. Patent No. 4,284,847
1048	U.S. Patent Appl. No. 10/826,531

1049	U.S. Patent Appl. No. 10/826,528
1050	U.S. Patent Appl. No. 10/826,537
1051	U.S. Patent No. 3,531,595
1052	U.S. Patent Appl. Publ. No. 2002/0068610
1053	U.S. Patent Appl. Publ. No. 2002/0069031
1054	U.S. Patent No. 5,047,860

I. MANDATORY NOTICES

A. Real Party-In-Interest – § 42.8(b)(1)

Petitioner Bose Corporation is the real party-in-interest.

B. Related Matters – § 42.8(b)(2)

1. United States Patent & Trademark Office

U.S. Patent No. 8,582,789 (“the ’789 patent”) was filed on June 6, 2008, as Application Serial No. 12/157,092, and is a continuation of Application Serial No. 10/826,527, which was filed on April 15, 2004. The ’789 patent claims priority to three provisional applications: (i) U.S. Provisional Application No. 60/462,570, which was filed on April 15, 2003, (ii) U.S. Provisional Application No. 60/469,221, which was filed on May 12, 2003, and (iii) U.S. Provisional Application No. 60/493,441, which was filed on August 8, 2003.

2. District Court Matters

The ’789 patent is asserted in the following pending cases:

- *IngenioSpec, LLC v. Sony Group Corp.*, 2:24-cv-00820 (E.D. Tex.);
- *IngenioSpec, LLC v. LG Elecs., Inc.*, 2:24-cv-00823 (E.D. Tex.);
- *IngenioSpec, LLC v. Apple Inc.*, 1:25-cv-00867 (W.D. Tex.);
- *Bose Corp. v. IngenioSpec, LLC*, 1:25-cv-12531 (D. Ma.).

The '789 patent was also asserted in the following case, which was dismissed without prejudice on December 12, 2024¹:

- *IngenioSpec, LLC v. Bose Corp.*, 2:24-cv-00822 (E.D. Tex.).

The '789 patent was also asserted in the following case, which was dismissed with prejudice on June 11, 2025:

- *IngenioSpec, LLC v. Samsung Elecs. Co.*, 2:24-cv-00819 (E.D. Tex.).

C. Counsel and Service Information – § 42.8(b)(3) and (b)(4)

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A power of attorney is submitted with this petition. Counsel for Petitioner consents to service of all documents via electronic mail.

¹ Prior to its dismissal, 2:24-cv-00822 was consolidated with 2:24-cv-00819 and 2:24-cv-00823 and 2:24-cv-00822 was designated as the lead case. The district court ordered that 2:24-cv-00822 be kept open as the lead case despite its dismissal.

Petitioner requests *inter partes* review of claims 1-82 of the '789 patent.

II. CERTIFICATION OF STANDING

The '789 patent is available for IPR and Petitioner is not barred or estopped from requesting IPR. 37 C.F.R. §42.104(a).

III. TABLE OF GROUNDS

Petitioner requests cancellation as follows:

Ground	Reference(s)	Claim(s)	Basis
1	Cheung	1-82	§§102, 103
2A	Enzmann	1-2, 4-8, 11-20, 22-23, 27-30, 43, 46-50, 52-54, 62, 75, 77, 81-82	§§102, 103
2B	Enzmann, Eaton	24, 31, 33-35, 39-41, 78-79	§103
2C	Enzmann, Sauer	45, 63-77	§103
2D	Enzmann, Hagen	51	§103
2E	Enzmann, Fretz	10, 26	§103
3A	Berger	1-8, 11-15, 18-20, 23, 25, 27-30, 46-48, 52, 62, 75-76, 80	§§102, 103
3B	Berger, Eaton	24, 31, 33-35, 39-41, 77-79	§103
3C	Berger, Eaton, DeJaco	16-17, 22, 43-44, 49-50, 53-54, 81-82	§103
3D	Berger, Eaton, DeJaco, Sauer	45, 63-74	§103
3E	Berger, Willis	10, 26	§103
3F	Berger, Eaton, DeJaco, Miles	51	§103

Each reference is prior art under pre-AIA §102(b) if—as discussed in Ground 1—the challenged claims are entitled to a priority date no earlier than the ’789 patent’s June 6, 2008 filing.

If the challenged claims are entitled to their earliest alleged priority date (*i.e.*, April 15, 2003), then (i) Cheung is not prior art, (ii) Enzmann is prior art under pre-AIA §102(e), (iii) Berger, Eaton, Sauer, Fretz, DeJaco, Willis, and Miles remain prior art under pre-AIA §102(b), and (iv) Hagen is prior art under both pre-AIA §§102(a), (e).

Each reference is analogous prior art, and none of the references used in Grounds 2 or 3 were cited during prosecution. EX1003 (Decl. of David Anderson “Anderson-Decl.”), ¶¶77-79.

IV. THE ’789 PATENT²

The ’789 patent is directed to hearing-enhancement systems for individuals with hearing impairments. 1:53-55, 3:3-5. The patent says many hearing-impaired individuals do not wear hearing aids due to drawbacks with then-conventional devices, including an uncomfortable “occlusion” effect that occurs when hearing aids are located inside a user’s ear. 1:57-63, 2:13-64. The occlusion effect “is the hollowness, echoic or stuffed sensation of hearing one’s own voice as one talks with a hearing aid inside one’s ear.” 2:13-17.

² Citations in Section IV are to EX1001.

The patent addresses occlusion by using a “directional speaker” located *outside* the user’s ear, *e.g.*, on the user’s clothing. 3:18-24, 5:58-63, FIG. 2. The speaker is directed at the user’s ear and transmits audio via ultrasonic signals. 5:66-6:17.

By locating the speaker outside the user’s ear, “the user’s ear remains free from any inserted objects and thus is free from the annoying occlusion effect, enabling the user to continue to hear sounds without interference.” 13:6-9; *see also* Abstract (similar); 3:50-56 (similar); 7:11-14 (similar).

The patent describes embodiments in which the audio signal output by the speaker is modified, *e.g.*, amplified, based on a user’s particular hearing characteristics. Abstract, 3:59-67, 13:32-38. An example of a hearing characteristic is the particular audio frequencies a user has difficulty hearing. 6:30-43.

An audio signal is modified to account for a user’s hearing characteristic by, for example, increasing power for the audio signal at the specific frequencies that the user would otherwise have difficulty hearing. 3:30-33, 3:44-46. Increasing audio-frequency power to compensate for hearing impairments was conventional in the hearing-aid field *long* before 2003. Anderson-Decl., ¶¶43-46 (citing EX1037 (issued 1938), EX1039 (issued 1942), and EX1040 (issued 1949) as examples).

A. Challenged Claims

Independent claim 1 is reproduced below with labels added:

1[PRE]. A hearing enhancement system for a user, comprising:

- [1A]** an audio system configured to receive input signals for broadcasting, and configured to up-convert the received input signals into up-converted signals to be wirelessly transmitted;
- [1B]** a wireless receiver configured to wirelessly receive the up-converted signals;
- [1C]** a down-converter configured to down-convert the received up-converted signals into down-converted signals;
- [1D]** a modifier configured to modify the down-converted signals into modified signals based on at least one hearing characteristic of the user to enhance the hearing of the user; and
- [1E]** a speaker configured to generate audio output signals from the modified signals for the user.

Claim 1 essentially recites a system in which an audio signal is wirelessly transmitted by an audio system (*e.g.*, a phone), and subsequently modified based on a “*hearing characteristic of [a] user*” before the signal is output via a speaker. Independent claim 13 is similar except it recites a “*hearing enhancement apparatus,*” rather than a “*hearing enhancement system.*”

B. Person of Ordinary Skill in the Art

POSAs would have had a bachelor's degree in electrical engineering or a related field, plus at least two years of industry or graduate-level experience with designing sound-amplifying devices, including hearing aids and/or headphones. Anderson-Decl., ¶¶23-28.

C. Prosecution History

The originally-filed claims were rejected for non-statutory double patenting over U.S. Patent No. 7,388,962. EX1002, 117-121. The applicant filed a terminal disclaimer (*id.*, 161), and the claims were allowed because they were allegedly narrower than the claims of the '962 patent. *Id.*, 175-177; *but see* Anderson-Decl., ¶¶49-52 (explaining the claims were actually ***broader*** because, *inter alia*, they did not require that the claimed speaker be “spaced apart” from a user's ear).

The applicant then filed serial requests for continued examination, adding the claims that became claims 29-82. EX1002, 221-235; 277-292; 317-335.

V. CLAIM INTERPRETATION

Claim terms are given their ordinary meaning in light of the specification and prosecution history. 37 C.F.R. §42.100(b).

VI. UNPATENTABILITY GROUNDS

A. Ground 1: Cheung Anticipates or Renders Obvious Claims 1-82

The '789 patent is a continuation of application No. 10/826,527 (“the Priority Application” (EX1007)), which was filed on April 15, 2004. For the challenged claims to have the Priority Application’s filing date, its disclosure “must reasonably convey to [a POSA] that the inventor possessed” the subject matter recited in the challenged claims “at the time the [Priority Application] was filed.” *Tronzo v. Biomet, Inc.*, 156 F.3d 1154, 1158 (Fed. Cir. 1998).

The challenged claims are not entitled to the Priority Application’s filing date because the claims lack written description support in that application. In brief, the challenged claims recite a “*speaker*,” which Patent Owner asserts, in its infringement complaints, covers speakers positioned *inside* a user’s ear. The Priority Application, however, demonstrates the inventor’s possession of only a particular type of speaker, *i.e.*, an ultrasonic directional speaker that—importantly—is positioned *outside* a user’s ear. Indeed, the Priority Application explicitly disparages prior-art hearing aids with speakers positioned inside a user’s ear. When, as here, a priority application focuses on a specific technology and disparages other technologies covered by the claims, written description support is lacking, and the challenged patent is not entitled to claim priority to the earlier application. *Infra* §VI.A.1.b.

Without the benefit of a 2004 filing date, the challenged claims' earliest possible priority date is June 6, 2008, when the application for the '789 patent was filed. If limited to that date, then Cheung (EX1006)—the publication of the Priority Application—is §102(b) prior art and anticipates (or renders obvious) claims 1-82.

1. Patent Owner Cannot Meets Its Burden to Show Priority.

Once a challenger identifies antedating prior art, the patentee has “the burden of going forward with evidence either that the prior art does not actually anticipate, or...that it is not prior art because the asserted claim is entitled to the benefit of a filing date prior to the alleged prior art.” *Dynamic Drinkware v. Nat’l Graphics*, 800 F.3d 1375, 1379-80 (Fed. Cir. 2015). Patent Owner thus has the burden to show that each challenged claim has written-description support in the Priority Application.

As to their scope, independent claims 1 and 13 recite “*a speaker configured to generate audio output signals.*” The plain language thus encompasses any speaker, including a speaker positioned in the ear.

This understanding is consistent with Patent Owner’s infringement contentions. Patent Owner has alleged that Bose’s QuietComfort Ultra earbuds infringe independent claim 13. EX1018. As seen below, the Bose earbuds are “in-the-ear” headphones with speakers in the user’s ears. As discussed *infra* §VI.A.1.a, the Priority Application explicitly disparages in-the-ear headphones, like Bose’s, precisely because they position their speakers in the user’s ear. EX1007, [0007].



Patent Owner has alleged similar in-the-ear earbuds infringe claim 13 in other litigations too. EX1019-EX1021. Patent Owner thus must establish that the Priority Application provides written description support for speakers that are inserted into a user's ear. It does not.

a. The Priority Application Demonstrates Possession of Only a Specific Type of Speaker, One that Does Not Go in the User's Ear.³

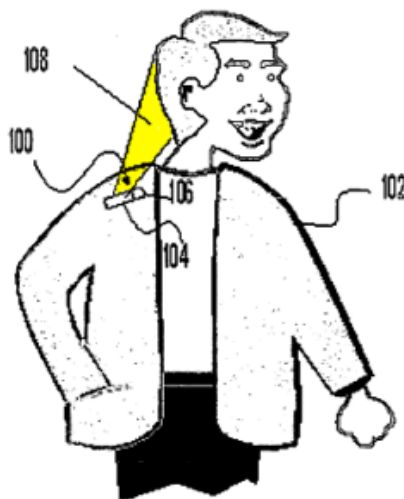
The Priority Application describes a hearing-enhancement system having a speaker with three related features: (i) it is positioned apart from a user's ear, (ii) it is directional, and (iii) it transmits ultrasonic audio signals. As demonstrated below, the Priority Application limits its alleged invention to a speaker with these three features and does not provide written description support for speakers that lack one or more of the features, *e.g.*, a speaker positioned within the user's ear.

³ Unless otherwise noted, citations in this section are to EX1007.

The Priority Application introduces its invention by explaining that many individuals who would benefit from hearing aids do not wear them due to certain drawbacks. [0004]-[0014]. For “in-the-ear” (ITE) and “completely-in-the-canal” (CIC) hearing aids, the Priority Application identifies drawbacks including (i) the need for hearing aids to be customized to fit “*into* the patient’s [ear] canal” ([0009]), and (ii) the disturbing occlusion effects associated with positioning the device into the ear ([0012]). *See also* [0007]. The Priority Application thus disparages hearing aids positioned inside a user’s ear as having specific drawbacks that discouraged hearing-impaired individuals from using them. Anderson-Decl., ¶¶57-59.

To address those drawbacks, the Priority Application’s “present invention” is a “system that enhances an individual’s hearing based on a directional speaker.” [0015]. The speaker is positioned *apart* from the user’s ear such that it can be worn on a user’s clothing. [0016]-[0017].

An embodiment of the “present invention” is depicted in Figure 2. [0032]. As seen below, the invention includes an interface unit 100 with a directional speaker 104 positioned on the user’s clothing, *i.e.*, apart from the user’s ear. [0044]-[0045]. The directional speaker is “in a line of sight of an ear of the user” and transmits modulated “ultrasonic signals in air towards the ear of the user” via a virtual cone 108 (annotated yellow below). [0045]-[0046]. The ultrasonic signals are “demodulated in air to create [] output audio signals” that the user can hear. *Id.*



EX1007, p. 32.

The Priority Application repeatedly describes its “speaker” as directional, ultrasonic, and positioned *apart* from the user’s ear. Title, [0003], [0015], [0017]-[0018], [0020], [0044]-[0046]; [0051] (“...does not require having any hearing aid inserted into the ear...”); [0060] (“Since the ear canal is open...”); [0075] (“...ear canal remaining open...”); [0082]; Anderson-Decl., ¶62.

The Priority Application even incorporates by reference another application from the same inventor that discloses “[d]ifferent embodiments of the directional speakers” ([0046]), and that application also repeatedly describes speakers that are directional, ultrasonic, and positioned apart from the user’s ear. EX1022, Abstract, [0052]; [0055] (the speaker is “8 inches” from ear); [0058]-[0074]; [0076]; [0104] (“6-8 inches away”); [0112]-[0113] (speaker is “attachable to the clothing”); Anderson-Decl., ¶63. It also disparages the use of speakers that go into the user’s ear as “not natural” and “annoying.” EX1022, [0007].

Given its disclosure, the Priority Application's as-filed claims are unsurprisingly directed to speakers that are directional, ultrasonic, and positioned apart from the user's ear. EX1007, 26-29. And the claims that issued from the Priority Application explicitly recite a "directional speaker [that] is ***configured to be spaced apart from at least one of the ears of the user.***" EX1005, claim 1. Indeed, this limitation was how the applicant distinguished prior-art ultrasonic directional speakers that were positioned near the user's ear. EX1009, 118.

