

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner,

v.

INGENIOSPEC, LLC
Patent Owner.

Patent No. 11,644,693

Inter Partes Review No. IPR2026-00339

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.100 *et seq.***

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. SUMMARY OF THE '693 PATENT	1
A. Background Of The '693 Patent.....	1
B. Priority Date	1
C. Prosecution History of the '693 Patent	2
D. Level of Ordinary Skill	3
III. CLAIM CONSTRUCTION	3
IV. PRECISE REASONS FOR RELIEF REQUESTED	5
V. GROUND 1: CLAIMS 1-5, 14-19, 24, 25, 27, 28, 42, 59, 60, 62, 63, AND 75 ARE RENDERED OBVIOUS BY ANDERSON.....	7
A. Summary of Anderson	7
B. Claim 1	11
1. [Preamble].....	11
2. [A]	11
3. [B]	13
4. [C]	16
5. [D]	17
6. [E].....	17
7. [F].....	17
8. [G]	18
C. Claim 2	18
1. [Preamble].....	18
2. [A]	18
D. Claim 3	18
1. [Preamble].....	18
2. [A]	18
E. Claim 4	19

TABLE OF CONTENTS
(continued)

	Page
1. [Preamble]	19
2. [A]	19
F. Claim 5	20
1. [Preamble]	20
2. [A]	20
3. [B]	20
G. Claim 14	20
1. [Preamble]	20
2. [A]	20
H. Claim 15	21
1. [Preamble]	21
2. [A]	21
I. Claim 16	21
1. [Preamble]	21
2. [A]	21
J. Claim 17	22
1. [Preamble]	22
2. [A]	22
3. [B]	22
4. [C]	22
K. Claim 18	23
1. [Preamble]	23
2. [A]	23
L. Claim 19	23
1. [Preamble]	23
2. [A]	23

TABLE OF CONTENTS
(continued)

	Page
M. Claim 24	24
1. [Preamble]	24
2. [A]	24
3. [B]	28
4. [C]	28
5. [D]	28
6. [E]	28
7. [F]	28
8. [G]	28
N. Claim 25	28
1. [Preamble]	28
2. [A]	29
3. [B]	29
O. Claim 27	30
1. [Preamble]	30
2. [A]	30
P. Claim 28	30
1. [Preamble]	30
2. [A]	30
Q. Claim 42	31
1. [Preamble]	31
2. [A]	31
3. [B]	31
R. Claim 59	31
1. [Preamble]	31
2. [A]	31

TABLE OF CONTENTS
(continued)

	Page
S. Claim 60	32
1. [Preamble]	32
2. [A]	32
T. Claim 62	33
1. [Preamble]	33
2. [A]	33
U. Claim 63	33
1. [Preamble]	33
2. [A]	33
V. Claim 75	33
1. [Preamble]	33
2. [A]	34
3. [B]	34
4. [C]	34
5. [D]	34
6. [E]	34
7. [F]	34
8. [G]	34
VI. GROUND 2: CLAIMS 6-13, 50, 61, AND 76 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF NEMIROVSKI	35
A. Summary of Nemirovski	35
B. Motivation to Combine with Reasonable Expectation of Success	37
C. Claim 6	39
1. [Preamble]	39
2. [A]	39

TABLE OF CONTENTS
(continued)

	Page
D. Claim 7	41
1. [Preamble]	41
2. [A]	41
E. Claim 8	42
1. [Preamble]	42
2. [A]	42
F. Claim 9	42
1. [Preamble]	42
2. [A]	42
G. Claim 10	42
1. [Preamble]	42
2. [A]	42
3. [B]	42
H. Claim 11	43
1. [Preamble]	43
2. [A]	43
I. Claim 12	43
1. [Preamble]	43
2. [A]	43
J. Claim 13	44
1. [Preamble]	44
2. [A]	44
K. Claim 50	45
1. [Preamble]	45
2. [A]	45
3. [B]	46

TABLE OF CONTENTS
(continued)

	Page
L. Claim 61	47
1. [Preamble]	47
2. [A]	47
3. [B]	47
4. [C]	47
M. Claim 76	48
1. [Preamble]	48
2. [A]	49
VII. GROUND 3: CLAIMS 20-22 AND 29 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF EATON	49
A. Summary of Eaton	49
B. Motivation to Combine with Reasonable Expectation of Success	51
C. Claim 20	52
1. [Preamble]	52
2. [A]	52
3. [B]	52
D. Claim 21	53
1. [Preamble]	53
2. [A]	53
E. Claim 22	53
1. [Preamble]	53
2. [A]	53
F. Claim 29	54
1. [Preamble]	54
2. [A]	54

TABLE OF CONTENTS
(continued)

	Page
VIII. GROUND 4: CLAIMS 23, 30, 36-38, AND 54-58 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF IRVIN	54
A. Summary of Irvin	54
B. Motivation to Combine with Reasonable Expectation of Success	58
C. Claim 23	60
1. [Preamble]	60
2. [A]	60
3. [B]	60
4. [C]	62
D. Claim 30	62
1. [Preamble]	62
2. [A]	62
E. Claim 36	62
1. [Preamble]	62
2. [A]	62
F. Claim 37	63
1. [Preamble]	63
2. [A]	63
G. Claim 38	65
1. [Preamble]	65
2. [A]	65
3. [B]	65
H. Claim 54	66
1. [Preamble]	66
2. [A]	66

TABLE OF CONTENTS
(continued)

	Page
3. [B]	66
I. Claim 55	66
1. [Preamble]	66
2. [A]	67
J. Claim 56	67
1. [Preamble]	67
2. [A]	67
3. [B]	67
K. Claim 57	68
1. [Preamble]	68
2. [A]	68
L. Claim 58	68
1. [Preamble]	68
2. [A]	68
IX. GROUND 5: CLAIMS 31, 32, 43, AND 44 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF PACZKOWSKI	69
A. Summary of Paczkowski	69
B. Motivation to Combine with Reasonable Expectation of Success	70
C. Claim 31	72
1. [Preamble]	72
2. [A]	72
D. Claim 32	73
1. [Preamble]	73
2. [A]	74
E. Claim 43	74

TABLE OF CONTENTS
(continued)

		Page
	1. [Preamble]	74
	2. [A]	74
	3. [B]	74
	4. [C]	75
F.	Claim 44	76
	1. [Preamble]	76
	2. [A]	76
X.	GROUND 6: CLAIMS 33-35 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF BODLEY	76
A.	Summary of Bodley	76
B.	Motivation to Combine with Reasonable Expectation of Success	78
C.	Claim 33	80
	1. [Preamble]	80
	2. [A]	80
D.	Claim 34	81
	1. [Preamble]	81
	2. [A]	81
E.	Claim 35	81
	1. [Preamble]	81
	2. [A]	81
	3. [B]	81
XI.	GROUND 7: CLAIMS 45-48 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF BODLEY AND ZADESKY	82
A.	Summary of Zadesky	82
B.	Motivation to Combine with Reasonable Expectation of Success	84

TABLE OF CONTENTS
(continued)

	Page
C. Claim 45	85
1. [Preamble]	85
2. [A]	85
D. Claim 46	86
1. [Preamble]	86
2. [A]	86
E. Claim 47	86
1. [Preamble]	86
2. [A]	87
F. Claim 48	87
1. [Preamble]	87
2. [A]	87
XII. GROUND 8: CLAIM 49 IS RENDERED OBVIOUS BY ANDERSON IN VIEW OF BODLEY, ZADESKY, AND PACZKOWSKI	88
A. Claim 49	88
1. [Preamble]	88
2. [A]	88
3. [B]	88
4. [C]	88
5. <i>Motivation to Combine</i>	88
XIII. GROUND 9: CLAIM 51 IS RENDERED OBVIOUS BY ANDERSON IN VIEW OF LYNCH AND PACZKOWSKI	89
A. Summary of Lynch	89
B. Motivation to Combine Anderson and Lynch with Reasonable Expectation of Success	91
C. Claim 51	92

TABLE OF CONTENTS
(continued)

	Page
1. [Preamble]	92
2. [A]	93
3. [B]	94
4. [C]	94
5. [D]	94
 XIV. GROUND 10: CLAIMS 64-71 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF LYNCH AND NEMIROVSKI	 94
A. Motivation to Combine	94
B. Claim 64	95
1. [Preamble]	95
2. [A]	95
3. [B]	95
4. [C]	95
5. [D]	95
C. Claim 65	95
1. [Preamble]	95
2. [A]	96
3. [B]	96
D. Claim 66	96
1. [Preamble]	96
2. [A]	96
E. Claim 67	96
1. [Preamble]	96
2. [A]	96
3. [B]	96
F. Claim 68	97

TABLE OF CONTENTS
(continued)

	Page
1. [Preamble]	97
2. [A]	97
G. Claim 69	97
1. [Preamble]	97
2. [A]	97
3. [B]	97
H. Claim 70	97
1. [Preamble]	97
2. [A]	97
3. [B]	97
4. [C]	97
5. [D]	98
I. Claim 71	98
1. [Preamble]	98
2. [A]	98
3. [B]	98
4. [C]	98
5. [D]	98
XV. NOTICES AND STATEMENTS.....	99
XVI. CONCLUSION.....	101
CERTIFICATION OF WORD COUNT (37 C.F.R. § 42.24).....	122
CERTIFICATE OF SERVICE (37 C.F.R. § 42.6(E)(4) AND 42.205(A)).....	123