Not only does the Priority Application only describe (and claim) a speaker positioned apart from the user's ear, it also identifies that feature as ***critical*** to addressing the ***drawbacks*** associated with conventional hearing aids with speakers positioned inside a user's ear. Anderson-Decl., ¶66. For example, the Abstract explains that because "the user's ear ***remains free*** from any inserted objects" the user "is free from annoying occlusion effects." EX1007, 30.

Similarly, the Priority Application explains that:

Since the directional speaker ***is not attached to or inserted in the ear,*** the user can still hear the audio signals directly from the audio source. Not only would such an approach ***eliminate the occlusion effect,*** with ***no hearing aid in the ear canal,*** the natural resonance of the ear canal (typically around 2700 Hz) boosts the audio signal strength in the 2 to 3 kHz ranges. Furthermore, ***without the hearing aid in the ear canal,*** there is no insertion loss due to the hearing aid.

EX1022, [0020].

Likewise, it explains: “With *no hearing aid inserted into one ear*, the audio signals do not experience any insertion loss, and *there is also no occlusion* effect due to the user’s own voice.” [0051]; *see also* [0075] (“With the ear canal remaining open, the user can still use a phone directly.”); [0060] (“Since the ear canal is open, the user can be hearing the audio signals both from the sender and the system.”).

When listing “advantages *of the invention*,” the Priority Application says: “the user’s ear remains free from any inserted objects and thus is free from the annoying occlusion effects, enabling the user to continue to hear sounds without interference.” [0095]. It likewise says: “the system is relatively inexpensive” because it does not “requir[e] an individually-fitted ear mold,” *i.e.*, it need not be customized to fit inside the user’s ear. *Id.*; Anderson-Decl., ¶¶69-71 (explaining how alleged “advantages of the invention” are attributable to the speaker being positioned apart from the user’s ear).

That the speaker is positioned apart from the user’s ear also ties directly to the speaker’s other two key features: directionality and ultrasonic signaling. Because the speaker is positioned some distance from the user’s ear, the audio signals it outputs “are transmitted in an open environment” and thus “people next to the user might pick up the audio signals.” [0026]. The use of a directional speaker that transmits ultrasonic signals toward the user’s ear reduces the likelihood that others near the user will hear the audio from the speaker. Anderson-Decl., ¶¶72-75.

At no point does the Priority Application describe a system having a speaker that is positioned within the user's ear. Anderson-Decl., ¶76. The only place where the Priority Application arguably describes such speakers is in describing prior-art hearing aids and their known drawbacks. [0004]-[0014]; Anderson-Decl., ¶76.

b. The Priority Application Does Not Provide Written Description Support for the Challenged Claims.

Although the disclosure of a species *may* provide written description support for later-filed genus claims, that is not the case where—as here—the relevant disclosure makes clear the invention is narrower than the later-filed genus claims. The Federal Circuit's *Tronzo v. Biomet, Inc.*, 156 F.3d 1154 (Fed. Cir. 1998) decision is illustrative.

The *Tronzo* patent concerned an artificial hip socket with a cup implant for insertion into a hip bone. 156 F.3d at 1156-57. The patent issued from a series of applications, each of which described the cup implant as having a conical shape. *Id.* Later-filed claims, however, recited the cup implant generically, without specifying its shape. The Federal Circuit held the later-filed claims were broader than the priority applications' disclosure and therefore not entitled to their earlier filing date. *Id.* at 1159-60. The Court observed that (i) the priority applications consistently described the invention as using conical-shaped cups, and (ii) the applications' only reference to differently shaped cup implants was "a recitation of the prior art" that described those differently-shaped implants as "inferior." *Id.*

Likewise, in *Anascape v. Nintendo*, 601 F.3d 1333 (Fed. Cir. 2010), a priority document failed to support generic claims to a controller having one or more “input members” that individually or collectively provided “six degrees of freedom.” The priority document criticized a prior-art design that relied on multiple input members, and emphasized that a “primary object of the invention” was to provide a “single input member” offering six degrees of freedom. *Id.* at 1336-38. The “only reasonable reading” of the document was that it “describe[ed] only a controller having a single input member operable in six degrees of freedom.” *Id.* at 1340.

And more recently, in *Arthrex v. Smith & Nephew*, 35 F.4th 1328, 1341 (Fed. Cir. 2020), the Federal Circuit evaluated later-filed claims that recited a generic “eyelet.” The patentee alleged the later-filed claims were entitled to an earlier priority date through a series of applications. *Id.* at 1342. The Board disagreed (and the Federal Circuit affirmed) because one of the priority applications did not describe a “flexible eyelet embodiment” that was “encompassed by the generic eyelet” recited in the later-filed claims. *Id.* Indeed, rather than describe the invention as including flexible eyelets, the priority application “criticizes” flexible eyelets and purports to overcome drawbacks associated with such eyelets. *Id.* at 1343. “Aside from this critique, the [priority] application is completely silent about flexible eyelets.” *Id.*

As in *Tronzo*, *Anascape*, and *Arthrex*, the Priority Application consistently describes the invention as limited to a specific speaker species. As in *Tronzo*, *Anascape*, and *Arthrex*, the Priority Application only describes a larger speaker genus as suffering drawbacks that the described speaker species purportedly resolves. As in *Tronzo*, *Anascape*, and *Arthrex*, the Priority Application fails to provide adequate written description support for the challenged claims.

Because claims 1-82 cannot claim priority to the Priority Application, Cheung is prior art and anticipates or renders obvious claims 1-82 as discussed below. Anderson-Decl., ¶¶82-122.

2. Claim 1

a. [1PRE]

Cheung discloses a “*hearing enhancement system*.” Abstract.

b. [1A]: “audio system...;”

Cheung discloses an embodiment in which its system has an “interface unit” with a directional speaker that “accesses audio signals from portable or non-portable [audio or audio-video] instruments” like a cellphone or television. [0090]-[0092]; *see also* Abstract, claims 18-19. As dependent claims 3 and 4 confirm, a cellphone and a television are each examples of “*an audio system configured to receive input signals for broadcasting*,” as each receives input signals for broadcasting (e.g., voice-audio from a cellular network or television-audio from a television network).

Cheung discloses embodiments in which the connection between its interface unit and a phone/television is wireless, *e.g.*, WiFi. [0091]-[0092]; *see also* Abstract, claim 16. In the wireless embodiments, the “audio signals” from the phone/television are “up-converted and transmitted” as wireless signals. [0091].

c. [1B]: “wireless receiver...”

In the wireless embodiments, Cheung’s system includes “the electronics to capture wireless signals from the instruments [*i.e.*, phone/television] through a wireless local area network, such as WiFi or Bluetooth.” [0091]. POSAs would have understood Cheung’s “interface unit” is the component in Cheung’s system that includes “the electronics to capture wireless signals” and that these electronics include a “*wireless receiver*” to receive, *i.e.*, “capture,” the up-converted wireless signals the phone/television transmits. [0090]-[0091]; Anderson-Decl., ¶¶88-89.

d. [1C]: “a down-converter...”

In the wireless embodiment, Cheung’s interface unit “down-converts the WiFi signal to re-generate the audio signals for the user,” which Cheung would perform with a down-converter. [0091]; Anderson-Decl., ¶¶90-91 (discussing RF down-converters).

- e. **[1D]: “a modifier configured to modify the down-converted signals into modified signals based on at least one hearing characteristic of the user...; and”**

Cheung teaches that “a portion of the input audio signals is amplified more than another portion to enhance the hearing of the user.” Claim 1; *see also* [0022]-[0023], FIG. 3, claim 22.

Cheung further discloses a “computing unit,” *e.g.*, a processor, that “transforms the input audio signals into modified audio signals by modifying certain frequencies differently than other frequencies to enhance the ability of the user to hear the input audio signals.” Claim 22; Anderson-Decl., ¶¶92-95 (explaining that POSAs would have understood the “computing unit,” *i.e.*, “*modifier*,” to be part of Cheung’s “interface unit”).

Cheung further discloses that the modification (or amplification) made to the audio signal is based on the user’s “*hearing characteristic*.” [0023] (“adjust the amplification of the audio signals across the frequencies based on the user’s hearing profile”), [0057]-[0060], claim 6.

- a. **[1E]: “a speaker...”**

Cheung’s interface unit includes a directional speaker that outputs the modified audio signals. Abstract, claim 22, [0048], FIG. 1.

3. Dependent Claims 2-12

a. Claim 2: "...WiFi."

Supra limitation [1B]; *see also* [0091].

b. Claim 3: "...audio system is selected from the list consisting a television, a stereo system, a CD player and a radio."

Supra limitation [1A]; *see also* [0092].

c. Claim 4: "....a phone."

Supra limitation [1A]; *see also* [0092].

d. Claim 5: "....audio system receives the input signals from a microphone."

When Cheung's interface unit receives audio signals wirelessly from a phone, the input signals are "*from a microphone*," *i.e.*, the microphone on the calling party's phone.

e. Claim 6: "....the down-converted signals are modified such that a portion of the audio output signals has an increased power to enhance the hearing of the user."

[0019] ("At least a portion of the output audio signals have higher power with respect to the received audio signals at corresponding frequencies to enhance the hearing of the user."); *see also* [0022]-[0023] (discussing various "frequency-dependent amplification" approaches); [0052]-[0054] (same); Anderson-Decl., ¶¶103-104.

- f. Claim 7: “...the portion with increased power is selected based on frequency, and wherein a higher frequency portion has increased power.”**

Supra claim 6; *see also* [0022] (“One approach [to frequency-dependent amplification] focuses on amplifying high audio frequencies.”).

- g. Claim 8**

- (1) [8PRE]**

Supra [1PRE].

- (2) [8A] wherein the at least one hearing characteristic of the user is determined via calibrating the user's hearing,**

[0054], [0057]-[0060], claim 6 (“one characteristic of the hearing of the user is determined through calibration”).

- (3) [8B] wherein the power of the audio output signals can be changed as a function of frequency, and**

[0022] (“amplifying the received audio signals can be frequency dependent”); [0023].

- (4) [8C] wherein the user can change the power of the audio output signals.”**

[0056] (“general volume controller that allows the user to adjust the output power of the speaker”).

- h. Claim 9: “...ultrasonic signals....”**

Abstract, claim 1.

i. Claim 10: “...directional speaker.”

Supra limitation [1E].

j. Claim 11: “...an ear speaker.”

Supra [1E]; Anderson-Decl., ¶¶112-116 (explaining “*ear speaker*,” in view of specification and prosecution history, encompasses a speaker that transmits audio toward an ear).

Separately, Cheung also incorporates by reference the same application and corresponding ear-speaker-related disclosure that the applicants added to the ’789 patent when amending to include claims reciting an “*ear speaker*.” *See* Cheung at [0002] (incorporating U.S. Patent Appl. No. 10/826,531 (EX1048)); EX1002, 145-155; Anderson-Decl., ¶117. That same disclosure—which the applicants added to support claim 11—anticipates claim 11 too. EX1048, [0004].

k. Claim 12: “...the speaker is in a headset.”

Cheung discloses that its “system,” which can be the interface unit alone in some embodiments, “can function as the **headset** of a phone, and can be coupled to the phone in a wireless manner, such as through WiFi or Bluetooth.” [0092]; *see also* [0074] (“The system (interface unit and/or the base unit)...”). When Cheung’s system, *i.e.*, interface unit, is used as a “headset of a phone,” then Cheung’s speaker “*is in a headset*.” Anderson-Decl., ¶118.

4. Independent Claim 13

Claim 13 is similar to claim 1 except it recites a “*hearing enhancement apparatus*” rather than a “*hearing enhancement system*.”

As discussed for claim 1, Cheung’s system includes an “*interface unit*” that is “wirelessly coupled to an audio system,” *e.g.*, cell phone or television. Abstract; *supra* §§VI.A.2.b-c. Cheung’s “*interface unit*” is thus a “*hearing apparatus*” as recited in the preamble of claim 13.

As also discussed with respect to claim 1, Cheung teaches embodiments in which the “interface unit” includes the “*wireless receiver*,” “*down-converter*,” “*modifier*,” and “*speaker*” recited in claims 1 and 13. [0018]; [0046]; [0081]; [0091]-[0092]; FIG. 1.

Cheung therefore anticipates claim 13.

5. Dependent Claims 14-82

Dependent claims 14-82 repeat many limitations such that one limitation (*e.g.*, “*directional speaker*”) is found in several different dependent claims. The chart below does not repeat claim language that is identical to earlier claim language that has already been discussed.

Claim	Cheung Disclosure or Prior Claim Mapping
Claim 14	<i>Supra</i> claim 6.

Claim	Cheung Disclosure or Prior Claim Mapping
[15PRE]	<i>Supra</i> claim 14.
[15A]	<i>Supra</i> claim 7.
[15B]	<i>Supra</i> claim 7.
[15C]	<i>Supra</i> [8A]
[15D]	<i>Supra</i> [8B]
[15E]	<i>Supra</i> [8C]

16: “...the down-converted signals are further modified based on the noise level of the environment of the apparatus.”	[0069]-[0070] (describing two approaches for adjusting the system’s amplification based on “the noise level of the environment of the system”); <i>see also</i> [0026].
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Claim 17	<i>Supra</i> claim 4.
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Claim 18	<i>Supra</i> claim 7.
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Claim 19	<i>Supra</i> claim 2.
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Claim 20	<i>Supra</i> [15C]-[15E].
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Claim 21	<i>Supra</i> claim 9.
Claim 22	<i>Supra</i> claim 16.
Claim 23	<i>Supra</i> claim 4.
Claim 24: “...hearing characteristic of the user is wirelessly received and stored in the hearing enhancement apparatus.”	[0060] (“hearing profile can be downloaded into the...system wirelessly”)
Claim 25: “...hearing characteristic of the user is retrieved from a portable media storage device while being physically in contact with the apparatus.”	[0023] (“hearing profile can also be stored in a memory device (such as a removable memory card or stick), which can be inserted into the system”); [0060].
Claim 26	<i>Supra</i> claim 10.
Claim 27	<i>Supra</i> claim 11.
Claim 28	<i>Supra</i> claim 12.
Claim 29	<i>Supra</i> claims 4, 6, 11.

Claim 30	[0057]-[0060].
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Claim 31: “...allows the user to calibrate the user's hearing via a computing device.”	[0058] (“[C]alibration can be done remotely through a web site. The web site can guide the user through the calibration process. This can be done, for example, by the user being positioned proximate to a computer terminal...”).
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Claim 32: “...configured to periodically remind the user to calibrate the user's hearing.”	[0061]
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Claim 33	<i>Supra</i> claim 24.
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Claim 34	<i>Supra</i> claim 12.
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Claim 35: “...the hearing enhancement apparatus is a computing device that is wearable.”	[0098]; FIG. 2.
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Claim 36	[0067], [0074] (describing that the “system” may refer to interface unit only); [0077] (“the
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	system...can also have the electronics to serve as a cell phone.”) [0083].
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Claim 37	<i>Supra</i> claim 32.
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Claim 38: “...includes a user control configured to allow the user to control the power of the audio output signals on a plurality of frequency bands across the audio frequencies.”	[0056] (“...general volume controller that allows the user to adjust the output power of the speaker. This adjustment can also be across certain frequency bands”).
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Claim 39	<i>Supra</i> claim 24.
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Claim 40	<i>Supra</i> claim 12.
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Claim 41	<i>Supra</i> claim 35.
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Claim 42	<i>Supra</i> claim 36.
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Claim 43: “...configured to alter a power level of the audio output signals based on a noise level of the environment of the apparatus.”	<i>Supra</i> claim 16.
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[44PRE]	<i>Supra</i> claim 43.
[44A]: wherein the hearing enhancement apparatus is configured to increase the power of the audio output signals as the noise level increases, and	<i>Supra</i> claim 16. <i>See also</i> [0026] (“power of the output audio signals is increased in a noisier environment”).
[44B]: ...configured not to further increase the power of the audio output signals if the noise level is beyond a certain predetermined threshold.	<i>Supra</i> [44A].

Claim 45: “...a volume control that is configured to respond to a voice command of the user.”	[0056]; [0063] (“system is trained to recognize specific recitation... and/or the user’s voice....when the user says sentences like any of the following, the system would be automatically turned on: ... Louder”).
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Claim 46	<i>Supra</i> claim 12.
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Claim 47	<i>Supra</i> claim 11.
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Claim 48: “...audio output signals are changed in view of a preference of the user stored in the apparatus.”	[0057] (explaining the user hearing profile may include a user preference because “[t]he specific power level that the user feels most comfortable would be the power level for that band for the
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	user.”); [0060] (“...hearing profile can be stored in the...system.”)
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Claim 49: “...audio output signals are changed based on audio sound in the environment of the apparatus.”	<i>Supra</i> claim 16.
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Claim 50: “...a microphone at least for receiving the audio sound in the environment of the apparatus.”	[0048] (“microphone 106 picks up the friend’s speech” when the friend is in nearby environment) [0069]-[0070] (“average power level [of the environment] can include the audio signals of the person talking to the user”)].
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Claim 51: “directional microphone.”	<i>Supra</i> claim 11; <i>See also</i> [0067]-[0068]; claim 11.
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Claim 52	<i>Supra</i> claim 48.
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Claim 53	<i>Supra</i> claim 49.
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Claim 54	<i>Supra</i> claim 50.
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Claim 55	<i>Supra</i> claim 36.
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Claim 56	<i>Supra</i> claim 52.
Claim 57	<i>Supra</i> claim 49.
Claim 58	<i>Supra</i> claim 50.
Claim 59	<i>Supra</i> claim 51.
Claim 60	<i>Supra</i> claim 49.
Claim 61	<i>Supra</i> claim 50.
Claim 62: “...a portion of the hearing enhancement apparatus is in a head-mounted electronic device.”	<i>Supra</i> claim 12.
Claim 63	<i>Supra</i> claim 45.
Claim 64: “...voice command from the user and operate according to the voice command.”	<i>Supra</i> claim 45.

Claim 65: “...hearing characteristic of the user is identified via measuring the user's hearing at least across a plurality of frequencies.”	<i>Supra</i> [8A].
Claim 66: “...alter a power level of the audio output signals so as to suppress at least a sound level associated with the environment of the apparatus so as to provide noise cancellation.”	<i>See</i> EX1049 at [0049] and EX1050 at [0067] both of which Cheung incorporates by reference at [0002]. <i>See also</i> EX1002, 320-335; Anderson-Decl., ¶122.
Claim 67	<i>Supra</i> claim 50.
Claim 68: “...wirelessly couple to a cell phone.”	<i>Supra</i> [1A]-[1B].
Claim 69: “...based on at least a preference of the user, the power of a first range of frequencies of the audio output signals is increased, and the power of a second range of frequencies of the audio output signals is not increased.”	<i>Supra</i> claim 48. <i>See also</i> [0022] (discussing frequency-dependent amplification wherein a band of high-frequency signals are amplified, but a band of low-frequency signals are not); [0051]-[0052].
Claim 70	<i>Supra</i> claim 66.
Claim 71	<i>Supra</i> claim 67.

Claim 72	<i>Supra</i> [1A]-[1B].
Claim 73	<i>Supra</i> claim 69.
Claim 74	<i>Supra</i> claim 65.
Claim 75	<i>Supra</i> [1A]-[1B].
Claim 76	<i>Supra</i> claim 69.
Claim 77	<i>Supra</i> claim 65.
Claim 78: “...assists in measuring the user's hearing.”	[0057] (“the system [e.g., the interface unit) can prompt the user and lead the user through an interactive calibration process”)
Claim 79	<i>Supra</i> claim 24.
Claim 80	<i>Supra</i> claim 25.
Claim 81	<i>Supra</i> claim 66.

B. Ground 2A: Enzmann Anticipates or Renders Obvious Claims 1-2, 4-8, 11-23, 27-30, 43, 46-50, 52-54, 62, 75, 77, 81-82

1. Enzmann (EX1008)

Enzmann discloses an “ear bud” that functions as a hearing aid and “as an ear bud device for a wireless phone.” Abstract; FIG. 2. In either mode, the device modifies an incoming audio signal in accordance with predefined characteristics for a user’s hearing. [0028]; [0046], [0058], claim 15; Anderson-Decl., ¶¶123-124. The connection between the earbud and phone is “wireless.” [0034].

2. Claim 1

a. [1PRE]

Enzmann discloses “systems...for providing a hearing aid capable of communicating with a wireless phone.” [0002]; *see also* [0011], [0026].

b. [1A]: “an audio system...”

Enzmann’s system includes a cellphone that wirelessly transmits audio signals received over a cellular network to the earbud. Abstract; [0032]-[0033]; FIG. 2 (element 270). Enzmann’s phone is an “*audio system configured to receive input signals for broadcasting.*” Anderson-Decl., ¶127; *see also* EX1001, claim 4.

Enzmann’s phone uses Bluetooth to transmit audio signals to the earbud. [0034]. POSAs understood that audio signals transmitted via Bluetooth would have been up-converted by the phone to a higher carrier frequency signal (*e.g.*, by a

transceiver/transmitter) for wireless transmission. Anderson-Decl., ¶¶128-132 (explaining, with corroboration, how audio signals are upconverted and subsequently down-converted for audio playback in conventional wireless audio systems).

If Patent Owner argues that Enzmann fails to disclose limitation [1A], then implementing Enzmann's system such that its phone includes circuitry to "*up-convert*" received cellular input signals "*into up-converted signals*" to be transmitted via a wireless medium (*e.g.*, Bluetooth) would have been the use of a known technique to improve similar devices in the same way. As Dr. Anderson explains, the need to up-convert (modulate) an audio signal onto a higher-frequency signal for wireless transmission (and the subsequent need to down-convert (demodulate) that signal for audio playback) was a fundamental aspect of electronic communication systems. Anderson-Decl., ¶¶133-134 (citing, *e.g.*, EX1025 at 1:11-20, EX1026 at [0022], and EX1027 at 2-4 as corroboration).

c. [1B]: "wireless receiver..."

Enzmann's earbud includes a "transmit/receive (TX/RX) unit" that "receives communications from the wireless phone." [0031]-[0033]; FIG. 2; Anderson-Decl., ¶135. The connection between the phone and the transmit/receive unit is "a *wireless* digital connection, such as Bluetooth." [0034].

d. [1C]: “down-converter...”

Enzmann’s earbud uses Bluetooth to receive audio signals from a phone. [0034]. POSAs understood that audio signals received via Bluetooth would have been down-converted by the earbud—*e.g.*, by Enzmann’s TX/RX unit—from a higher carrier frequency signal to a lower baseband frequency signal. FIG. 2; Anderson-Decl., ¶136.

If Patent Owner argues that Enzmann fails to disclose limitation [1C], then implementing Enzmann’s system such that its earbud’s TX/RX unit down-converted (demodulated) the received upconverted signal would have been a routine (indeed, expected) design. Anderson-Decl., ¶137.

e. [1D]: “modifier...”

As seen in Figure 2, Enzmann’s earbud includes a “source control module 230” that receives data from the TX/RX unit and communicates data to DSP 220. [0032]-[0033]; [0043].

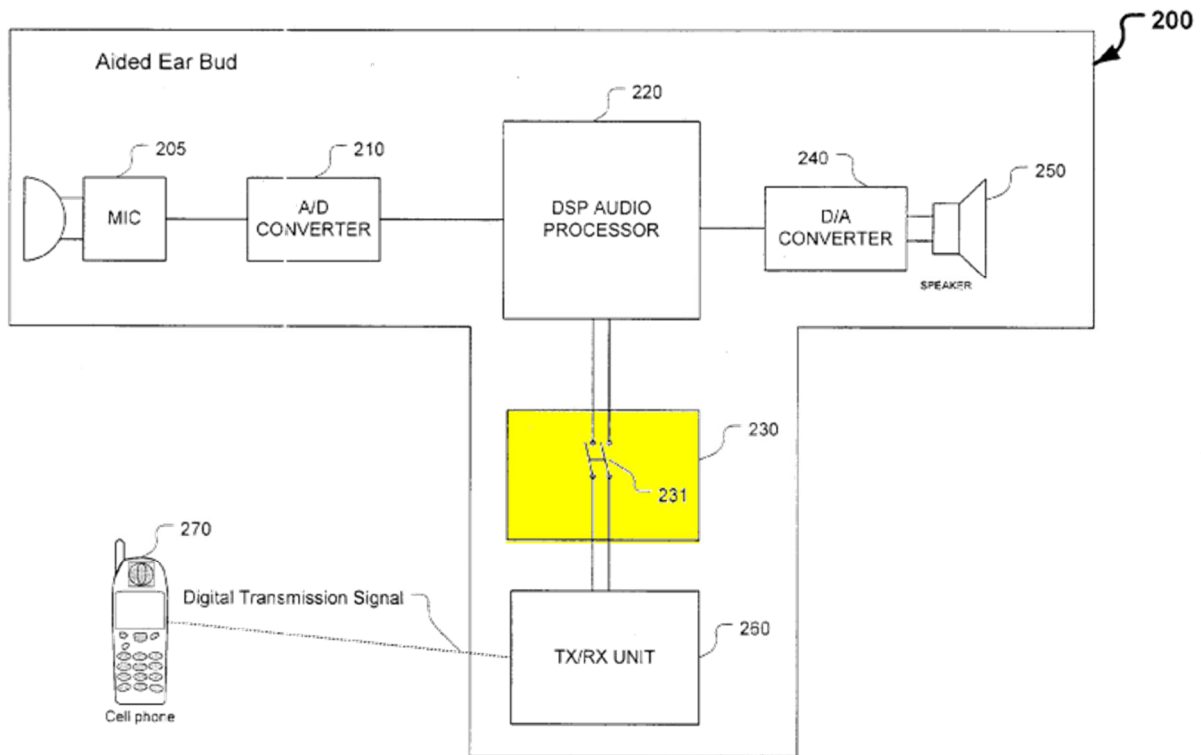


FIG. 2

Enzmann's source-control module (including its digital logic 230), by itself or in combination with DSP 220, is a “*modifier*” as claimed. [0042], FIG. 4; Anderson-Decl., ¶¶138-139. For example, Enzmann explains the source-control module includes an “amplification chart” that contains a “series of pre-stored dynamic frequency maps based on the user’s *hearing characteristics*.” [0046]; FIG. 4. The digital logic within the source-control module “receive[s] the transmitted signal from the TX/RX unit 260 and process[es] those signals to an optimal form based on the user’s *hearing*, speaker and ambient noise *characteristics*.” [0046]; *see also* [0028]; [0050] (explaining DSP “fixes” audio based on input from the digital logic); [0057]-[0058] (same); claims 5-7, 13-18.

Figure 5 (below) depicts an amplification chart that Enzmann's digital logic uses to adjust the decibels of an audio signal at higher frequencies "to produce a result that is very close to the desired [hearing] characteristic." [0046]; *see also* claims 13-18; Anderson-Decl., ¶140.

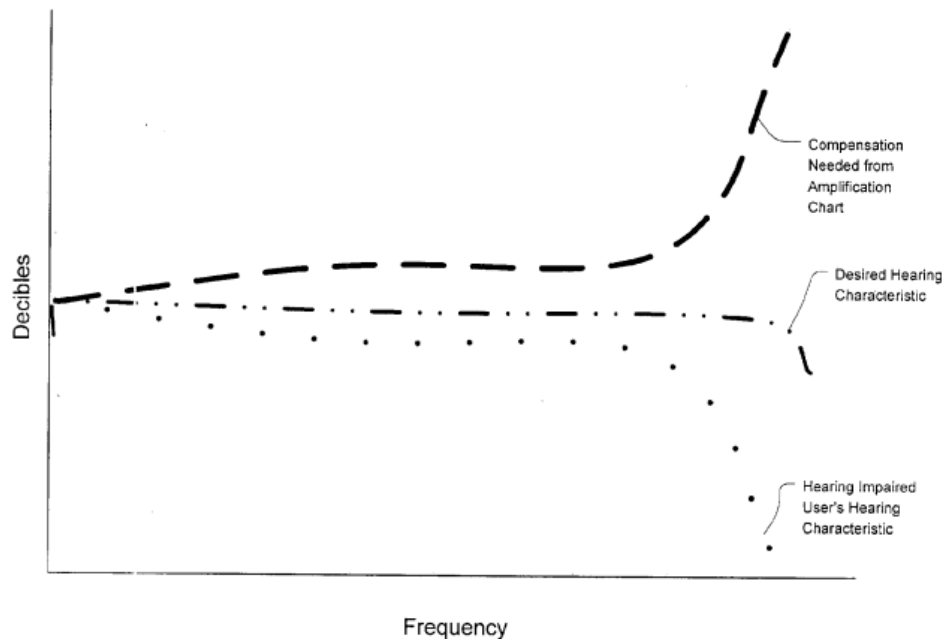


FIG. 5

f. [1E]: “speaker...”

Enzmann's aided earbud includes a speaker that outputs audio based on audio signals received from Enzmann's digital-signal processor, and those signals include audio signals that have been adjusted based on the amplification chart as discussed for [1D]. [0050]; *see also* [0057]-[0061]; claim 10.

3. Dependent Claims 2, 4-8, 11-12

a. Claim 2: “...WiFi.”

Enzmann’s connection between its earbud and phone can be “any kind of wireless...connection.” [0034]. POSAs would have understood “any” wireless connection included WiFi which was a known medium for transmitting audio signals. Anderson-Decl., ¶¶142-143 (citing, *e.g.*, EX1052 and EX1053 as corroboration).

Alternatively, implementing Enzmann’s connection using WiFi would have been the simple substitution of one known element (Bluetooth) for another (WiFi) to obtain predictable results (a wireless connection over which audio signals can be transmitted). Anderson-Decl., ¶144.

b. Claim 4: “....audio system is a phone”

See [1A]; *see also* [0030] (“ear bud for the wireless phone”); [0034]; [0009].

c. Claim 5: “....audio system receives the input signals from a microphone”

The audio signals that Enzmann’s earbud receives from a phone are “*input signals from a microphone*,” *i.e.*, the microphone on the calling-party’s phone. Anderson-Decl., ¶146.

- d. **Claim 6: “....the down-converted signals are modified such that a portion of the audio output signals has an increased power to enhance the hearing of the user.”**

As shown in Figure 5’s amplification chart, the digital logic in Enzmann’s source-control module modifies audio signals from the phone by increasing sound level (decibels) at higher frequency. [0046]; FIG. 5. Increasing the decibels of an audio signal conventionally requires increasing the signal’s power. Anderson-Decl., ¶¶147-148.

- e. **Claim 7: “...the portion with increased power is selected based on frequency, and wherein a higher frequency portion has increased power.”**

See claim 6; Anderson-Decl., ¶149.

- f. **Claim 8**

- (1) **[8PRE]**

See [1PRE].