TABLE OF AUTHORITIES

Page

Cases

<i>Realtime Data LLC v. Iancu</i> , 912 F.3d 1368 (Fed. Cir. 2019)	5
--	---

Statutes

35 U.S.C. §§ 102(a)	8, 35, 49, 54, 69, 76, 82, 89
35 U.S.C. §§ 102(b)	8, 35, 49, 69, 82
35 U.S.C. §§ 102(e)	8, 35, 54, 69, 76, 82, 89
35 U.S.C. § 103	5, 6, 7
35 U.S.C. §§ 311-319	5

Other Authorities

37 C.F.R. § 42.6(e)(4)	123
37 C.F.R. § 42.205(a)	123
37 C.F.R. § 42.8(b)(1)	99
37 C.F.R. § 42.8(b)(2)	99
37 C.F.R. § 42.8(b)(3)	99
37 C.F.R. § 42.8(b)(4)	100
37 C.F.R. § 42.15(a)	101
37 C.F.R. § 42.24	122
37 C.F.R. § 42.100 <i>et seq.</i>	5
37 C.F.R. § 42.104(a)	100

TABLE OF AUTHORITIES
(continued)

	Page
37 C.F.R. § 42.104(b)	5
37 C.F.R. § 42.104(b)(4).....	7

Exhibit List

Exhibit Description	Exhibit #
U.S. Patent No. 11,644,693 to Howell et al.	EX1001
Prosecution History of U.S. Patent No. 11,644,693	EX1002
Declaration of Dr. Chris Kyriakakis	EX1003
U.S. Patent No. 5,721,783 to Anderson	EX1004
U.S. Patent No. 6,671,379 to Nemirovski	EX1005
WIPO International Publication No. WO 2001/54458 to Eaton et al.	EX1006
U.S. Patent No. 7,010,332 to Irvin et al.	EX1007
U.S. Patent No. 7,150,526 to Jannard et al.	EX1008
U.S. Patent No. 7,620,433 to Bodley	EX1009
U.S. Patent No. 7,046,230 to Zadesky et al.	EX1010
U.S. Patent No. 7,599,508 to Lynch et al.	EX1011
U.S. Patent No. 7,026,789 to Bozzzone et al.	EX1012
U.S. Patent No. 6,674,869 to Paczkowski	EX1013
Defendant's Proposed Claim Constructions in <i>IngenioSpec, LLC v. Apple Inc.</i> , Case No. 1:25-cv-00867 (W.D. Tex. Dec. 22, 2025)	EX1014
Radio Shack 1996 Catalog	EX1015
Excerpts from R. GRAF, MODERN DICTIONARY OF ELECTRONICS (Butterworth-Heinemann 7th Ed. 1999)	EX1016

Bevan Yueh et al., <i>Screening and Management of Adult Hearing Loss in Primary Care: Scientific Review</i> , 289 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 1976 (2003).	EX1017
P. Henry et al., <i>Bone Conduction: Anatomy, Physiology, and Communication</i> , Army Research Laboratory, ARL-TR-4138 (May 2007)	EX1018
Excerpts from R. MURPHY, INTRODUCTION TO AI ROBOTICS (MIT Press 2000)	EX1019
Manufacturer's Datasheet for Sharp PD100MC0MPx Photodiode	EX1020
U.S. Patent No. 7,500,746 to Howell et al.	EX1021
Plaintiff's Sept. 19, 2025 Infringement Claim Chart for U.S. Patent No. 11,644,693 in <i>IngenioSpec, LLC v. Apple Inc.</i> , Case No. 1:25-cv-00867 (W.D. Tex.)	EX1022
D. A. Spencer et al., <i>TCAS Experimental Unit (TEU) Hardware Description</i> , Lincoln Laboratory, AD-A169870 (June 6, 1986)	EX1023
Excerpts from P. SCHERZ ET AL., PRACTICAL ELECTRONICS FOR INVENTORS (McGraw-Hill 2000)	EX1024
Excerpts from L. BAXTER, CAPACITIVE SENSORS: DESIGN AND APPLICATIONS (IEEE Press 1997)	EX1025
Excerpts from P. HOROWITZ AND W. HILL, THE ART OF ELECTRONICS (Cambridge Univ. Press 2nd Ed. 1989)	EX1026
Curriculum Vitae of Dr. Chris Kyriakakis	EX1027

I. INTRODUCTION

Petitioner Apple Inc. (“Petitioner” or “Apple”) petitions for *inter partes* review of claims 1-25, 27-38, 42-51, 54-71, 75, and 76 of U.S. Patent No. 11,644,693 (the “’693 Patent” (EX1001)). The challenged claims—issued just under three years ago—do not present any patentable improvement over the prior art, as set forth in this Petition and in the supporting Declaration of Dr. Chris Kyriakakis. (EX1003.)

Accordingly, Petitioner requests that the Board institute *inter partes* review of the ’693 patent and cancel the claims at the conclusion of the instituted proceeding.

II. SUMMARY OF THE ’693 PATENT

A. Background Of The ’693 Patent

The ’693 patent relates to wearable audio devices, such as eyeglasses, with electrical components that produce audio output customized to hearing characteristics of a user. (EX1001, 2:66-3:9; EX1003, ¶24.) For example, the electrical components can support signal capturing, processing, and display; and can be used to provide audio output and/or audio pick-up. (EX1001, 3:10-22; EX1003, ¶24.) However, as set forth in this Petition, the claims of the ’693 patent do not represent any patentable improvement over the prior art. (EX1003, ¶24.)

B. Priority Date

The application that became the ’693 patent (Appl. No. 17/873,104) was

filed on July 25, 2022, and claims priority to numerous provisional and non-provisional U.S. patent applications. For the purposes of this Petition only, a priority date of July 28, 2004 is assumed. This is the filing date of the earliest application (Provisional Appl. No. 60/592,045) to which the '693 patent claims priority.

C. Prosecution History of the '693 Patent

The prosecution of the '693 patent was not robust. The Examiner's prior art search was deficient for being underinclusive and tainted by errors in the search classification and queries. The Examiner relied exclusively on prior art submitted by the applicant, who indiscriminately submitted hundreds of references in a series of Information Disclosure Statements. (EX1002.) Of the over 800 references cited on the face of the patent, not one was cited by the Examiner himself. (EX1001, (56) ("References Cited").)

The conspicuous lack of references cited by the Examiner can be explained by multiple defects in the search process, including the application's unduly narrow classification for search purposes as an optical system under G02C ("Physics/Optics/Spectacles; Sunglasses or Goggles Insofar as They Have the Same Features as Spectacles; Contact Lenses"). *See* EX1001, (58) ("Field of Classification Search"). The Examiner further applied similarly inapt search queries, which were directed to optical systems, though the claims do not even

recite optical systems. (EX1002.) The application's misclassification and the Examiner's unsound search methodology all but ensured that the prior art demonstrating the claims' obviousness, including the Anderson reference discussed below, would not be located.

Petitioner respectfully submits that instituting the Petition to review the recently-issued '693 patent is a meritorious use of Board resources in view of these myriad prosecution defects.

D. Level of Ordinary Skill

Based on the disclosure of the '693 patent and an assumed priority date of July 28, 2004, a person of ordinary skill in the art ("POSITA") would have had a Bachelor of Science degree and a Master's degree in Electrical Engineering, Computer Engineering, Physics, or an equivalent field, as well as one to two years of academic or industry experience in mobile devices, wireless communications, or audio electronics, or comparable industry experience. (EX1003, ¶19.)

III. CLAIM CONSTRUCTION

In the co-pending district court litigation, Petitioner proposed claim constructions, and the court entered claim constructions in an oral order on April 6, 2026, as set forth below for the '693 patent:

Term / Claims	Petitioner’s Proposed Construction in Co-Pending Litigation	Court’s Construction in April 6, 2026, Oral Order
“head-worn personal electronic apparatus” / “head-worn wearable electronic device” / “head-worn electronic personal audio apparatus”/ “head-worn electronic device” ’693 patent, claims 24-27, 30, 31, 33-38, 42, 49, 50, 52-54, 61, 64, 70-73	“electronic eyewear or headwear”	“electronic eyewear or headwear”
“[a/the] speaker[s] ... proximate to an ear of the user” / “the first speaker . . . proximate to a first ear of the user” / “the second speaker ... proximate to a second ear of the user” ’693 patent, claims 24, 42, 75	“[a/the] speaker[s] . . . near an ear of the user” / “the first speaker . . . near a first ear of the user” / “the second speaker . . . near a second ear of the user”	Plain and ordinary meaning

(EX1014.)

In this proceeding, Petitioner does not propose any construction for any claim term. The Board construes the claim terms “only to the extent necessary to

resolve the controversy” at hand: here, the invalidity of the claims under 35 U.S.C. § 103. *Realtime Data LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (internal citation omitted). The Board should not construe any of the claim terms because, as set forth in the Petition, the claims are invalid under § 103 under any reasonable interpretation and thus no claim construction is necessary to resolve any issue before the Board. (EX1003, ¶30.) However, even if the Board were to apply the same claim constructions proposed by Petitioner in the district court, or the claim constructions ordered by the court on April 6, 2026, the challenged claims are invalid under § 103 as set forth herein.