- (2) **[8A] ...hearing characteristic of the user is determined via calibrating the user's hearing,**

The ’789 patent explains “[c]alibration enables the system to determine (e.g., estimate) the hearing sensitivity of the user.” EX1001, 7:29-31. One calibration technique involves playing different sound-pressure levels (typically expressed in dB) at different audio frequency bands to test a user’s hearing, with the user indicating which SPL for each frequency band “the user feels most comfortable.” *Id.*, 7:33-39.

As discussed for limitation [1D], Enzmann's Figure 5 depicts an amplification chart that Enzmann uses to adjust the decibels of an audio signal at higher frequencies "to produce a result that is very close to the desired [hearing] characteristic." [0046]. As seen below, Enzmann's amplification chart identifies (a) the frequencies a specific user has difficulty hearing, (b) the frequencies a non-hearing impaired user is expected to hear, and (c) the increase in decibels needed to compensate for the user's specific hearing impairment. [0046]; Anderson-Decl., ¶¶151-152.

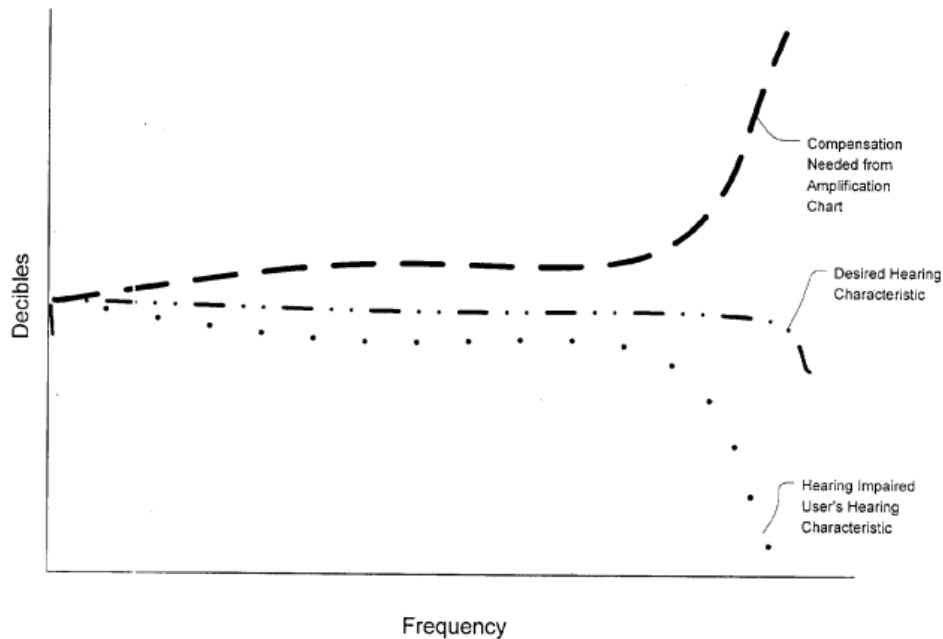


FIG. 5

As Dr. Anderson explains, Enzmann's amplification chart includes information typical of an audiogram, which is a visual representation of a user's hearing that had been used long before 2003. Anderson-Decl., ¶¶153-155 (citing, *inter alia*, EX1037 (from 1936) at FIGS. 1-3 and EX1046 (from 1950) at 1:15-21, 2:14-21). Like a conventional audiogram, the dotted line in Enzmann's Figure 5 depicts a user's hearing ability across different frequencies with the particular user's hearing depicted in Figure 5 "lack[ing] significant hearing capability in higher frequencies." Enzmann, [0046]; Anderson-Decl., ¶154. In Enzmann's Figure 5, the Y axis represents sound intensity (measured in dBs), while the X axis represents audio frequency. Anderson-Decl., ¶153.

POSAs would have known that generating the data for an audiogram chart "typically involves playing a set of tones through headphones while adjusting the level and frequency of the tones, and having the patient indicate whether each tone can be heard or is inaudible." EX1029, [0005]; Anderson-Decl., ¶155 (citing, *e.g.*, EX1043 at 1:20-46, EX1046 at 1:52-57, 2:4-12, EX1047 at 8:3-21, 11:39-47). This "typical[]" practice for creating an audiogram is the same calibration technique that the '789 patent describes at 7:29-41. Anderson-Decl., ¶157. POSAs would have expected that the user-specific information in Enzmann's amplification chart was generated using a similar calibration technique and/or doing so would have been the obvious implementation of Enzmann's teachings. Anderson-Decl., ¶158.

Accordingly, Enzmann's amplification chart, *i.e.*, the claimed "*hearing characteristic of the user*," is (or would have been) determined "*via calibrating the user's hearing*."

- (3) [8B] wherein the power of the audio output signals can be changed as a function of frequency, and

Supra claim 6.

- (4) [8C] wherein the user can change the power of the audio output signals.

Although Enzmann does not explicitly state that users can "*change the power of the audio output signals*," POSAs knew hearing aids included means by which a user could adjust the device's volume. Anderson-Decl., ¶160 (citing EX1012 at 1:19-24 and EX1014 at 4:65-67 as corroboration). If not disclosed by Enzmann already, then implementing Enzmann's earbud such that its volume could be adjusted by a user would have been a routine design choice that benefited patients by allowing them to adjust volume to their preferred levels. Anderson-Decl., ¶161.

g. Claim 11: "...an ear speaker."

Enzmann's earbud fits in a user's ear. [0008] (explaining ear buds are "placed in or in close proximity to the ear").

h. Claim 12: “...in a headset.”

POSAs would have known there were several alternative design choices available for earbuds, including headsets. Anderson-Decl., ¶¶163-165 (citing EX1011 and EX1023 as examples). Implementing Enzmann’s earbud using a headset design rather than Enzmann’s earbud design would have been a routine design choice. Anderson-Decl., ¶166.

4. Independent Claim 13

Claim 13 is similar to claim 1 except claim 13 recites a “*hearing enhancement apparatus*” rather than a “*hearing enhancement system*.” As discussed for claim 1, Enzmann’s system includes an earbud with a “*wireless receiver*,” “*down-converter*,” “*modifier*,” and “*speaker*” as recited in claim 13.

Enzmann’s earbud meets claim 13’s “*hearing apparatus*,” and Enzmann anticipates (or renders obvious) claim 13 for the same reason it anticipates (or renders obvious) claim 1.

5. Dependent Claims 14-20, 22-23, 27-30, 43, 46-50, 52-54, 62, 75, 77 and 81-82.

The chart below identifies how Enzmann discloses (or renders obvious) the various dependent claims. *See also* Anderson-Decl., ¶¶168-202.

Claim	Enzmann Disclosure or Prior Claim Mapping
Claim 14	<i>Supra</i> claims 6, 13.

Claim	Enzmann Disclosure or Prior Claim Mapping
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[15PRE]	<i>Supra</i> claim 14.
[15A]	<i>Supra</i> claims 6-7.
[15B]	<i>Supra</i> claim 6-7.
[15C]	<i>Supra</i> [8A]
[15D]	<i>Supra</i> [8B]
[15E]	<i>Supra</i> [8C]

Claim 16	<i>Supra</i> claim 15. <i>See also</i> [0046] (explaining digital logic within the source-control module “process[es]” the down-converted signals “to an optimal form based on the user’s hearing, speaker and ambient noise characteristics”); [0047] (“The ambient noise characteristic is usually dynamic and updated as the noise levels around the ear bud change.”).
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Claim 17	<i>Supra</i> claims 4, 16.
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Claim 18	<i>Supra</i> claims 6-7, 14.
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Claim 19	<i>Supra</i> claims 2, 13.
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Claim	Enzmann Disclosure or Prior Claim Mapping
Claim 20	<i>Supra</i> claims 8, 13.
Claim 22	<i>Supra</i> claim 13, 16.
Claim 23	<i>Supra</i> claims 4, 13.
Claim 27	<i>Supra</i> claims 11, 13.
Claim 28	<i>Supra</i> claims 12-13.
Claim 29	<i>Supra</i> claims 4, 6, 11, 13, 17.
Claim 30	<i>Supra</i> claim 8.
Claim 43	<i>Supra</i> claims 16, 29.
Claim 46	<i>Supra</i> claims 12-13.
Claim 47	<i>Supra</i> claims 11, 46.

Claim 48: “...wherein the audio output signals are changed in view of a preference of the user stored in the apparatus.”	As discussed above for claim 8, Enzmann’s amplification chart is (or would have been) determined by calibrating a user’s hearing, which reflects the user’s preferences for adequate hearing. Anderson-Decl., ¶190.
Claim 49	<i>Supra</i> claims 16, 48.
Claim 50: “...a microphone at least for receiving the audio sound in the environment of the apparatus.”	<i>Supra</i> claim 49. <i>See also</i> [0031] (“ear bud[] comprises a microphone 205”); [0033] (“Ambient noise...[is] capture[d] by the microphone 205....”)
Claim 52	<i>Supra</i> claims 46, 48.
Claim 53	<i>Supra</i> claims 16, 46.
Claim 54	<i>Supra</i> claims 50, 53.
Claim 62: “...a head-mounted electronic device.”	[0008] (“The ear bud device...is essentially a headphone -type device”).

Claim 75: “...wherein the apparatus is configured to wirelessly couple to a cell phone.”	<i>Supra</i> claims 4, 62.
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Claim 77	<i>Supra</i> claims 30, 62.
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Claim 81: “...alter a power level of the audio output signals so as to suppress at least a sound level associated with the environment of the apparatus so as to provide noise cancellation.”	<i>Supra</i> claim 16, 62. In Enzmann, “ambient noise” that the earbud’s microphone captures is “typically <i>reduced in volume</i>” before being combined with the input audio signal from, <i>e.g.</i>, a cellular phone. Enzmann, [0040]; <i>see also</i> [0027], [0046]-[0047]. The combined audio output signal is then played for the user. <i>Id.</i>, [0046]-[0047]; Anderson-Decl., ¶¶199-201.
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Claim 82	<i>Supra</i> claims 50, 62, 81.
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C. Ground 2B: Enzmann in View of Eaton Renders Claims 24, 31, 33-35, 39-41, and 79 Obvious.

Ground 2B challenges claims that either directly or via dependency require the “*hearing characteristic of the user*” recited in independent claim 13 be “*wirelessly received and stored in the hearing enhancement apparatus.*” These claims would have been obvious for the reasons discussed below.

1. Eaton (EX1010)

Eaton discloses techniques for using a mobile device—like a phone—to program hearing aids. Eaton, Abstract; 2:15-20; 4:10-16; 6:30-33; claim 24. Eaton teaches adjusting “audiological parameters” for a hearing aid so as to “tailor[]” those parameters “for a specific patient.” *Id.*, 4:13-16. To tailor the parameters, the patient’s hearing “is tested to obtain aural responses to various conditions. These responses are then used to determine which audiological parameters to adjust as well as the ranges of audiological parameter values that may be adjusted.” *Id.*, 4:17-22. An “aural response,” Eaton explains, is “a result obtained by applying a series of tests on the patient; one test may include sending audio test signals and measuring the response of the patient to those audio test signals.” *Id.*, 9:20-26.

Eaton discloses an embodiment in which the device sends “audio test signals” to the hearing aid and receives aural responses from the patient to those signals. *Id.*, 11:17-24, claim 6. The device then sends the aural responses (or an audiogram based on those responses) to a “programming fitting server,” which derives an “audiological parameter from the aural responses [or audiogram].” 11:24-33. The patient-specific audiological parameter is then transmitted by the mobile device to the hearing aid which uses it to adjust audio signals to improve the user’s hearing. *Id.*, 1:15-16, 11:33-12:4, claim 46 (“upgraded audiological software includes a piece of software to be executed on the hearing aid”).

2. The Enzmann-Eaton Combination

In view of Eaton, POSAs had reason to implement Enzmann's earbud such that its amplification chart could be updated wirelessly. Enzmann explicitly recognizes that "[t]he user's hearing characteristics," as reflected in its amplification chart, "remain static unless the aided ear bud 200 is reprogrammed to compensate for additional hearing loss or increase and different users." Enzmann, [0046]. Enzmann thus motivates POSAs to consider techniques for updating the amplification chart. Anderson-Decl., ¶206.

Eaton's technique for updating a hearing aid is one such technique, and Eaton touts its technique as an improvement on the then-conventional technique for reprogramming hearing aids—*i.e.*, visiting an audiologist's office—which was considered "laborious and time intensive." Eaton, 1:17-25. POSAs thus had reason to modify Enzmann's system to use Eaton's technique for wirelessly programming a hearing aid to a user's personal hearing characteristics. Anderson-Decl., ¶207.

In the Enzmann-Eaton combination, a user would utilize a mobile device, such as a phone, to send "audio test signals" to Enzmann's earbud and receive an aural response from the patient to those test signals. Eaton, 11:17-24. The mobile device would then send those aural responses to Eaton's "programming fitting server" which would process the responses to generate "audiological parameters...used to tailor an audiological therapy." Eaton, 11:31-32; Anderson-Decl., ¶208.

In an obvious implementation of Enzmann-Eaton, the “audiological parameters” would take the form of an updated version of Enzmann’s amplification chart that reflects changes to the user’s hearing profile (and corresponding changes to the amplification needed to account for such changes). Anderson-Decl., ¶209. The audiological parameters, *i.e.*, updated amplification chart, would then be sent wirelessly to Enzmann’s hearing aid for storage and subsequent use. Enzmann, [0043] (“memory device 310”), [0048] (explaining the amplification chart is “stored in EEPROM”), FIG.4; Anderson-Decl., ¶209.

POSAs would have had a reasonable expectation of success in achieving the proposed combination as modifying Enzmann to store/use an updated amplification chart requires only routine software engineering. Anderson-Decl., ¶210.

3. Claims 24, 31, 33-35, 39-41, and 78-79

a. Claim 24: “...hearing characteristic...is wirelessly received and stored....”

As discussed *supra* §VI.C.2, in the Enzmann-Eaton combination, an updated version of Enzmann’s amplification chart, *i.e.*, “*one hearing characteristic of the user,*” is received via a wireless connection with a mobile device and stored in memory on Enzmann’s hearing aid. Enzmann, [0043]; [0048]; FIG. 4; Eaton, 6:11-25; *see also* claim 13 (Ground 2A).

b. Claim 31: “...calibrate the user’s hearing via a computing device.”

As discussed *supra* §VI.C.2, in the Enzmann-Eaton combination, the mobile device, which is a “*computing device*” that the user operates, sends audio test signals to Enzmann’s hearing aid and receives aural responses from the patient to those test signals. Eaton, 11:17-24; *see also* claim 6; 5:11-16 (“diagnostics and adjustment is initiated by a patient”). Based on the patient’s aural responses, the hearing aid is re-calibrated using an updated amplification chart that accounts for changes in the user’s hearing. *Supra* §VI.C.2.

c. Claim 33

Supra claim 24; *see also* claim 30 (Ground 2A).

d. Claim 34

Supra claim 33; *see also* claim 12 (Ground 2A).

e. Claim 35: “...a computing device that is wearable.”

Enzmann’s earbud—used in the Enzmann-Eaton combination—is a “*computing device that is wearable*.” Enzmann, FIG. 2 (depicting electronics for the earbud); [0008].

f. Claim 39

Supra claim 24; *see also* claim 29 (Ground 2A).

g. Claim 40

Supra claim 39; *see also* claim 12 (Ground 2A).

h. Claim 41

Supra claims 35 and 39.

i. Claim 78: “...hearing enhancement apparatus assists in measuring the user’s hearing.”

As discussed *supra* §§VI.C.1-2, Eaton’s audiological parameters are determined by “sending audio test signals” to a hearing aid and “measuring the response of the patient to those audio test signals.” Eaton, 9:19-26. When that technique is implemented with Enzmann’s earbud, the earbud “*assists in measuring the user’s hearing*” because it plays the audio test signals for the patient. *See also* claim 62 in Ground 2A.

j. Claim 79

Supra claim 24; *see also* claim 62 (Ground 2A).

D. Ground 2C: Enzmann in View of Sauer Renders Obvious Claims 45 and 63-77.

At a high-level, the claims challenged in Ground 2C require (directly or via dependency) that claim 13’s “*hearing enhancement apparatus*” include voice-control capabilities. As discussed below, adding such functionality to Enzmann’s earbud would have been obvious.

1. Sauer (EX1012)

Sauer discloses a voice-controlled hearing aid. Sauer, Title; Abstract. Sauer explains that some hearing-aid users have difficulty adjusting a hearing aid's physical controls, *e.g.*, a knob for controlling volume. *Id.*, 1:16-50.

To address this problem, Sauer discloses the use of a “voice decoder” that recognizes certain “code words” the user utters and adjusts settings based on those words. *Id.*, Abstract; 3:5-26; claim 1; FIG. 1. For example, “the hearing aid wearer can modify the volume gain of the hearing aid on the basis of stored code words and corresponding spoken instructions such as ‘softer’ and ‘louder.’” *Id.*, 3:31-34. To capture words spoken by the user, Sauer's system uses the hearing aid's pre-existing microphone. *Id.*, 4:19-23.

2. The Enzmann-Sauer Combination

As discussed in Ground 2A for limitation [8C], POSAs would have understood that Enzmann's earbud includes means for controlling the earbud's volume despite Enzmann not explicitly describing such a mechanism. In view of Sauer, POSAs would have known that one suitable mechanism for controlling the volume on Enzmann's earbud would have been to use Sauer's voice decoder. Anderson-Decl., ¶225.

Sauer explicitly motivates the combination by touting the benefits of voice-controls. 1:15-58; Abstract. Moreover, using Sauer’s voice-control technique would have been the simple substitution of one known element for controlling a hearing aid’s volume (Sauer’s voice control) for another (Enzmann’s unidentified control) to obtain predictable results, *i.e.*, a hearing aid with volume users can adjust. That Enzmann already includes a microphone for capturing the user’s voice (Enzmann, [0033]), highlights its compatibility with Sauer’s technique. POSAs therefore had reason to modify Enzmann’s earbud to utilize Sauer’s technique for voice-controlled functionality, and a reasonable expectation of success in doing so. Anderson-Decl., ¶226.

In an obvious implementation of Enzmann-Sauer, Enzmann’s earbud would be modified to include Sauer’s voice decoder which would identify certain code words such as “softer” or “louder,” the utterance of which would cause Enzmann to reduce or increase the earbud’s volume. Anderson-Decl., ¶227.

3. Claims 45 and 63-77

a. Claim 45: “...a volume control that is configured to respond to a voice command of the user.”

As discussed *supra* §VI.D.2, in the Enzmann-Sauer combination, Enzmann’s earbud “*includes a volume control*” in the form of Sauer’s voice-decoder and code-word technique and that volume control “*is configured to respond to a voice command of the user,*” as claimed. *See also* claim 29 in Ground 2A.

b. Claim 63

Supra claim 45; *see also* claim 62 (Ground 2A).

c. Claim 64

Supra claim 45; *see also* claim 62 (Ground 2A).

d. Claim 65: “...hearing characteristic...is identified via measuring the user's hearing at least across a plurality of frequencies.”

In the Enzmann-Sauer combination, Enzmann’s earbud continues to use an amplification chart to modify the audio signal based on a user’s unique hearing characteristics. *Supra* §VI.B.2.e (discussing “*at least one hearing characteristic*” limitation). As seen below in Figure 5, Enzmann’s amplification chart “*is identified via measuring the user's hearing at least across a plurality of frequencies,*” as claimed. Enzmann, [0028] (“preprogrammed frequency mapping of the user's hearing characteristics”); [0046] (“frequency maps”); Anderson-Decl., ¶¶231-232.

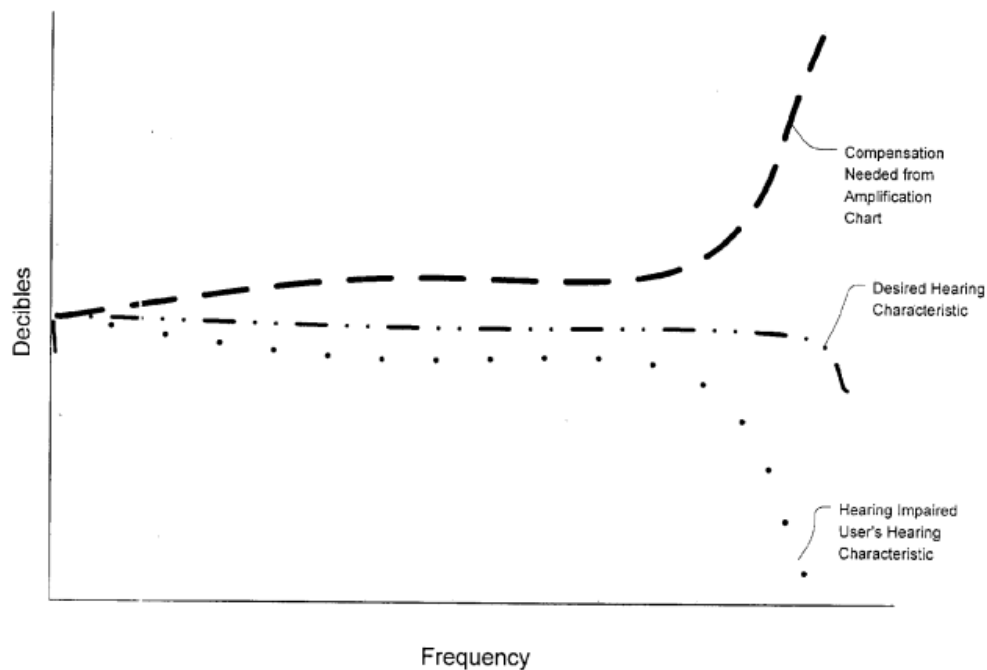


FIG. 5

e. Claim 66

Supra claim 65; *see also* claim 81 (Ground 2A).

f. Claim 67

Supra claim 66; *see also* claim 50 (Ground 2A).

g. Claim 68

Supra claim 67; *see also* limitation [1A] (Ground 2A).

h. Claim 69

As discussed with claim 48, Enzmann's amplification chart reflects a user's audio preferences as determined by, *e.g.*, a hearing test performed by an audiologist.

As reflected in Enzmann's Figure 5 (below), *"the power of a first range of frequencies of the audio output signals is increased,"* (blue circle below) whereas *"the power of a second range of frequencies of the audio output signals is not increased"* (red circle below). Anderson-Decl., ¶237.

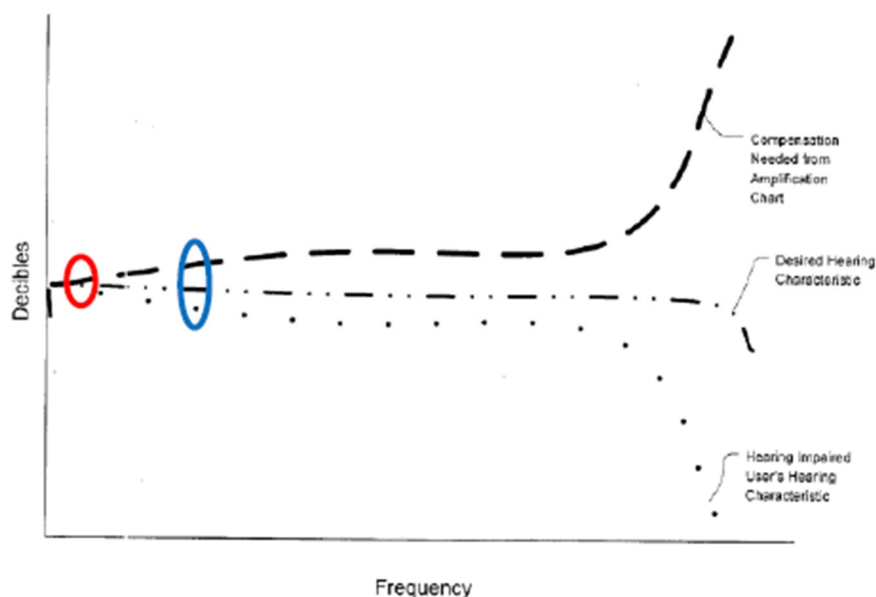


FIG. 5

If Patent Owner argues that Enzmann-Sauer fails to meet claim 69, the claim would have been obvious over Enzmann-Sauer in view of POSAs' background knowledge. Specifically, POSAs understood many hearing-impaired individuals suffer from slope loss, which requires signal amplification for high frequency audio but not for lower frequencies. Anderson-Decl., ¶238. POSAs thus would have expected that, for at least some individuals, Enzmann's amplification chart would

reflect a need for audio-signal compensation only for a range of high-frequency signals and not low-frequency signals, meeting claim 69. Anderson-Decl., ¶239.

i. Claim 70

Supra claims 64, 66.

j. Claim 71

Supra claims 67, 70.

k. Claim 72

Supra claims 68, 71.

l. Claim 73

Supra claims 69, 72.

m. Claim 74

Supra claims 65, 73.

n. Claim 76

Supra claims 62, 69.

o. Claim 77

Supra claims 62, 65.

E. Ground 2D: Enzmann in View of Hagen Renders Claim 51 Obvious.

Claim 51 limits the “*microphone*”—recited in claim 50⁴—to “*a directional microphone.*” Implementing Enzmann’s earbud such that its microphone is “*directional*” would have been obvious for the reasons discussed below.

1. Hagen (EX1014)

Hagen discloses a hearing aid with a microphone system that a user can switch between a non-directional (or omni-directional) mode and a directional mode. 1:10-17; Anderson-Decl., ¶¶248-250. As Hagen explains, “[a] non-directional hearing aid system allows the wearer to pickup sounds from any direction,” whereas a “directional hearing aid helps the wearer to hear the voice of the person he or she is having a conversation with, while reducing the miscellaneous crowd noise present within the room.” 1:18-28. Hagen teaches it would be desirable to allow a user to switch between a directional and non-directional mode. 2:45-60.

2. The Enzmann-Hagen Combination

In view of Hagen, POSAs would know it was beneficial to allow a person using Enzmann’s earbud the option of switching its microphone from a directional mode to a non-directional mode. For example, when Enzmann’s earbud is operating as a hearing aid, it would be beneficial for the microphone to be directional so the

⁴ Discussed in Ground 2A.

user can better hear the person with whom he or she is speaking. Conversely, when the earbud is being used as a companion to a phone, the microphone can be switched to a non-directional mode to better pick up (and thus cancel out) background sounds. Hagen, 1:18-28; Anderson-Decl., ¶251.

Separately, Hagen’s description of prior-art hearing aids confirms that the use of directional microphones to improve a hearing-impaired person’s ability to hear a conversation was known, such that using a directional microphone in Enzmann’s earbud would have been a routine design choice for POSAs. Anderson-Decl., ¶252 (citing, *e.g.*, EX1030 at 1:5-10 and EX1031 at 1:21-44). POSAs thus had reason to modify Enzmann’s earbud to include a directional microphone so as to better capture the voice of a person speaking to the earbud-wearer, and a reasonable expectation of success in doing so. Anderson-Decl., ¶¶252-253.

In the Enzmann-Hagen combination, Enzmann’s earbud would include Hagen’s microphone system, and a user of Enzmann’s earbud would thus be able to make Enzmann’s microphone a directional microphone. Anderson-Decl., ¶254.

3. Claim 51

As discussed immediately above, in the Enzmann-Hagen combination, Enzmann’s microphone would have been—at least in certain modes of operation—a “*directional microphone*.” *See also* Claim 50 in Ground 2A.

F. Ground 2E: Enzmann in View of Fretz Renders Claims 10 and 26 Obvious.

Claims 10 and 26, respectively, limit the “*speaker*” of independent claims 1 and 13 to a “*directional speaker*.” Implementing Enzmann’s earbud such that its speaker is “*directional*” would have been obvious for the reasons discussed below.

1. Fretz (EX1013)

Fretz discloses an open-ear hearing aid. Fretz, Abstract; FIGS. 1, 5A-5B. Fretz explains that hearing aids inserted into a user’s ear have known drawbacks including creation of an “occlusion effect” that results “in sounds which are both unnatural and uncomfortable for the user.” *Id.*, 1:24-30, 3:1-5. Fretz discloses an open-ear hearing aid that keeps the user’s ear open thereby preventing the occlusion effect. *Id.*, 4:14-25, 14:25-15:2.

Fretz explains that its design facilitates “a greater possibility of feedback than with conventional, sealed canal hearing aids. That is, with an open ear canal, sound emanates from the open canal with little attenuation. The microphone [] picks up sound from both distant sources and sound coming out of the ear canal. The sound coming out of the ear canal causes feedback.” *Id.*, 12:12-16. To address this issue, Fretz teaches the use of a directional speaker (referred to as a “receiver”) which “can be designed so that sound is transmitted with higher amplitude toward the ear drum than it is in the other direction.” *Id.*, 14:6-24; *see also* 10:1-3 (“receiver... is an output device, such as a loudspeaker”).

2. The Enzmann-Fretz Combination

Fretz discloses an alternative design for Enzmann's earbud, and Fretz explicitly motivates POSAs to utilize its design to avoid drawbacks of in-the-ear hearing aids like Enzmann's earbud. Fretz, 1:24-30, 3:1-5. POSAs thus had reason to implement Enzmann's earbud using Fretz's design, and a reasonable expectation of success in making the combination. Anderson-Decl., ¶¶259-260. In the combination, Enzmann's earbud would retain Enzmann's functionality, but the earbud would use Fretz's open-ear design, including its use of a directional speaker to reduce feedback. Anderson-Decl., ¶260.

3. Claims 10 and 26

In the Enzmann-Fretz combination, Enzmann's earbud would have been implemented to include a “*directional speaker*” to reduce feedback, thereby rendering claims 10 and 26 obvious. *See also* claims 1 and 13 (Ground 2A).

G. Ground 3A: Berger Anticipates and/or Renders Obvious Claims 1-8, 11-15, 18-20, 23, 25, 27-30, 46-48, 52, 62, 75-76, and 80.

1. Berger (EX1011)⁵

Berger integrates a hearing aid into various electronic devices. Abstract; [0041]. An embodiment in which a hearing aid is integrated into a wireless headset is shown in Figure 6 below ([0041]):

⁵ Citations in Ground 3A are to EX1011.

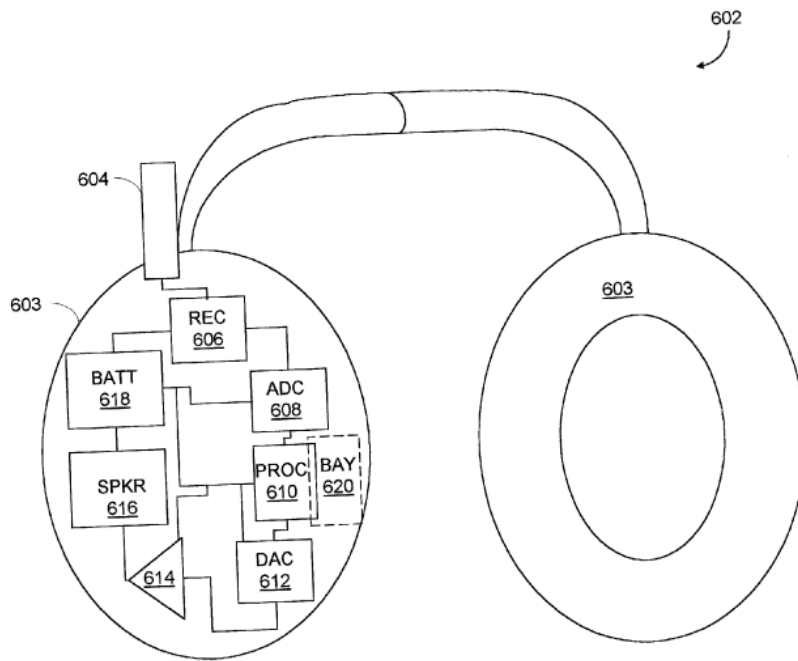


FIGURE 6

Figure 6's headset includes various components including a receiver 606 and a processor 610. [0041]. The headset works with electronic devices, including a television and/or cellphone. [0008]; [0039]; [0041].