IV. PRECISE REASONS FOR RELIEF REQUESTED

Pursuant to 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq.* (including § 42.104(b)), Petitioner requests cancellation of claims 1-25, 27-38, 42-51, 54-71, 75, and 76 of the '693 Patent based on the following references and the accompanying Declaration of Dr. Chris Kyriakakis. (EX1003.) All challenged claims are unpatentable, *e.g.*, as obvious, in view of the prior art, at least as set forth herein.

Prior Art Reference	Abbreviation
U.S. Patent No. 5,721,783	Anderson (EX1004)
U.S. Patent No. 6,671,379	Nemirovski (EX1005)
WIPO International Publication No. WO 01/54458	Eaton (EX1006)
U.S. Patent No. 7,010,332	Irvin (EX1007)
U.S. Patent No. 7,620,433	Bodley (EX1009)
U.S. Patent No. 7,046,230	Zadesky (EX1010)
U.S. Patent No. 7,599,508	Lynch (EX1011)
U.S. Patent No. 6,674,869	Paczkowski (EX1013)

The statutory grounds for the challenge of each claim are set forth below.

Throughout the Petition, all statutory citations are pre-AIA based on the earliest possible priority date of July 28, 2004.

Ground	35 U.S.C. §	Claims	Prior Art References
1	103	1-5, 14-19, 24, 25, 27, 28, 42, 59, 60, 62, 63, 75	Anderson
2	103	6-13, 50, 61, 76	Anderson, Nemirovski
3	103	20-22, 29	Anderson, Eaton
4	103	23, 30, 36-38, 54-58	Anderson, Irvin
5	103	31, 32, 43, 44	Anderson, Paczkowski
6	103	33-35	Anderson, Bodley

Ground	35 U.S.C. §	Claims	Prior Art References
7	103	45-48	Anderson, Bodley, Zadesky
8	103	49	Anderson, Bodley, Zadesky, Paczkowski
9	103	51	Anderson, Lynch, Paczkowski
10	103	64-71	Anderson, Lynch, Nemirovski

Below, Petitioner discusses why the challenged claims are unpatentable, including by specifying how and where the prior art satisfies each limitation of each challenged claim, as required by 37 C.F.R. § 42.104(b)(4).¹ Petitioner's showing establishes a reasonable likelihood that it will prevail on each ground of invalidity as to each challenged claim.

V. GROUND 1: CLAIMS 1-5, 14-19, 24, 25, 27, 28, 42, 59, 60, 62, 63, AND 75 ARE RENDERED OBVIOUS BY ANDERSON

A. Summary of Anderson

Anderson is a U.S. Patent that was filed on June 7, 1995 and issued on February 24, 1998. (EX1004.) Anderson is thus prior art to the '693 patent under at least 35 U.S.C. §§102(a), (b), and (e). Anderson was not cited during

¹ Petitioner also shows how each claim preamble is satisfied, but does not concede that any preamble is limiting for any ground in the Petition.

prosecution.

Anderson discloses a hearing aid that includes an earpiece and a remote processor unit (RPU) that receives signals from and transmits signals to the earpiece. (EX1004, 1:7-10; EX1003, ¶32.) FIG. 1 illustrates:

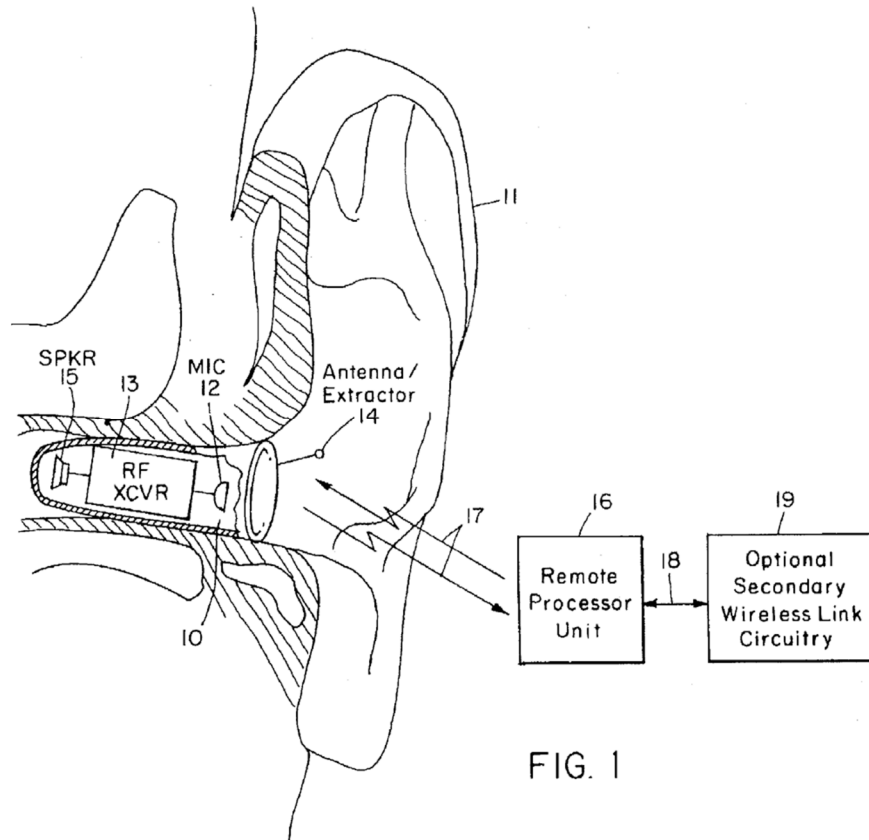


FIG. 1

(EX1004, FIG. 1; EX1003, ¶32.)

The earpiece includes a microphone, RF transceiver, and speaker, and the RPU may be worn or carried by the user and can interface with a telephone network. (EX1004, 3:58-60, 4:1-12, 5:61-6:5; EX1003, ¶33.)

Anderson discloses “many variations of the system shown in FIG. 1.” (EX1004, 4:15-18; EX1003, ¶34.) In some embodiments, the earpiece is worn in

the user's ear canal, such as shown for earpiece 10 in FIG. 1; or may utilize a behind-the-ear ("BTE") unit. (EX1004, 3:53-58; EX1003, ¶34.) In some embodiments, such as shown in FIG. 2, the earpiece belongs to a head-worn headset 21:

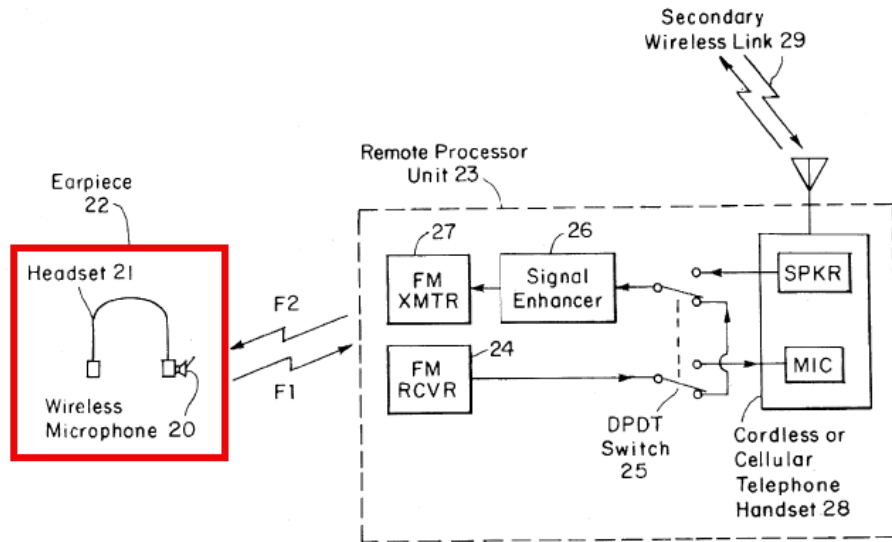


FIG. 2

(EX1004, 4:15-39, FIG. 2 (annotated); EX1003, ¶34.)

The headset earpiece 22 shown in FIG. 2 is “functionally similar” to the in-ear earpiece 10 shown in FIG. 1. (EX1004, 4:33-35; EX1003, ¶35.) The headset earpiece 22 can be made using commercial off-the-shelf components, such as a Radio Shack model 12-103 headset receiver:



(EX1004, 4:26-39; EX1015, 46; EX1003, ¶35.)

During operation of the hearing aid, audio signals from the environment are picked up by the microphone of the earpiece and transmitted over a two-way wireless link to the RPU. (EX1004, 1:55-59; EX1003, ¶36.) The RPU then enhances the audio signals, *e.g.*, by adjusting the signals to accommodate for a user's hearing impairment, and subsequently transmits the enhanced signals over the two-way wireless link to the earpiece. (EX1004, 1:61-63, 27:4-17; EX1003, ¶36.) The system may also support mobile telephone functionality and noise cancellation. (EX1004, 2:60-65, 23:19-26, 24:45-25:14, FIG. 2; EX1003, ¶36.)

Anderson is analogous art to the '693 patent because it is directed to the same field of endeavor: wearable devices with electrical components, including those that provide audio output. (EX1001, Abstract, 2:66-3:9; EX1004, Abstract, 1:5-2:39; EX1003, ¶37.) For example, Anderson relates to wearable hearing aid systems in which audio signals are presented to a user—analogous to the wearable

audio devices of the '693 patent. (*See* EX1001, 2:66-9:62; EX1004, 1:5-2:39; EX1003, ¶37.) Similarly, by disclosing systems in which “audio signals are enhanced according to the user’s needs,” Anderson is reasonably pertinent to a problem faced by the '693 patent inventors—using wearable devices to provide users with “enhanced hearing.” (EX1001, 2:66-3:9; EX1004, 1:55-63; EX1003, ¶37.)

B. Claim 1

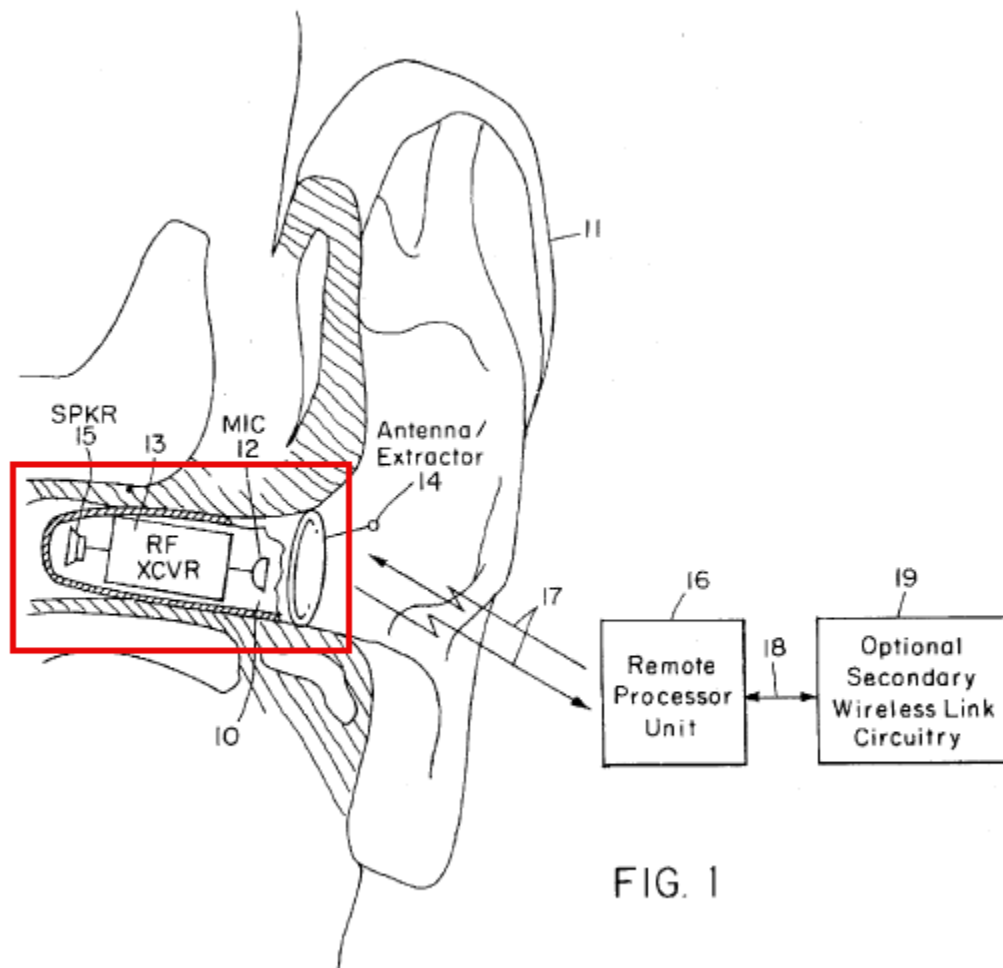
1. [Preamble]²

Anderson discloses a hearing aid system with an earpiece 10 and a remote processor unit (RPU) 16 that wirelessly receives signals from the earpiece; generates custom audio “enhanced according to the user’s needs” from the signals; and transmits the customized audio to the earpiece for playback to the user. (EX1004, 1:7-10, 1:50-65; EX1003, ¶38.) Anderson’s hearing aid is a personal audio system at least because the audio playback “can only be heard by the user”. (EX1004, 3:58-60, 23:11-14, FIG. 1; EX1003, ¶38.)

2. [A]

Anderson’s earpiece 10 can be worn “completely-in-the-canal” of the ear 11, as shown in FIG. 1:

² See the claims appendix for a full recitation of each claim.



(EX1004, 3:54-55, FIG. 1 (annotated); EX1003, ¶39.)

The POSITA would have understood each of these in-ear earpieces to be an ear bud. (EX1003, ¶40.)

In binaural embodiments, “[t]wo earpieces (one in each ear)” communicate with the RPU. (EX1004, 23:36-39; EX1003, ¶41.) Anderson explains, in the context of the headset embodiment of FIG. 2, that binaural embodiments are “based on the same principles” as monaural embodiments. (EX1004, 4:30-33;

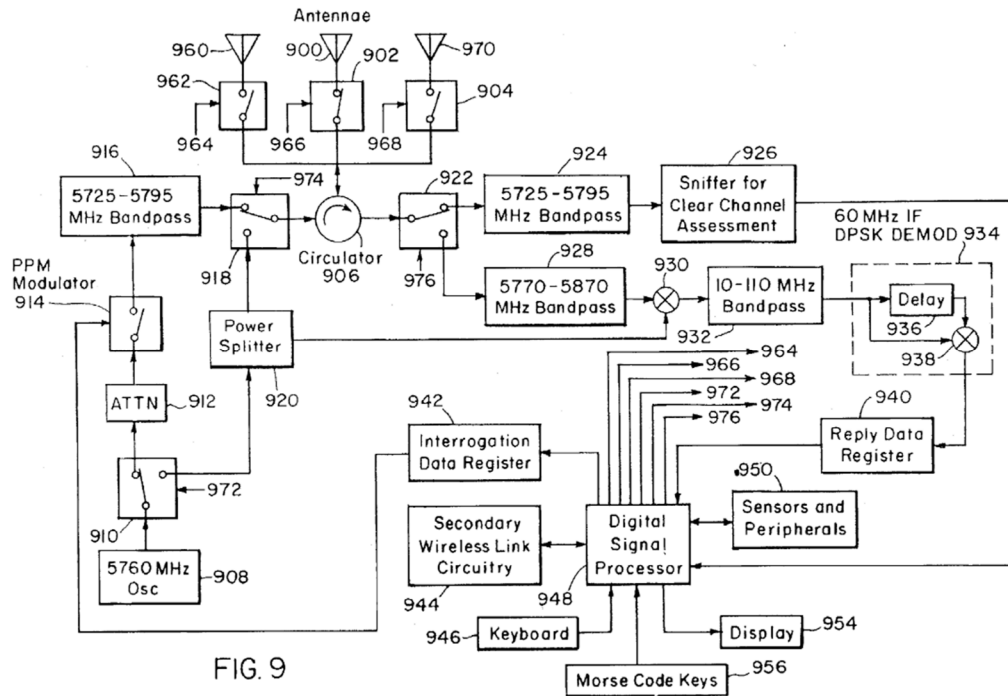
EX1003, ¶41.)

A POSITA would have found it obvious to implement the FIG. 1 earpieces in a binaural configuration to achieve the disclosed advantages of binaural embodiments—such as directionality and hearing protection—for in-ear devices. (EX1004, 23:36-65; EX1003, ¶42.) Moreover, because the FIG. 1 earpieces are “functionally similar” to those of FIG. 2, and because binaural embodiments rely on the same principles as monaural embodiments, such an implementation would have been straightforward and reasonably likely to succeed. (EX1004, 4:30-35; EX1003, ¶42.)

Accordingly, the POSITA would have understood references in Anderson to a single earpiece —whether in headset embodiments or in-ear embodiments—to apply to either or both earpieces in a binaural embodiment. (EX1003, ¶43.)