Berger describes the functionality of its electronic components in the context of the handset shown in Figures 1 and 2A ([0017]-[0022]), but POSAs would have understood that the components perform the same functionality in Figure 6's headset, *e.g.*, processor 610 performs the same functions as processor 210. Anderson-Decl., ¶264.

The headset's receiver "receives [a] digital wireless signal" picked up by antenna 604 and generates a digital audio signal that is transmitted to the processor. [0018]; [0041]. "A user's [hearing] prescription is programmed into" the processor, which "transforms the [digital audio] signal by applying a transfer function with more gain in the frequency ranges where the user has lost hearing." [0019]; [0041]. The modified signal is then transmitted to digital-to-analog converter 612 where it is converted to an analog signal, amplified by an amplifier 614, and output by speaker 616. [0019]; [0041].

2. Claim 1

a. [1PRE]

Berger discloses a "system" that "integrates a hearing aid with devices," including a wireless headset, and the system includes "a processor [that] transforms an electrical signal to compensate for a hearing impairment." Abstract; *see also* [0041].

b. [1A]: "audio system...;"

Berger's system includes "*an audio system configured to receive input signals for broadcasting*" such as a television or cellphone, each of which receives audio signals—*e.g.*, television or cellular signals—as inputs for broadcasting. [0008]; [0039], [0041]; Anderson-Decl., ¶268.

As Berger observes, a wireless headset needs “a receiver....because the incoming signal must be demodulated.” [0046]. POSAs would have understood Berger’s observation to disclose that the incoming wireless signal the headset receives, *e.g.*, from a television or cellphone, has been modulated, *i.e.*, up-converted, for wireless transmission by the transmitting source, *e.g.*, the television or cellphone. Anderson-Decl., ¶269. Berger thus discloses “*an audio system...configured to up-convert the received input signals into up-converted signals to be wirelessly transmitted.*”

c. [1B]: “...wireless receiver...”

As seen below, Berger’s headset includes “receiver 606.” [0018]; [0041].

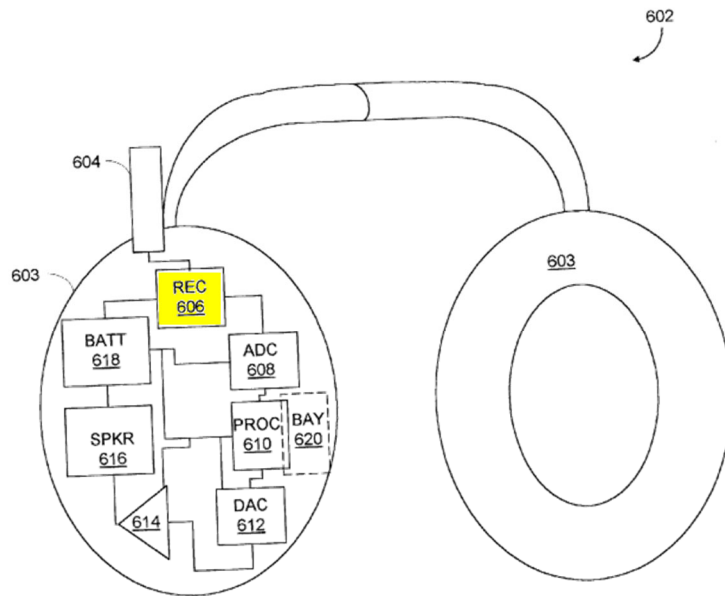


FIGURE 6

d. [1C]: “...down-converter...”

Berger’s receiver is a “*down-converter*” that converts the received wireless signal to a down-converted signal for audio playback. [0046] (a receiver “demodulate[s],” *i.e.*, down-converts, “the incoming signal”); Anderson-Decl., ¶272.

e. [1D]: “a modifier...”

Berger’s headset includes “*a modifier*” as claimed, *i.e.*, processor 610. The processor “transforms the [received audio] signal by applying a transfer function with more gain in the frequency ranges where the user has lost hearing.” [0021]; *see also* [0022]; [0003] (hearing aids “remedy a specific pattern of frequency loss specified by a user’s prescription”); [0038]; Anderson-Decl., ¶¶273-274.

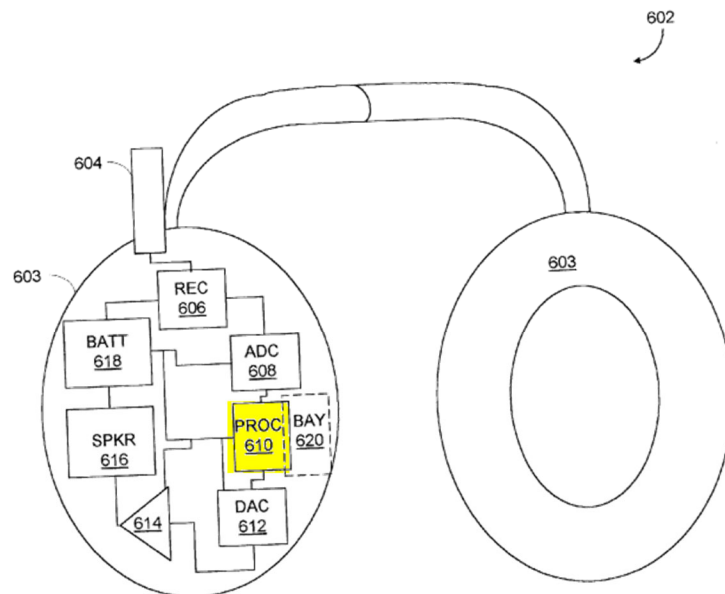


FIGURE 6

f. [1E]: “a speaker...”

Berger’s headset includes speaker 616. [0019]; [0041].

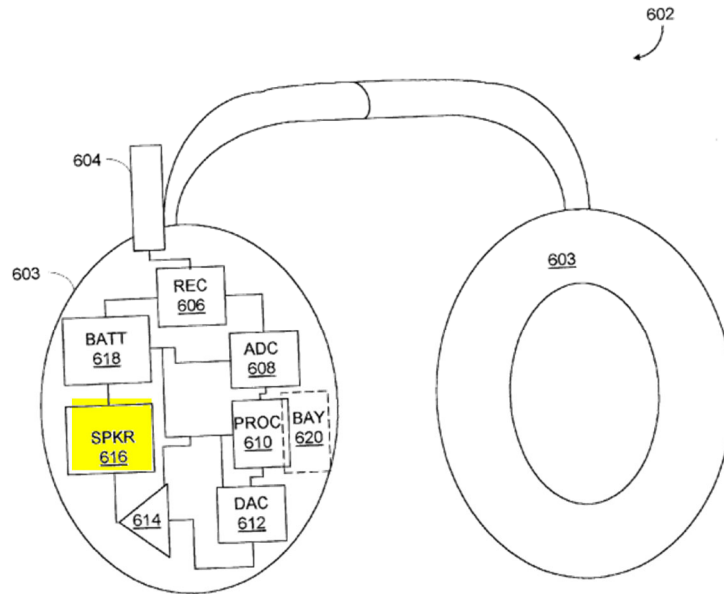


FIGURE 6

3. Dependent Claims 2-8 and 11-12

a. Claim 2: “...WiFi....”

Berger does not state which wireless protocol its headset uses. POSAs would have understood, however, that one suitable protocol encompassed by Berger’s disclosure of a wireless headset is WiFi. Anderson-Decl., ¶276.

Alternatively, implementing Berger’s wireless connection using WiFi would have been the simple substitution of one known element (Berger’s unidentified wireless protocol) for another (WiFi) to obtain predictable results (a wireless connection over which audio signals can be transmitted). Anderson-Decl., ¶277.

b. Claim 3: “...television...”

Supra [1A].

c. Claim 4: “....phone”

Supra [1A].

If Patent Owner argues that Berger fails to disclose using its wireless headset with a phone, then doing so would have been obvious in view of (a) Berger’s teaching that its invention is suitable for a headset used with a phone ([0007]-[0008]), and (b) POSAs’ background knowledge that wireless headsets for use with phones were common. EX1036 (defining “headset” as “a set of headphones, typically with a microphone attached, *used especially in telephone and radio communication*”); Anderson-Decl., ¶¶281-283 (citing, *e.g.*, EX1032 at [0023]-[0025], EX1033 at [0003]-[0005], EX1034 at 2:15-51 & FIG. 2, EX1035 at [0017] & FIG. 2, as corroboration).

d. Claim 5

The audio signals that Berger’s headset receives from, *e.g.*, a phone, are “*input signals from a microphone,*” *i.e.*, the microphone on the calling party’s phone. Anderson-Decl., ¶284.

- e. **Claim 6: “....down-converted signals are modified such that a portion of the audio output signals has an increased power to enhance the hearing of the user.”**

Based on a “user’s prescription,” Berger’s processor “transforms the [audio] signal by applying a transfer function with *more gain* in the frequency ranges where the user has lost hearing.” [0019]. Increasing the gain of audio signals increases the signals’ power. Anderson-Decl., ¶285.

- f. **Claim 7: “...wherein the portion with increased power is selected based on frequency, and wherein a higher frequency portion has increased power.”**

Supra claim 6.

As Berger explains, a common form of hearing loss is “slope loss” in which an individual loses “the ability to hear high frequencies.” [0002]. When the prescription programmed into processor 210 is for an individual with “slope loss,” then “the processor boosts the high frequencies.” [0035]; *see also* [0019]; claim 4 of Berger; Anderson-Decl., ¶¶286-287.

- g. **Claim 8**

- (1) **[8PRE]**

Supra [1PRE].

- (2) **[8A] ...hearing characteristic...is determined via calibrating the user’s hearing,**

The ’789 patent explains that a user’s hearing characteristic can be calibrated “by a third party, such as an audiologist.” EX1001, 7:49-50.

POSAs would have understood that the “user’s prescription” stored in Berger’s processor and used to adjust Berger’s audio signal was “*determined via calibrating the user’s hearing*,” e.g., by an audiologist. As Dr. Anderson explains (and consistent with the ’789 patent), a hearing-aid prescription details the specific amplification needed to restore a person’s unique hearing loss and is generated based on a hearing exam, *i.e.*, “*via calibrating the user’s hearing*.” Anderson-Decl., ¶290.

Alternatively, if Patent Owner argues that Berger’s “user’s prescription” was not determined “*via calibrating the user’s hearing*,” then doing so would have been obvious because mapping, *i.e.*, calibrating, a user’s hearing was the conventional manner by which hearing-aid prescriptions were generated. Anderson-Decl., ¶291.

- (3) **[8B] wherein the power of the audio output signals can be changed as a function of frequency, and**

Supra claim 6.

- (4) **[8C] wherein the user can change the power of the audio output signals.**

As noted *supra* Ground 2A ([8C]), POSAs would have expected hearing-aid devices, like Berger’s headset, to have volume controls. Moreover, Berger discloses techniques by which the user prescription stored in the processor can be changed, and changing from one prescription to another would “*change the power of the audio output signals*,” e.g., different prescriptions require different amplification/power adjustments. Berger at [0023]-[0027], [0041]; Anderson-Decl., ¶¶293-294.

Alternatively, if Berger does not expressly suggest such a volume control, then implementing Berger's headset such that its volume could be adjusted by a user would have been a routine design choice that benefited patients by allowing them to adjust volume to comfortable levels. Anderson-Decl., ¶295.

h. Claim 11: "...ear speaker."

Berger's headset (including its speaker) is designed to fit over a user's ear and thus "*is an ear speaker.*" FIG. 6.

i. Claim 12: "...headset."

FIG. 6; [0041].

4. Independent Claim 13

Claim 13 is similar to claim 1 except claim 13 recites a "*hearing enhancement apparatus*" rather than a "*hearing enhancement system.*" As discussed for claim 1, Berger's system includes a headset with a "*wireless receiver,*" "*down-converter,*" "*modifier,*" and "*speaker*" as recited in claim 13. [0041]; FIG. 6.

Berger's headset meets claim 13's "*hearing apparatus,*" and Berger anticipates (or renders obvious) claim 13 for the same reason it anticipates (or renders obvious) claim 1.

5. Dependent Claims 14-15, 18-20, 23, 25, 27-30, 46-48, 52, 62, 75-76, and 80

a. Claim 14

Supra claim 6.

b. Claim 15

[15PRE]	<i>Supra</i> claim 14.
[15A]	<i>Supra</i> claim 7.
[15B]	<i>Supra</i> claim 7.
[15C]	<i>Supra</i> [8A]
[15D]	<i>Supra</i> [8B]
[15E]	<i>Supra</i> [8C]

c. Claim 18

Supra claim 7.

d. Claim 19

Supra claim 2.

e. Claim 20

Supra claim [15C]-[15E].

f. Claim 23

Supra claim 4.

g. Claim 25: “...hearing characteristic...is retrieved from a portable media storage device....”

Berger, [0024] (“prescription can be programmed into a ‘smart card’”); [0041] (“smart card bay 620 [in Figure 6] allows insertion of a smart card”); Anderson-Decl., ¶¶305-306.

h. Claim 27

Supra claim 11.

i. Claim 28

Supra claim 12.

j. Claim 29

Supra claims 4, 6, 11, and 17.

k. Claim 30

As discussed *supra* limitation [8A], POSAs would have understood that the “user’s prescription” stored in Berger’s processor and used to adjust Berger’s audio signal was “*determined via calibrating the user’s hearing*,” *e.g.*, by an audiologist. POSAs would also have understood that the “user’s prescription” was obtained by testing the user’s hearing “*across the one or more frequencies*” because that was the conventional way to test a person’s hearing to generate a prescription. Anderson-Decl., ¶¶310-311 (citing corroboration).

Alternatively, performing such a test would have been obvious given that it was a conventional technique for testing a patient’s hearing. Anderson-Decl., ¶312.

l. Claim 46

Supra claim 12.

m. Claim 47

Supra claim 11.

n. Claim 48: “...audio output signals are changed in view of a preference of the user stored in the apparatus.”

Berger’s processor is programmed with a user’s prescription and modifies the audio signal based on that prescription, *e.g.*, increasing gain where the user has lost hearing. [0019], [0021]. The user’s prescription reflects an individual’s “*preference*” as the prescription reflects the amount of gain the user desires to be applied to particular audio frequencies. Anderson-Decl., ¶315.

Berger also discloses that multiple prescriptions can be programmed into the processor and a user can select between those multiple prescriptions. [0022], [0027]. Selecting one prescription over another changes the audio signals based on “*a preference of the user.*” Anderson-Decl., ¶316.

o. Claim 52

Supra claim 48.

p. Claim 62: “...head-mounted electronic device.”

Figure 6.

q. Claim 75

Supra limitation [1A], claim 4.