3. [B]

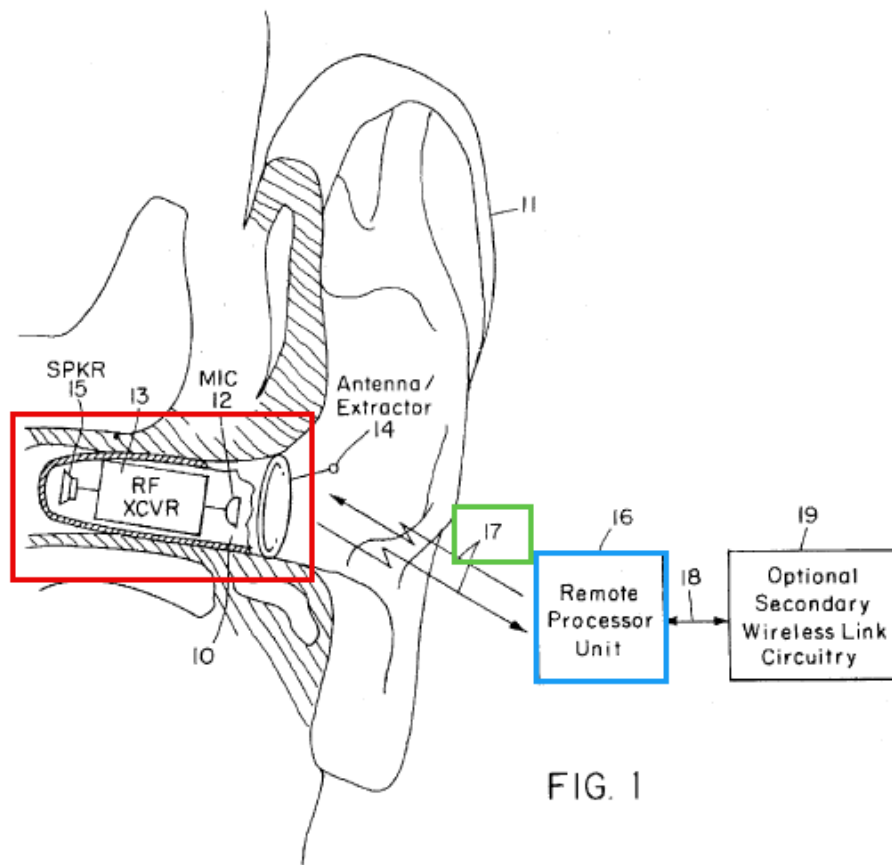
Anderson’s RPU 16 is configured to communicate with the earpieces and other devices. (EX1004, 1:7-10; EX1003, ¶44.) FIG. 9 illustrates the RPU:



(EX1004, 3:42-43, FIG. 9; EX1003, ¶44.)

The RPU 16 is a mobile communication device: it is “worn by ... the user,” communicates wirelessly with the earpieces, and includes secondary wireless link circuitry (944) for communication with a cellular telephone system, enabling the system to function as a virtual telephone handset. (EX1004, 1:51-55, 23:19-26, 24:45-25:14, FIG. 9; EX1003, ¶45.)

The RPU 16 communicates with the earpieces 10 to support audio output and receives audio signals from a microphone 12 located in an earpiece, as shown in FIG. 1:



(EX1004, 22:62-23:3, FIG. 1 (annotated); EX1003, ¶46.)

The RPU enhances audio signals “according to the user’s needs” using a stored program that compensates for hearing loss—for example, by adjusting the pitch (frequency) of a speech signal. (EX1004, 5:11-21, 23:3-5, 23:29-31, 27:15-17, FIG. 9; EX1003, ¶47.) A POSITA would have understood this processing to modify speech signals based on the user’s hearing impairment, *i.e.*, reduced sensitivity to particular frequencies. (EX1004, 5:15-21; EX1003, ¶47.)

Anderson further discloses identifying hearing impairment through a hearing test in which the RPU “generate[s] tones of varying frequencies and amplitudes” to

“determine[] appropriate gain vs. frequency parameters” for use by the stored program. (EX1004, 27:4-24; EX1003, ¶48.) A POSITA would have understood these disclosures to teach that the RPU 16 stores a user-specific hearing profile based on the test results—*i.e.*, gain-versus-frequency parameters—and uses that profile to compensate for hearing loss as described above. (EX1004, 27:4-24; EX1003, ¶48.)

This is analogous to the hearing profile described in the '693 patent, which comprises digital data representing a user's “amplification across frequencies” (analogous to Anderson's gain-versus-frequency parameters) and is stored in a portable device. (EX1001, 68:62-69:52; EX1016, 314; EX1003, ¶49.)

4. [C]

As described above for element [B], Anderson's RPU uses a stored program to “compensate for the user's hearing loss.” (EX1004, 27:4-24; EX1003, ¶50.) User-specific gain vs. frequency parameters are determined via a hearing test and stored in a hearing profile. (EX1004, 27:4-24; EX1003, ¶50.) The RPU's stored program applies these parameters to an audio signal to produce a user-specific output signal. In particular, the program applies frequency-dependent gain values—either increasing or decreasing the signal at corresponding frequencies—to compensate for the user's hearing impairment at those frequencies. (EX1004, 23:29-31, 27:14-15; EX1003, ¶50.)

5. [D]

Anderson's RPU produces the customized audio signals described above by providing "amplification and other forms of signal enhancement." (EX1004, 2:36-39; EX1003, ¶51.) The RPU processing includes applying hearing aid parameters, such as an amplification level set by the RPU DSP 948, and frequency-specific gain values to compensate for hearing loss, either of which the POSITA would have understood to include amplifying the input signal. (EX1004, 22:62-23:35; EX1003, ¶51.)

6. [E]

In Anderson, the customized audio output signals are "transmitted from the RPU 16 over the primary wireless link 17 to the earpiece 10, where they are converted by a speaker 15 to sounds that can only be heard by the user 11." (EX1004, 23:11-14; EX1003, ¶52.) In binaural embodiments, the audio output signals are "transmitted from the RPU to the left and right earpiece speakers". (EX1004, 24:10-14; EX1003, ¶52.)

7. [F]

See element [E]. (EX1003, ¶53.) The customized audio output signals are transmitted from the RPU to the earpieces, "where they are converted by a speaker 15 to sounds"; the POSITA would have understood that the signals must be received by the earpieces, *i.e.*, so that they can be converted by the earpieces'

respective speakers. (EX1004, 23:11-14; EX1003, ¶53.)

8. [G]

See elements [E] and [F]. (EX1003, ¶54.) The customized audio output signals are transmitted from the RPU to the earpieces, “where they are converted by a speaker 15 to sounds” for the user; the POSITA would thus understand the sounds to be generated by the earpieces’ respective speakers in accordance with the earpieces receiving the audio output signals. (EX1004, 23:11-14; EX1003, ¶54.)

C. Claim 2

1. [Preamble]

See claim 1. (EX1003, ¶55.)

2. [A]

See claim 1[B]. (EX1003, ¶56.)

D. Claim 3

1. [Preamble]

See claim 2. (EX1003, ¶57.)

2. [A]

In Anderson’s hearing test, described above with respect to claim 1[B], the RPU “generate[s] tones of varying frequencies and amplitudes” and presents them to the user via the earpiece to determine gain-versus-frequency parameters for

compensating hearing loss. (EX1004, 27:4-17; EX1003, ¶58.)

Because audio playback through the earpiece “can only be heard by the user,” the test necessarily relies on user feedback to determine whether the tones are audible. (EX1004, 23:11-14; EX1003, ¶59.) A POSITA would have understood that such hearing tests depend on the user to indicate which tones are heard, as the user is best positioned to assess the audibility of tones presented via the earpiece. (*See* EX1017, 1980 (explaining that screening a user for hearing loss includes presenting tones to a user at various frequencies and asking the user to “indicate whether he or she can hear the tone”); EX1003, ¶59.)

E. Claim 4

1. [Preamble]

See claim 1. (EX1003, ¶60.)

2. [A]

Anderson’s RPU uses a stored program to “perform[] signal enhancement to compensate for the user’s hearing loss” using “appropriate gain vs. frequency parameters.” (EX1004, 27:13-17; EX1003, ¶61.) The POSITA would have understood Anderson’s gain to refer to a gain factor, indicating a level of signal amplification; and accordingly that Anderson’s “gain vs. frequency parameters” for signal enhancement provide frequency-specific gain factors used to amplify specific frequencies. (EX1004, 27:4-17; EX1003, ¶61.)

F. Claim 5**1. [Preamble]**

See claim 1. (EX1003, ¶62.)

2. [A]

See claim 1[E]. (EX1003, ¶63.)

3. [B]

See claim 1[G]. (EX1003, ¶64.)

G. Claim 14**1. [Preamble]**

See claim 1. (EX1003, ¶65.)

2. [A]

Anderson's RPU includes two-way wireless link circuitry 19 to "communicate with a telephone or other communication network," thereby "replac[ing] a conventional telephone handset in many applications". (EX1004, 2:49-51, 24:50-58; EX1003, ¶66.) The POSITA would have understood the RPU to include a mobile phone at least because it worn by, and thus moves with, the user; and includes telephone handset functionality to communicate with a telephone network. (EX1004, 1:51-55; EX1003, ¶66.)

H. Claim 15

1. [Preamble]

See claim 1. (EX1003, ¶67.)

2. [A]

Anderson's RPU can include a "peripheral device[]" to provide music (*e.g.*, from a compact disc) or other information to the user. (EX1004, 24:45-47, 25:51-59; EX1003, ¶68.) As an example, a peripheral device can provide music from, *e.g.*, a compact disc. (EX1004, 25:51-59; EX1003, ¶68.) The RPU combines the enhanced audio signals described for claim 1 with other audio information, which the POSITA would have understood to include the music, and transmits this customized audio output to the earpiece. (EX1004, 23:5-14; EX1003, ¶68.)

I. Claim 16

1. [Preamble]

See claim 1. (EX1003, ¶69.)

2. [A]

Anderson discloses that "speech signals from a nearby talker" are processed by the RPU to "help compensate for a user's hearing loss relative to a particular talker's voice characteristics" as described above. (EX1004, 5:3-21; EX1003, ¶70.) The POSITA would have understood the speech signals to include a voice conversation, *i.e.*, a conversation involving the nearby talker. (EX1003, ¶70.)

J. Claim 17**1. [Preamble]**

See claim 1. (EX1003, ¶71.)

2. [A]

Anderson's earbud earpiece includes a primary microphone 12 configured to detect audio signals and transmit them to the RPU. (EX1004, 1:51-63, 22:62-23:5; EX1003, ¶72.) Additionally, the earpiece includes an auxiliary microphone, housed in the same case, configured to detect audio signals from the user via bone conduction. (EX1004, 26:54-61; EX1003, ¶72.)

3. [B]

Anderson discloses that a user can provide voice commands, which are "received as audio signals by the earpiece 10 and transmitted to the RPU 16." (EX1004, 25:15-30; EX1003, ¶73.) The POSITA would have understood the audio signals to be picked up by the microphones, which are the components of the earpiece that receive audio signals. (EX1004, 5:3-6, 6:8-15, 22:62-23:5; EX1003, ¶73.)

4. [C]

Anderson's voice commands cause the RPU to "initiate actions" such as changing hearing aid parameter settings (*e.g.*, volume), or activating appliances or environmental controls in a distributed wireless network. (EX1004, 25:22-27;

EX1003, ¶74.)

K. Claim 18

1. [Preamble]

See claim 1. (EX1003, ¶75.)

2. [A]

As described for claim 1[B], Anderson's RPU "performs signal enhancement to compensate for the user's hearing loss" based on gain vs. frequency parameters that are determined based on a hearing test and stored in a hearing profile. (EX1004, 27:4-17; EX1003, ¶76.) The POSITA would have understood such a gain parameter to characterize an amplitude of a signal; and thus would have understood Anderson to disclose enhancing the audio signals by raising (amplifying) or lowering (attenuating) the amplitude of different frequency bands, based on their corresponding gain parameters, in accordance with the results of the user's hearing test. (EX1016, 314; EX1004, 27:4-17; EX1003, ¶76.)

L. Claim 19

1. [Preamble]

See claim 1. (EX1003, ¶77.)

2. [A]

As described for claim 3[A], Anderson's hearing test prompts the user to respond to the audio tones and thus determine the gain vs. frequency parameters of

his or her hearing profile. (EX1004, 27:4-17; EX1017, 1980; EX1003, ¶78.)

Anderson discloses that the hearing test used to determine gain vs. frequency parameters for signal enhancement can be “performed via the earpiece normally worn by the user” and that “[a]ll signal generation capabilities necessary to perform hearing tests are available in the hearing aid system comprising an earpiece 10 and RPU 16.” (EX1004, 27:4-9; EX1003, ¶79.) Further, audio playback by the earpiece “can only be heard by the user”. (EX1004, 23:11-14; EX1003, ¶79.) The POSITA would thus understand that the user, as the only person who can hear the test’s audio playback, self-determines the hearing profile by providing the responses that result in the profile’s gain vs. frequency parameters. Additionally, as described for claim 3[A], the POSITA would have understood Anderson’s hearing test to rely on the user’s own indications of audio tone detection. (EX1017, 1980; EX1003, ¶79.)

M. Claim 24

1. [Preamble]

See claim 1[Preamble]. (EX1003, ¶80.)

2. [A]

Anderson teaches that the earpiece may be “form[ed]” from a headset 21, as shown in FIG. 2:

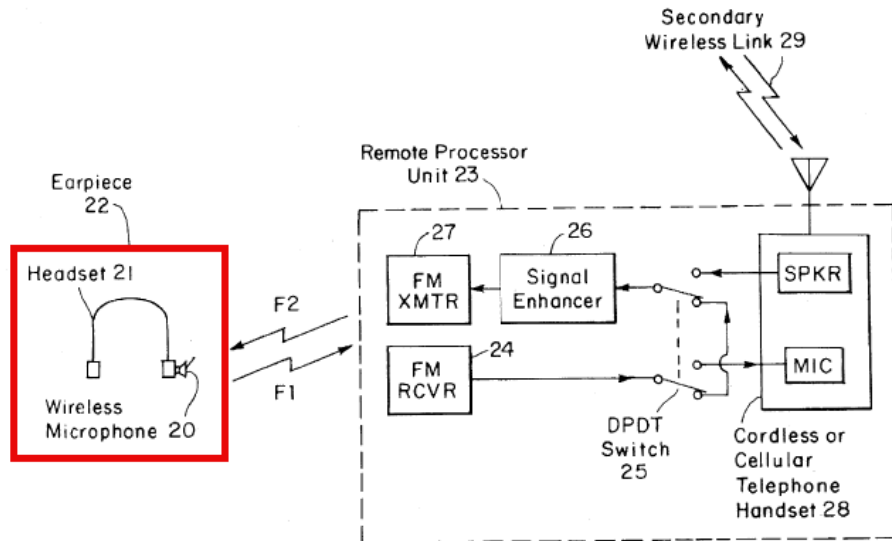


FIG. 2

(EX1004, 4:15-39, 5:52-55, FIG. 2 (annotated); EX1003, ¶81.)

The POSITA would have understood headset 21 and its earpiece 22 to be head-worn at least because FIG. 2 illustrates headset 21 (and thus earpiece 22) as including a headband that rests on the user's head for support; and because headset 21 can be a "Radio Shack (R) model 12-103" stereo headset, which similarly includes a headband, as shown below:



(EX1004, 4:26-39; EX1015, 46; EX1003, ¶82.)

The POSITA would have understood from these disclosures that Anderson's headset 21 can include a pair of speakers, one for each ear, as shown above; with each speaker wearable near (and thus proximate to) its respective ear, *i.e.*, when the headset is worn. (EX1003, ¶83.)

Anderson illustrates headset 21 and earpiece 22 within the context of a “limited-feature embodiment,” shown in FIG. 2. (EX1004, 4:15-29; EX1003, ¶84.) However, the POSITA would have understood headset 21 and earpiece 22 to be combinable with the “full-featured” embodiment of FIG. 1. (EX1004, 3:52-58; EX1003, ¶84.) This is because Anderson characterizes FIG. 1 and FIG. 2 as showing two preferred embodiments of the same invention; explains that the headset earpiece shown in FIG. 2 is “functionally similar” to the in-ear earpiece 10 of FIG. 1; and further explains that “many other earpiece housing types” can be used in place of the CIC earpiece housing shown in FIG. 1. (EX1004, 3:52-58, 4:15-35; EX1003, ¶84.) The POSITA would have understood from these disclosures that the FIG. 1 system could be flexibly implemented using various housings for the earpiece, including headset 21. (EX1003, ¶84.)

The POSITA would have been motivated to use the headset instead of the CIC housing to realize advantages in cost, simplicity, and commercial availability described by Anderson. (EX1003, ¶85.) Even using headset 21 in a full-featured

application, it would provide certain advantages over the in-ear embodiment. (EX1003, ¶85.) Unlike some CIC housings, the headset did not need to be customized to fit in a user's ear canal. (EX1004, 4:15-5:60; EX1015, 46; EX1003, ¶85.) Additionally, there would have been comfort benefits: many users do not like supporting objects with their ears, a problem addressed by replacing a CIC housing with a headset. (See EX1011, 1:17-21; EX1003, ¶85.) And using a larger headset rather than a small in-ear device would make it easier and less expensive to include the processing and communication capabilities of the full-featured application, and would reduce the likelihood of misplacing the device. (EX1004, 2:36-39 (relaxing earpiece size constraints leads to a "cost-effective design"), 21:31-34; EX1003, ¶85.) Anderson provides specific guidance for adapting the headset using "techniques [that] are well known in the art," and notes that schematics and service manuals for the headset were readily available, demonstrating that the POSITA would have had a reasonable expectation of success in making the combination. (EX1004, 4:26-5:60; EX1003, ¶85.)

Because the POSITA would have combined headset 21 and its earpiece 22 with the full-featured FIG. 1 embodiment, throughout this Petition, unless otherwise noted, references to the earpiece 10 shown for FIG. 1 should be understood to apply equally to earpiece 22 and headset 21. (EX1003, ¶86.)

3. [B]

See claim 1[B]. (EX1003, ¶87.)

4. [C]

See claim 1[C]. (EX1003, ¶88.)

5. [D]

See claim 1[D]. (EX1003, ¶89.)

6. [E]

In Anderson, enhanced audio signals are “transmitted from the RPU 16 over the primary wireless link 17 to the earpiece 10, where they are converted by a speaker 15 to sounds that can only be heard by the user 11.” (EX1004, 23:8-14; EX1003, ¶90.) Similarly, for two-earpiece (stereo) embodiments, the audio signals are “transmitted from the RPU to the left and right earpiece speakers” for presentation to the user. (EX1004, 4:30-33, 24:10-14; EX1015, 46; EX1003, ¶90.)

7. [F]

See element [E]. (EX1003, ¶91.)

8. [G]

See element [E]. (EX1003, ¶92.) In Anderson’s binaural embodiments, stereo audio signals are presented to both ears. (EX1004, 4:30-33; EX1003, ¶92.)

N. Claim 25**1. [Preamble]**

See claim 24. (EX1003, ¶93.)