- r. Claim 76: “...wherein based on at least a preference of the user, the power of a first range of frequencies of the audio output signals is increased, and the power of a second range of frequencies of the audio output signals is not increased.”**

As discussed *supra* claim 7, Berger explains a common hearing impairment is “slope loss,” *i.e.*, difficulty hearing “high frequencies.” [0002]. When the prescription programmed into processor 210, *i.e.*, “*a preference of the user*” is for an individual with “slope loss,” then “the processor boosts the high frequencies,” but does not boost low frequencies. [0035]; *see also* [0019]; Anderson-Decl., ¶320.

- s. Claim 80**

Supra claim 25.

H. Ground 3B: Berger in View of Eaton Renders Claims 24, 31, 33-35, 39-41, and 77-79 Obvious.

1. Eaton

Eaton is discussed *supra* Ground 2B.

2. The Combination

As discussed *supra* Ground 2B, Eaton discloses using mobile devices to test a patient’s hearing and wirelessly program a hearing aid based on that test.

POSAs would have had reason to implement Berger’s headset such that the prescription programmed into Berger’s processor was updated wirelessly using Eaton’s technique. Berger teaches that its processor is “preferably programmable, so that the programming *can be changed* if a user’s prescription changes.”

Berger, [0023]. Berger likewise teaches that prescriptions can be accessed from a remote location like a PBX. [0022]. Berger thus encourages POSAs to identify techniques for updating the prescription and/or accessing prescriptions from a remote location, and Eaton's wireless technique is one such technique. Anderson-Decl., ¶325. Eaton also touts its technique as an improvement on the then-conventional technique for reprogramming hearing aids, which was considered "laborious and time intensive." Eaton, 1:17-25. POSAs thus had reason to modify Berger's system to use Eaton's technique for wirelessly programming a hearing aid, and a reasonable expectation of success in doing so. Anderson-Decl., ¶¶325-327.

In the Berger-Eaton combination, a user would utilize a cellphone to send "audio test signals" to Beger's headset and receive an aural response from the patient to those test signals. Eaton, 11:17-24. The cellphone would then send those aural responses to Eaton's "programming fitting server" which would process the responses to generate "audiological parameters...used to tailor an audiological therapy," *e.g.*, to generate an updated hearing prescription for the user. Eaton, 11:31-32. The updated hearing prescription would then be sent wirelessly to Berger's headset where it would be programmed into the processor. Berger, [0019]; Anderson-Decl., ¶326.

3. Claims 24, 31, 33-35, 39-41, and 77-79

a. Claim 24: “...hearing characteristic...is wirelessly received and stored....”

As discussed *supra* §VI.H.2, in the Berger-Eaton combination, an updated version of Berger’s prescription, *i.e.*, “*one hearing characteristic of the user*,” is received wirelessly from a phone and programmed into, *i.e.*, “*stored*,” Berger’s processor. Berger, [0019]; Eaton, 6:11-25; *see also* claim 13 (Ground 3A).

b. Claim 31: “...calibrate the user’s hearing via a computing device.”

As discussed *supra* §VI.H.2, in the Berger-Eaton combination, a cellphone, which is a “*computing device*” that the user operates, sends audio test signals to Berger’s headset and receives aural responses from the user to those test signals. Eaton, 11:17-24; 5:11-16 (“such diagnostics and adjustment is initiated by a patient”), claim 6. Based on the patient’s aural responses, the hearing aid is recalibrated using an updated prescription that accounts for changes in the user’s hearing. Anderson-Decl., ¶¶329-330.

c. Claim 33

Supra claim 24; *see also* claim 30 (Ground 3A).

d. Claim 34

Supra claim 33; *see also* claim 12 (Ground 3A).

e. Claim 35: “...a computing device that is wearable.”

Berger’s headset—which is used in the Berger-Eaton combination—is a “*computing device that is wearable.*” Berger, FIG. 6 (depicting various computing electronics for the headset); *see also* claim 33.

f. Claim 39

Supra claim 24; *see also* claim 29 in Ground 3A.

g. Claim 40

Supra claim 39; *see also* claim 12 in Ground 3A.

h. Claim 41

Supra claims 35 and 39.

i. Claim 77

In Berger-Eaton, the user’s hearing is measured using test signals to generate aural responses that “are formatted to form an audiogram before sending the information the programming fitting server” (Eaton, 11:24-28) where the audiogram is used to update a user’s hearing prescription. POSAs would have understood that an audiogram depicts a user’s hearing profile “*across a plurality of frequencies*” and that the user’s prescription in Berger-Eaton is therefore “*identified via measuring the user's hearing at least across a plurality of frequencies.*” Anderson-Decl., ¶337.

j. Claim 78: “...hearing enhancement apparatus assists in measuring the user's hearing.”

As discussed *supra* §VI.H.2, Berger’s headset in Berger-Eaton “*assists in measuring the user’s hearing*” because it plays the audio test signals for the patient. *See also* claim 62 (Ground 3A).

k. Claim 79

Supra claim 24; *see also* claim 62 (Ground 3A).

I. Ground 3C: Berger-Eaton in View of DeJaco Renders Claims 16-17, 22, 43-44, 49-50, 53-54, and 81-82 Obvious.

Ground 3C challenges claims that recite adjusting audio based on “*the noise level of the environment of the apparatus.*” As described in the ’789 patent, such techniques include increasing “the gain of the system,” *i.e.*, volume, “so as to ensure that the average power of the output audio signals is higher than the noise level by a certain degree.” EX1001, 9:14-17. As discussed below, the claims challenged in Ground 3C would have been obvious.

1. DeJaco (EX1015)

DeJaco discloses automatically increasing the volume of a cellphone speaker “in response to an increase in the background noise level.” DeJaco, Abstract. DeJaco explains that when people use cellphones in noisy environments, they have difficulty hearing the caller unless they manually increase the phone’s volume, which “is inconvenient” and “may be dangerous,” *e.g.*, when driving. DeJaco, 2:14-20.

DeJaco discloses a processor that includes a “background noise level detection unit” and a “speaker gain look-up table.” DeJaco, 5:24-33. The detection unit determines “the background noise level from signals received from” a microphone on the cellphone, and “yield[s] a digital value representative of background noise level.” *Id.* Using the digital value and the speaker gain look-up table, DeJaco’s cellphone increases the gain of the speaker automatically. DeJaco, 7:3-24; FIG. 5.

2. The Combination

As discussed in Ground 3A for limitation [1A] and claim 4, Berger’s wireless headset is (or would have been) used with a cellphone. This would have been useful (and even legally required), for example, when a user uses the phone while driving because the user’s hands would remain free for driving. Anderson-Decl., ¶343; EX1024, [0003] (explaining jurisdictions have enacted laws requiring “hands-free cellular devices” while driving).

DeJaco teaches it can be “dangerous” for users to manually adjust the volume of a phone while driving. DeJaco, 2:14-20. DeJaco therefore gives POSAs reason to implement its technique for automatic-volume control in Berger’s wireless headset (as used in Berger-Eaton) to adjust the headset’s volume automatically when, *e.g.*, driving a car. Anderson-Decl., ¶344.

In the Berger-Eaton-Dejaco combination, Berger's headset (modified as discussed in Ground 3B for Berger-Eaton) would be further modified to include DeJaco's "background noise level detection unit" and a "speaker gain look-up table." The headset would also include a microphone for picking up background noise. Berger does not depict a microphone, but POSAs would have expected the headset to include a microphone at least when the headset was used with a phone because the microphone would be needed to capture the user's voice for the telephone conversation. EX1036 (defining "headset" as including "a microphone"); Anderson-Decl., ¶345. Alternatively, adding a microphone to Berger's headset would have been the use of a known technique (*i.e.*, the use of a microphone on a headset for voice communication and/or background-noise detection) to improve a similar device. Anderson-Decl., ¶346.

The Berger-Eaton-DeJaco headset would capture, *inter alia*, background noise with the headset's microphone and adjust the volume of the headset's speaker utilizing DeJaco's detection unit and look-up table, *e.g.*, the volume would increase to overcome an increase in background noise. Anderson-Decl., ¶347. POSAs would have had a reasonable expectation of success in implementing the combination as the use of microphones in headsets was well known, and DeJaco's automatic-volume technique requires routine engineering skills to implement. *Id.*

3. Claims 16-17, 22, 43-44, 49-50, 53-54, and 81-82

- a. Claim 16: “...down-converted signals are further modified based on the noise level of the environment of the apparatus.”**

As discussed *supra* §VI.I.2, in Berger-Eaton-DeJaco, Berger’s headset utilizes DeJaco’s automatic-volume technique which would change the gain of, *i.e.*, “*modif[y]*,” the wireless signals transmitted by the phone to the headset, *i.e.*, “*the down-converted signals.*” This modification to the signals would be “*based on the noise level of the environment of the apparatus,*” *e.g.*, gain is increased when the noise level increases.

- b. Claim 17**

Supra claim 16; *see also* claim 4 (Ground 3A).

- c. Claim 22**

Supra claims 16-17; *see also* claim 4 (Ground 3A).

- d. Claim 43: “...alter a power level of the audio output signals based on a noise level of the environment of the apparatus.”**

As discussed with claim 16, the Berger-Eaton-DeJaco headset adjusts volume, *i.e.*, “*a power level of the audio output signals*” to overcome background noise, *i.e.*, “*based on a noise level of the environment of the apparatus.*”

- e. Claim 44: “...configured not to further increase the power of the audio output signals if the noise level is beyond a certain predetermined threshold.”**

See claim 43.

POSAs would have appreciated that increasing the volume of a headset's speaker too much would become disturbing or even harmful. Anderson-Decl., ¶352. Therefore, when implementing Berger-Eaton-DeJaco, POSAs would have designed DeJaco's "speaker gain look-up table" (*see* DeJaco, FIG. 5) to have a maximum "gain level" for the speaker that would not be exceeded even if the detected background noise increased. Anderson-Decl., ¶353. Indeed, DeJaco already suggests such an implementation as it sets a maximum "gain level" for its speaker. DeJaco, 4:7-11; 5:33-6:14; FIGS. 1-2;

f. Claim 49

Supra claim 16; *see also* claim 48 (Ground 3A).

g. Claim 50

As discussed *supra* §VI.I.2, the Berger-Eaton-DeJaco combination adds a microphone to Berger's headset to detect, *inter alia*, background noise.

h. Claim 53

Supra claim 16; *see also* claim 46 (Ground 3A).

i. Claim 54

Supra claim 50; *see also* claim 46 (Ground 3A).

j. Claim 81

As discussed above for claim 16, Berger-Eaton-DeJaco's headset increases the speaker's volume to overcome, *i.e.*, drown out, background noise. By drowning out, *i.e.*, suppressing, the background noise via increasing gain of the audio output, the headset "*is configured to alter a power level of the audio output signals so as to suppress at least a sound level associated with the environment of the apparatus so as to provide noise cancellation.*" See also claim 62 (Ground 3A).

k. Claim 82

Supra claims 50, 81.

J. Ground 3D: Berger-Eaton-DeJaco in View of Sauer Renders Obvious Claims 45 and 63-74.

1. Sauer

Sauer is discussed *supra* Ground 2C.

2. The Combination

In view of Sauer and for the reasons discussed in Ground 2C, POSAs would have implemented the Berger-Eaton-DeJaco headset (Ground 3C) so the headset's microphone was used not only for automatic-volume control (and telephone communication), but also to allow users to control volume with a spoken command. Anderson-Decl., ¶¶362-363. The Berger-Eaton-DeJaco-Sauer headset would retain all the functionality of Berger-Eaton-DeJaco's headset discussed in Ground 3C, and would also have voice control for volume. Anderson-Decl., ¶364.

3. Claims 45 and 63-74

a. Claim 45

As discussed *supra* §VI.J.2, the Berger-Eaton-DeJaco-Sauer combination “includes a volume control that is configured to respond to a voice command of the user.”

b. Claim 63

Supra claim 45; *see also* claim 62 (Ground 3A).

c. Claim 64

Supra claim 45; *see also* claim 62 (Ground 3A).

d. Claim 65

Supra claim 64; *see also* claim 77 (Ground 3B).

e. Claim 66

As discussed for claim 16 in Ground 3C, Berger-Eaton-DeJaco’s headset increases the speaker’s volume to overcome, *i.e.*, drown out, background noise. The headset would do the same in the Berger-DeJaco-Eaton-Sauer combination. By drowning out, *i.e.*, suppressing, the background noise via increasing gain of the audio output, the headset “is configured to alter a power level of the audio output signals so as to suppress at least a sound level associated with the environment of the apparatus so as to provide noise cancellation.”

f. Claim 67

Supra claim 66; *see also* claim 50 (Ground 3C).

g. Claim 68

The Berger-Eaton-DeJaco-Sauer headset “*is configured to wirelessly couple to a cell phone*” for the reasons discussed *supra* in Ground 3A for limitations [1A] and claim 4.

h. Claim 69

Supra claim 67; *see also* claim 76 (Ground 3A).

i. Claim 70

Supra claims 64, 66.

j. Claim 71

Supra claim 71; *see also* claim 50 (Ground 3C).

k. Claim 72

Supra claims 68, 71.

l. Claim 73

Supra claim 72; *see also* claim 76 (Ground 3A).

m. Claim 74

Supra claim 73; *see also* claim 77 (Ground 3B).

K. Ground 3E: Berger in view of Willis Renders Claims 10 and 26 Obvious.

As discussed below, implementing Berger’s headset with a “*directional speaker*” would have been obvious.

1. Willis (EX1016)

Willis discloses an audio-transducer, *i.e.*, speaker, that uses magnets to vibrate a diaphragm back-and-forth so that audio is output by the transducer in a particular direction. Willis, 3:17-23, 3:44-47; 4:16-20; Anderson-Decl., ¶¶379-381. Willis teaches that with its transducer, “satisfactory bass response is maintained with an air gap between the head and the transducer,” which advantageously “permit[s] the subject to hear external sounds such as door bells” and allows “for quadra-sonic reproduction.” Willis, 4:5-12; FIG. 5 (depicting headphones with an “air gap 54” between the speaker and the user’s ear).

2. The Combination

Willis discloses an alternative design for Berger’s headset, and Willis explicitly motivates POSAs to utilize its design to permit a user to hear external sounds while also achieving quadra-sonic, *i.e.*, immersive sound. Willis, 4:5-12. POSAs thus had reason to implement Berger’s headset using Willis’s directional-speaker and air-gap design, and a reasonable expectation of success in making the combination. Anderson-Decl., ¶383. In the combination, Berger’s headset would retain the functionality it has in Berger but would be implemented using Willis’ design, including its use of a directional speaker. Anderson-Decl., ¶384.

3. Claims 10 and 26

In the Berger-Willis combination, Berger's headset would have been implemented to include a "*directional speaker*" so as to improve audio quality and/or permit a user to hear environmental noises thereby rendering claims 10 and 26 obvious. *See also* claims 1 and 13 (Ground 3A).

L. Ground 3F: Berger-Eaton-DeJaco in view of Miles Renders Claim 51 Obvious.

1. Miles (EX1017)

Miles discloses a headphone with a directional microphone that is positioned on the top of the headphone so as to isolate the microphone from the user's mouth and the headphone's speakers. Miles, Abstract, 1:53-57, 2:16-18. The microphone is used to pick up ambient noise. *Id.*, 1:57-59.