2. [A]

Anderson's earpiece includes a rechargeable battery 860, as illustrated in

FIG. 8:

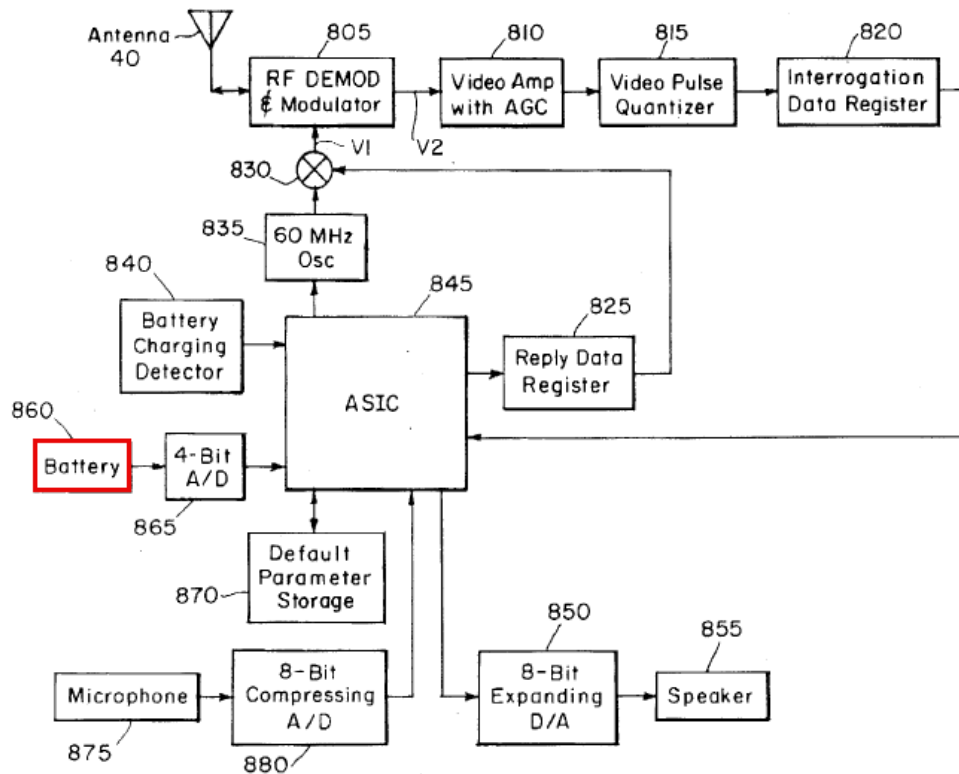


FIG. 8

(EX1004, 3:40-41, 6:55-57 (“use of a rechargeable battery is desirable”),
22:35-44, FIG. 8 (annotated); EX1003, ¶94.)

3. [B]

Anderson's earpiece battery can be charged by placing the head-worn earpiece in “recharger/storage tray”, which the POSITA would have understood to disclose coupling the earpiece to a docking station. (EX1004, 22:35-48; EX1003, ¶95.)

O. Claim 27**1. [Preamble]**

See claim 24. (EX1003, ¶96.)

2. [A]

See claim 1[E]. (EX1003, ¶97.) The RPU and earpiece are wirelessly networked via the two-way wireless link 17. (EX1004, 1:50-63, 4:1-4; EX1003, ¶97.)

P. Claim 28**1. [Preamble]**

See claim 27. (EX1003, ¶98.)

2. [A]

Anderson's wireless network is preferably implemented with operating frequencies in the 900 MHz to 6 GHz range, because of that range's "proven ability to ... provide a *short-range wireless communication link*". (EX1004, 7:39-49 (emphasis added); EX1003, ¶99.) Similarly, in preferred embodiments, the wirelessly networked RPU and earpiece are separated by two feet. (EX1004, 6:60-63; EX1003, ¶99.) Based on these disclosures, POSITA would have understood Anderson to teach a short-range wireless network. (EX1003, ¶99.)

Q. Claim 42**1. [Preamble]**

See claim 24. (EX1003, ¶100.)

2. [A]

See claim 24[A]. (EX1003, ¶101.)

3. [B]

See claim 24[A]. (EX1003, ¶102.)

R. Claim 59**1. [Preamble]**

See claim 42. (EX1003, ¶103.)

2. [A]

Anderson's earpiece includes electronic circuitry (e.g., ASIC 845) configured to provide audio signals to the user via a speaker (e.g., speaker 855). (EX1004, FIG. 8; EX1003, ¶104.) FIG. 8 illustrates the earpiece:

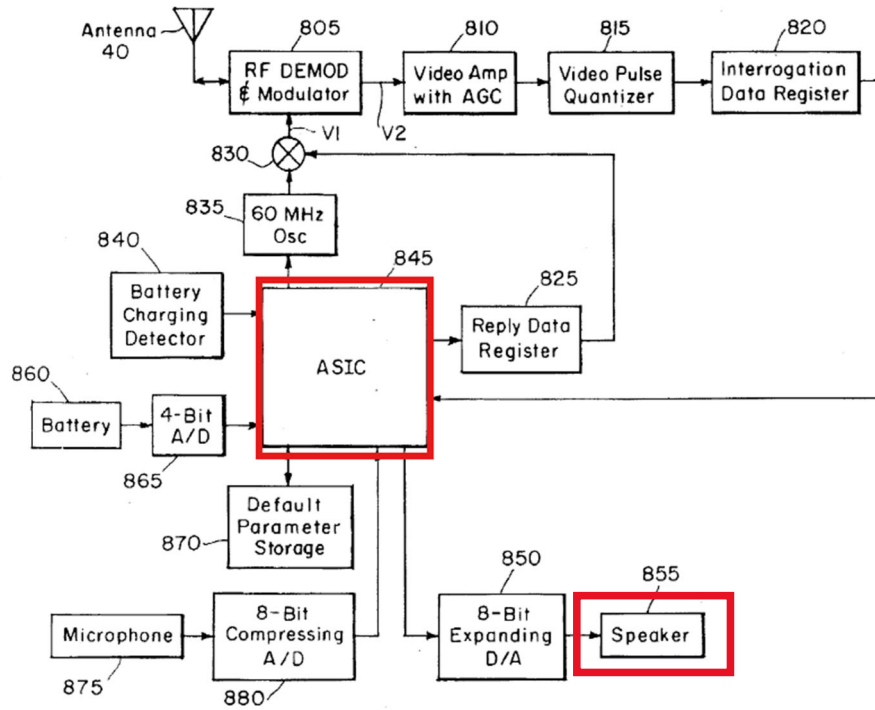


FIG. 8

(EX1004, FIG. 8 (annotated); EX1003, ¶104.)

These audio signals include audio alerts, such as “a verbal warning that an earpiece or RPU battery voltage is low.” (EX1004, 24:15-22; EX1003, ¶105.)

S. Claim 60

1. [Preamble]

See claim 59. (EX1003, ¶106.)

2. [A]

Anderson discloses that the audio alerts can be “made imperceptible to a casual observer if desired.” (EX1004, 24:15-20; EX1003, ¶107.) The POSITA thus would have understood the audio alerts to be based on a user preference

setting (*i.e.*, whether the user desires the alerts to be imperceptible). (EX1003, ¶107.)

T. Claim 62

1. [Preamble]

See claim 42. (EX1003, ¶108.)

2. [A]

Anderson discloses that sensors 950, which are located in the earpiece, can take “[a]utomatic measurements” of heart pulse rate and body temperature. (EX1004, 24:23-25; EX1003, ¶109.) The POSITA would thus have understood sensors 950 to be internal to the head-worn structure and to include physical condition sensors. (EX1003, ¶109.)

U. Claim 63

1. [Preamble]

See claim 62. (EX1003, ¶110.)

2. [A]

See claim 62[A]. (EX1003, ¶111.) Sensors 950 can measure the user’s heart pulse rate, *i.e.*, heart beat rate. (EX1004, 24:23-25; EX1003, ¶111.)

V. Claim 75

1. [Preamble]

See claim 1[Preamble]. (EX1003, ¶112.)

2. [A]

Anderson's earpiece (and thus the earpiece's speaker) can be worn "in or at the ear". (EX1004, 1:6-10; EX1003, ¶113.) For example, in some embodiments, the earpiece (containing the speaker) is worn in the user's ear canal, such as shown for earpiece 10 in FIG. 1; or may utilize a behind-the-ear ("BTE") unit. (EX1004, 3:53-58; EX1003, ¶113.) In such BTE embodiments, the POSITA would have understood the earpiece's speaker to be positioned near (and thus proximate) to the user's ear. (EX1003, ¶113.)

3. [B]

See claim 1[B]. (EX1003, ¶114.)

4. [C]

See claim 1[C]. (EX1003, ¶115.)

5. [D]

See claim 1[D]. (EX1003, ¶116.)

6. [E]

See claim 24[E]. (EX1003, ¶117.)

7. [F]

See claim 24[F]. (EX1003, ¶118.)

8. [G]

See claim 24[G]. (EX1003, ¶119.)

VI. GROUND 2: CLAIMS 6-13, 50, 61, AND 76 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF NEMIROVSKI

A. Summary of Nemirovski

Nemirovski is a U.S. Patent that was filed on July 31, 2001, published on October 3, 2002, and issued on December 30, 2003. (EX1005.) Nemirovski is thus prior art to the '693 patent under at least 35 U.S.C. §§102(a), (b), and (e). Nemirovski was not cited during prosecution.