2. The Combination

Miles would have motivated POSAs to implement the Berger-Eaton DeJaco headset (discussed *supra* Ground 3C) such that the microphone used to capture and measure the noise level in the user's environment was a directional microphone positioned on the top of the headphone. Anderson-Decl., ¶388. Such a design would have ensured that the microphone better captured background noise by reducing the likelihood that the microphone captured the user's voice or sound from the headphone's speakers. *Id.*

3. Claim 51

In the Berger-Eaton-DeJaco-Miles combination, Berger’s headset would have been implemented to include a “*directional microphone*” so as to improve DeJaco’s automatic-volume-control functionality thereby rendering claim 51 obvious. *See also* claims 1 and 13 (Ground 3A).

VII. CONCLUSION

The Board should institute IPR.

Respectfully submitted,
Bose Corp.

Date: September 19, 2025

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VIII. CLAIM LISTING

The following claim listing assigns element labels (e.g., [1A1], [1A2], etc.) to certain claims for clarity.

Claim 1
[1PRE] A hearing enhancement system for a user, comprising:
[1A] an audio system configured to receive input signals for broadcasting, and configured to up-convert the received input signals into up-converted signals to be wirelessly transmitted;
[1B] a wireless receiver configured to wirelessly receive the up-converted signals;
[1C] a down-converter configured to down-convert the received up-converted signals into down-converted signals;
[1D] a modifier configured to modify the down-converted signals into modified signals based on at least one hearing characteristic of the user to enhance the hearing of the user; and
[1E] a speaker configured to generate audio output signals from the modified signals for the user.
Claim 2
A hearing enhancement system as recited in claim 1, wherein the up-converted signals are in the WiFi frequency band.
Claim 3
A hearing enhancement system as recited in claim 1, wherein the audio system is selected from the list consisting a television, a stereo system, a CD player and a radio.
Claim 4
A hearing enhancement system as recited in claim 1, wherein the audio system is a phone.
Claim 5
A hearing enhancement system as recited in claim 1, wherein the audio system receives the input signals from a microphone.

Claim 6
A hearing enhancement system as recited in claim 1, wherein the down-converted signals are modified such that a portion of the audio output signals has an increased power to enhance the hearing of the user.
Claim 7
A hearing enhancement system as recited in claim 6, wherein the portion with increased power is selected based on frequency, and wherein a higher frequency portion has increased power
Claim 8
[8PRE] A hearing enhancement system as recited in claim 1,
[8A] wherein the at least one hearing characteristic of the user is determined via calibrating the user's hearing,
[8B] wherein the power of the audio output signals can be changed as a function of frequency, and
[8C] wherein the user can change the power of the audio output signals.
Claim 9
A hearing enhancement system as recited in claim 1, wherein the speaker is configured to generate ultrasonic signals, with at least a portion of the ultrasonic signals transformed into the audio output signals in air.
Claim 10
A hearing enhancement system as recited in claim 1, wherein the speaker is a directional speaker.
Claim 11
A hearing enhancement system as recited in claim 1, wherein the speaker is an ear speaker.
Claim 12
A hearing enhancement system as recited in claim 1, wherein the speaker is in a headset.
Claim 13
[1PRE] A hearing enhancement apparatus for a user, the apparatus being wirelessly coupled to an audio system, which is configured to up-convert input signals into up-converted signals to be wirelessly transmitted, the apparatus comprising:
[1A] a wireless receiver configured to wirelessly receive the up-converted signals;

[1B] a down-converter configured to down-convert the received up-converted signals into down-converted signals;
[1C] a modifier configured to modify the down-converted signals into modified signals based on at least one hearing characteristic of the user to enhance the hearing of the user; and;
[1D] a speaker configured to generate audio output signals from the modified signals for the user.
Claim 14
A hearing enhancement apparatus as recited in claim 13, wherein the down-converted signals are modified such that a portion of the audio output signals has an increased power to enhance the hearing of the user.
Claim 15
[15PRE] A hearing enhancement apparatus as recited in claim 14,
[15A] wherein the portion with the increased power is selected based on frequency
[15B] wherein a higher frequency portion has increased power,
[15C] wherein the at least one hearing characteristic of the user is determined via calibrating the user's hearing,
[15D] wherein the power of the audio output signals can be changed as a function of frequency, and,
[15E] wherein the user can change the power of the audio output signals.
Claim 16
A hearing enhancement apparatus as recited in claim 15, wherein the down-converted signals are further modified based on the noise level of the environment of the apparatus.
Claim 17
A hearing enhancement apparatus as recited in claim 16, wherein the apparatus is also configured to operate as at least a part of a phone.
Claim 18
A hearing enhancement apparatus as recited in claim 14, wherein the portion with increased power is selected based on frequency, and wherein a higher frequency portion has increased power.
Claim 19
A hearing enhancement apparatus as recited in claim 13, wherein the up-converted signals are in the WiFi frequency band.

Claim 20
A hearing enhancement apparatus as recited in claim 13, wherein the at least one hearing characteristic of the user is determined via calibrating the user's hearing, wherein the power of the audio output signals can be changed as a function of frequency, and wherein the user can change the power of the audio output signals.
Claim 21
A hearing enhancement apparatus as recited in claim 13, wherein the speaker is configured to generate ultrasonic signals, with at least a portion of the ultrasonic signals transformed into the audio output signals in air.
Claim 22
A hearing enhancement apparatus as recited in claim 13, wherein the down-converted signals are further modified based on the noise level of the environment of the apparatus.
Claim 23
A hearing enhancement apparatus as recited in claim 13, wherein the apparatus is also configured to operate as a phone.
Claim 24
A hearing enhancement apparatus as recited in claim 13, wherein the at least one hearing characteristic of the user is wirelessly received and stored in the hearing enhancement apparatus.
Claim 25
A hearing enhancement apparatus as recited in claim 13, wherein the at least one hearing characteristic of the user is retrieved from a portable media storage device while being physically in contact with the apparatus.
Claim 26
A hearing enhancement apparatus as recited in claim 13, wherein the speaker is a directional speaker.
Claim 27
A hearing enhancement apparatus as recited in claim 13, wherein the speaker is an ear speaker.
Claim 28
A hearing enhancement apparatus as recited in claim 13, wherein the speaker is in a headset.

Claim 29

A hearing enhancement apparatus as recited in claim 13, wherein the audio system is configured to operate as a phone, wherein the hearing enhancement apparatus is configured to operate in conjunction with or at least as a part of a mobile phone, wherein the speaker is an ear speaker, and wherein to enhance the hearing of the user, the modifier is configured to modify the down-converted signals into modified signals at one or more frequencies within the audio frequencies, with the one or more frequencies being determined by the at least one hearing characteristic of the user.

Claim 30

A hearing enhancement apparatus as recited in claim 29, wherein the at least one hearing characteristic of the user is determined via calibrating the user's hearing at least across the one or more frequencies to generate at least a portion of the hearing profile of the user, and wherein the hearing profile is stored in the hearing enhancement apparatus.

Claim 31

A hearing enhancement apparatus as recited in claim 30, wherein the hearing enhancement apparatus allows the user to calibrate the user's hearing via a computing device.

Claim 32

A hearing enhancement apparatus as recited in claim 30, wherein the hearing enhancement apparatus is configured to periodically remind the user to calibrate the user's hearing.

Claim 33

A hearing enhancement apparatus as recited in claim 30, wherein at least a portion of the at least one hearing characteristic of the user is wirelessly received by and stored in the hearing enhancement apparatus

Claim 34

A hearing enhancement apparatus as recited in claim 33, wherein the hearing enhancement apparatus is a headset.

Claim 35

A hearing enhancement apparatus as recited in claim 33, wherein the hearing enhancement apparatus is a computing device that is wearable.

Claim 36

A hearing enhancement apparatus as recited in claim 33, wherein the hearing enhancement apparatus is a mobile phone.

Claim 37
A hearing enhancement apparatus as recited in claim 36, wherein the hearing enhancement apparatus is configured to periodically remind the user to calibrate the user's hearing.
Claim 38
A hearing enhancement apparatus as recited in claim 36, wherein the hearing enhancement apparatus includes a user control configured to allow the user to control the power of the audio output signals on a plurality of frequency bands across the audio frequencies.
Claim 39
A hearing enhancement apparatus as recited in claim 29, wherein at least a portion of the at least one hearing characteristic is wirelessly received by and stored in the hearing enhancement apparatus.
Claim 40
A hearing enhancement apparatus as recited in claim 39, wherein the hearing enhancement apparatus is a headset.
Claim 41
A hearing enhancement apparatus as recited in claim 39, wherein the hearing enhancement apparatus is a computing device that is wearable.
Claim 42
A hearing enhancement apparatus as recited in claim 39, wherein the hearing enhancement apparatus is a mobile phone.
Claim 43
A hearing enhancement apparatus as recited in claim 29, wherein the hearing enhancement apparatus is configured to alter a power level of the audio output signals based on a noise level of the environment of the apparatus.
Claim 44
[44PRE] A hearing enhancement apparatus as recited in claim 43,
[44A] wherein the hearing enhancement apparatus is configured to increase the power of the audio output signals as the noise level increases, and
[44B] wherein the hearing enhancement apparatus is configured not to further increase the power of the audio output signals if the noise level is beyond a certain predetermined threshold.

Claim 45
A hearing enhancement apparatus as recited in claim 29, wherein the apparatus includes a volume control that is configured to respond to a voice command of the user.
Claim 46
A hearing enhancement apparatus as recited in claim 13, wherein the hearing enhancement apparatus is a headset.
Claim 47
A hearing enhancement apparatus as recited in claim 13, wherein the hearing enhancement apparatus is a headset.
Claim 48
A hearing enhancement apparatus as recited in claim 47, wherein the audio output signals are changed in view of a preference of the user stored in the apparatus.
Claim 49
A hearing enhancement apparatus as recited in claim 48, wherein the audio output signals are changed based on audio sound in the environment of the apparatus.
Claim 50
A hearing enhancement apparatus as recited in claim 49 further comprising a microphone at least for receiving the audio sound in the environment of the apparatus.
Claim 51
A hearing enhancement apparatus as recited in claim 50, wherein the microphone is a directional microphone.
Claim 52
A hearing enhancement apparatus as recited in claim 46, wherein the audio output signals are changed in view of a preference of the user stored in the apparatus.
Claim 53
A hearing enhancement apparatus as recited in claim 46, wherein the audio output signals are changed based on audio sound in the environment of the apparatus.
Claim 54
A hearing enhancement apparatus as recited in claim 53 further comprising a microphone at least for receiving the audio sound in the environment of the apparatus.

Claim 55
A hearing enhancement apparatus as recited in claim 13, wherein the hearing enhancement apparatus is a mobile phone.
Claim 56
A hearing enhancement apparatus as recited in claim 55, wherein the audio output signals are modified in view of a preference of the user stored in the apparatus.
Claim 57
A hearing enhancement apparatus as recited in claim 56, wherein the audio output signals are modified based on audio sound in the environment of the apparatus.
Claim 58
A hearing enhancement apparatus as recited in claim 57 further comprising a microphone at least for receiving the audio sound in the environment of the apparatus.
Claim 59
A hearing enhancement apparatus as recited in claim 58, wherein the microphone is a directional microphone.
Claim 60
A hearing enhancement apparatus as recited in claim 55, wherein the audio output signals are modified based on audio sound in the environment of the apparatus.
Claim 61
A hearing enhancement apparatus as recited in claim 60 further comprising a microphone at least for receiving the audio sound in the environment of the apparatus.
Claim 62
A hearing enhancement apparatus as recited in claim 13, wherein at least a portion of the hearing enhancement apparatus is in a head-mounted electronic device.
Claim 63
A hearing enhancement apparatus as recited in 62, wherein the apparatus comprises a volume control that is configured to respond to a voice command.
Claim 64
A hearing enhancement apparatus as recited in 62, wherein the apparatus is configured to recognize at least a voice command from the user and operate according to the voice command.

Claim 65
A hearing enhancement apparatus as recited in claim 64, wherein the at least one hearing characteristic of the user is identified via measuring the user's hearing at least across a plurality of frequencies.
Claim 66
A hearing enhancement apparatus as recited in claim 65, wherein the hearing enhancement apparatus is configured to alter a power level of the audio output signals so as to suppress at least a sound level associated with the environment of the apparatus so as to provide noise cancellation.
Claim 67
A hearing enhancement apparatus as recited in claim 66 further comprising a microphone configured to receive audio sound at the environment of the apparatus for determining the sound level associated with the environment of the apparatus.
Claim 68
A hearing enhancement apparatus as recited in claim 67, wherein the apparatus is configured to wirelessly couple to a cell phone.
Claim 69
A hearing enhancement apparatus as recited in claim 68, wherein based on at least a preference of the user, the power of a first range of frequencies of the audio output signals is increased, and the power of a second range of frequencies of the audio output signals is not increased.
Claim 70
A hearing enhancement apparatus as recited in claim 64, wherein the hearing enhancement apparatus is configured to alter a power level of the audio output signals so as to suppress at least a sound level associated with the environment of the apparatus so as to provide noise cancellation.
Claim 71
A hearing enhancement apparatus as recited in claim 70 further comprising a microphone configured to receive audio sound at the environment of the apparatus for determining the sound level associated with the environment of the apparatus.
Claim 72
A hearing enhancement apparatus as recited in claim 71, wherein the apparatus is configured to wirelessly couple to a cell phone.

Claim 73
A hearing enhancement apparatus as recited in claim 72, wherein based on at least a preference of the user, the power of a first range of frequencies of the audio output signals is increased, and the power of a second range of frequencies of the audio output signals is not increased.
Claim 74
A hearing enhancement apparatus as recited in claim 73, wherein the at least one hearing characteristic of the user is identified via measuring the user's hearing at least across a plurality of frequencies.
Claim 75
A hearing enhancement apparatus as recited in 62, wherein the apparatus is configured to wirelessly couple to a cell phone.
Claim 76
A hearing enhancement apparatus as recited in 62, wherein based on at least a preference of the user, the power of a first range of frequencies of the audio output signals is increased, and the power of a second range of frequencies of the audio output signals is not increased.
Claim 77
A hearing enhancement apparatus as recited in 62, wherein the at least one hearing characteristic of the user is identified via measuring the user's hearing at least across a plurality of frequencies.
Claim 78
A hearing enhancement apparatus as recited in claim 77, wherein the hearing enhancement apparatus assists in measuring the user's hearing.
Claim 79
A hearing enhancement apparatus as recited in 62, wherein information regarding the at least one hearing characteristic of the user is wirelessly received and stored in the hearing enhancement apparatus.
Claim 80
A hearing enhancement apparatus as recited in 62, wherein information regarding the at least one hearing characteristic of the user is retrieved from a portable media storage device while the portable media storage device is physically and electrically connected to the apparatus.

Claim 81

A hearing enhancement apparatus as recited in 62, wherein the hearing enhancement apparatus is configured to alter a power level of the audio output signals so as to suppress at least a sound level associated with the environment of the apparatus so as to provide noise cancellation.

Claim 82

A hearing enhancement apparatus as recited in claim 81 further comprising a microphone configured to receive audio sound at the environment of the apparatus for determining the sound level associated with the environment of the apparatus.

CERTIFICATE OF SERVICE UNDER 37 C.F.R. § 42.6 (E)(4)

I certify that on September 19, 2025, I will cause a copy of the foregoing document, including any exhibits or appendices filed therewith, to be served via Overnight FedEx at the following correspondence address of record for the patent:

IPVENTURE, INC.
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Date: September 19, 2025

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24, the undersigned certifies that the foregoing IPR petition contains 13,888 words excluding a table of contents, a table of authorities, Mandatory Notices under § 42.8, a certificate of service or word count, or appendix of exhibits or claim listing. Petitioners have relied on the word count feature of the word processing system used to create this paper in making this certification.

Date: September 19, 2025

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