Nemirovski discloses an earset with multiple microphones for use in a communication system. FIG. 5 illustrates an embodiment:

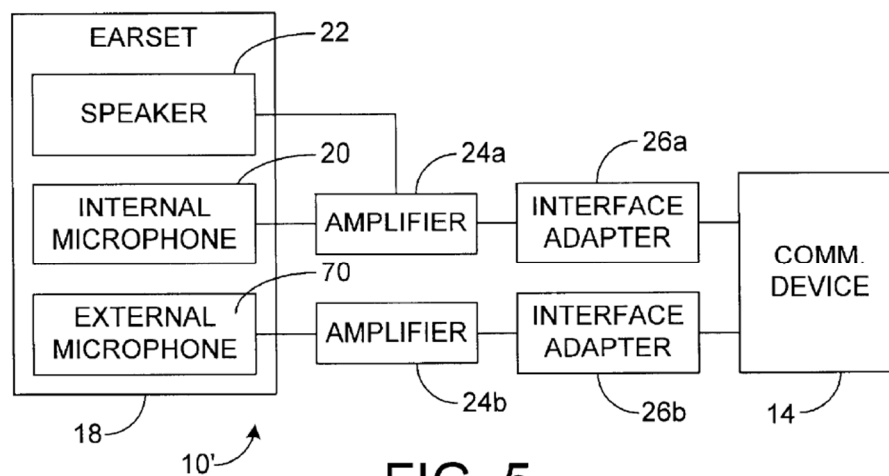


FIG. 5

(EX1005, FIG. 5; EX1003, ¶121.)

In some embodiments, Nemirovski's earset is "retained ... by a headset assembly," which a POSITA would have understood as headwear supported by the top of the user's head. (EX1005, 6:19-22; EX1003, ¶122.)

The earset includes an internal microphone, an external microphone, and a

speaker. (EX1005, 9:46-50, FIG. 5; EX1003, ¶123.) The microphones detect sound and generate electrical signals that may be amplified and transmitted to a communication device for playback to the user via the speaker. (EX1005, 4:34-47; EX1003, ¶123.)

Nemirovski further teaches using one or two earsets, with two improving performance “due to the detection of more information.” (EX1005, 7:30-38; EX1003, ¶124.)

The internal microphone faces the ear canal to capture user speech, while the external microphone captures ambient sound. (EX1005, 5:45-50, 6:58-64, 9:22-26, 9:54-60; EX1003, ¶125.) These signals are used to distinguish speech from noise and to cancel external noise. (EX1005, 9:19-31, 10:8-13; EX1003, ¶125.)

Nemirovski is analogous art to the '693 patent because both concern wearable devices with electrical components that provide audio output. (EX1001, Abstract, 2:66-3:9; EX1005, Abstract, 2:10-45; EX1003, ¶126.) For example, Nemirovski's earset with a microphone and speaker is analogous to the audio devices disclosed in the '693 patent. (*See* EX1001, 2:66-9:62; EX1005, 2:10-25; EX1003, ¶126.) It is also reasonably pertinent to the problem addressed by the '693 patent—providing “enhanced hearing” using wearable devices—because it discloses components that detect speech and produce a corrected microphone signal. (EX1001, 2:66-3:9; EX1005, 2:10-45; EX1003, ¶126.)

B. Motivation to Combine with Reasonable Expectation of Success

The POSITA would have been motivated to combine Anderson with Nemirovski with a reasonable expectation of success. (EX1003, ¶127.) Anderson discloses hearing aid earpieces compatible with multiple microphones, including a body-worn microphone used to detect background noise and adjust parameters such as volume amplification. (EX1004, 7:10-13, 22:27-33, 23:26-31; EX1003, ¶127.)

The POSITA would have pursued this combination to address Anderson’s shortcomings. (EX1003, ¶128.) First, Anderson acknowledges drawbacks of body-worn microphones—susceptibility to wind and clothing noise, inability to track head movement, and lack of stand-alone operation—and suggests relocating the microphone to the earpiece, but does not explain how to do so while preserving background-noise detection. (EX1004, 22:20-27; EX1003, ¶128.)

Second, although Anderson’s earpieces include microphones for voice and cellular functions, environmental noise can degrade speech signals. (EX1004, 23:14-35, 24:45-25:50, 26:57-61, FIG. 1, FIG. 9; EX1003, ¶129.) Anderson acknowledges this problem but offers incomplete or suboptimal solutions, such as bone conduction—which provides “suboptimal sound transmission”—and multiple earpieces, which may be impractical in some cases (*e.g.*, while driving) and are described without complete implementation detail (*e.g.*, for accommodating

multiple air-path microphones). (EX1004, 26:54-27:3; EX1018, 2; EX1003, ¶129.) Instead, Anderson suggests combination with known techniques to distinguish environmental noise. (EX1004, 23:65-24:1; EX1003, ¶129.)

A POSITA would have looked to Nemirovski to supply those techniques. (EX1003, ¶130.) Nemirovski discloses earpieces with internal and external microphones for detecting speech and environmental noise, along with methods for separating and canceling noise. (EX1005, 5:45-50, 6:58-64, 9:19-31, 9:54-60, 10:8-13; EX1003, ¶130.) Applying this arrangement to Anderson's earpiece(s) would improve signal processing and enable hands-free communication without the drawbacks of bone conduction. (EX1005, 3:6-44, 10:8-11:6; EX1003, ¶130.)

Although Anderson notes differences between hearing aids and telephone handsets, a POSITA would still have combined Nemirovski because Anderson includes analogous voice and cellular functionality and would benefit from Nemirovski's noise-reduction techniques. (EX1004, 2:7-16; EX1003, ¶131.)

A POSITA also would have had a reasonable expectation of success. (EX1003, ¶132.) Anderson and Nemirovski disclose analogous audio devices used with communication systems and share familiar components—microphones, speakers, and amplifiers—used in conventional ways. (EX1004, 1:6-10, 3:52-4:14, FIG. 1, FIG. 8; EX1005, 3:6-9, 9:45-50, FIG. 5; EX1003, ¶132.) And Nemirovski further provides implementation detail, including signal-processing

techniques for detecting speech, to guide integration with systems such as Anderson. (EX1005, 10:27-11:6; EX1003, ¶132.) The combination would thus apply known techniques to achieve predictable results. (EX1003, ¶132.)

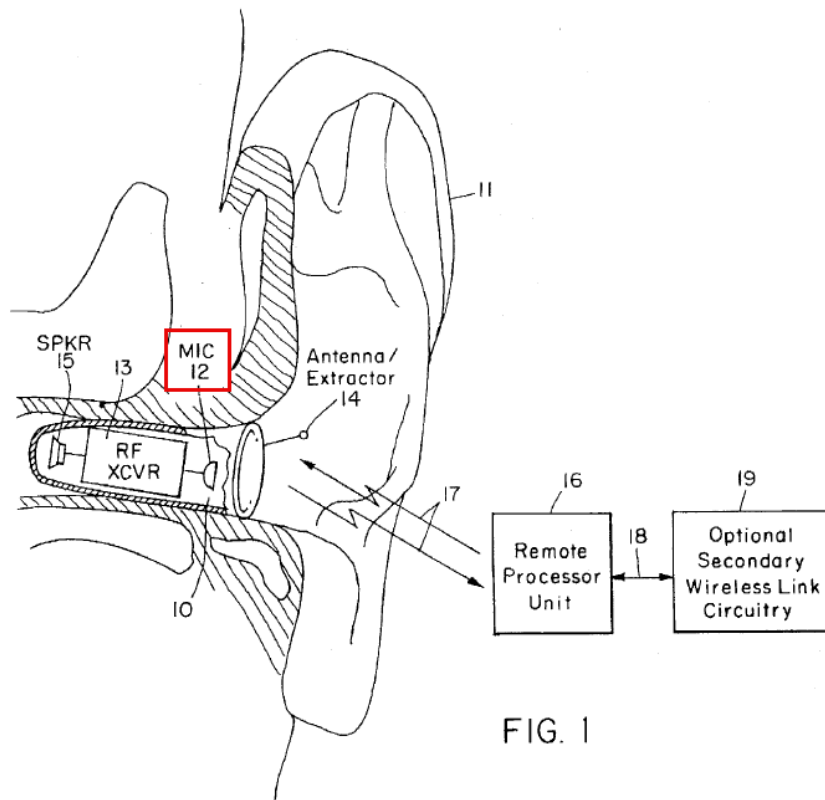
C. Claim 6

1. [Preamble]

See claim 1. (EX1003, ¶133.)

2. [A]

Anderson discloses an earbud having a primary microphone 12, as shown in FIG. 1:



(EX1004, 22:62-23:5, 23:36-39, 25:29-30, 26:54-27:3, FIG. 1 (annotated); EX1003, ¶134.)

Nemirovski discloses an earset having an internal microphone and an external microphone. (EX1005, 9:46-50, FIG. 5; EX1003, ¶135.) As explained above, a POSITA would have incorporated this multi-microphone arrangement into Anderson's earpiece to improve speech detection and noise cancellation. (EX1003, ¶135.) The internal microphone is directed toward the ear canal and detects sounds emanating from the user, enabling accurate speech detection. (EX1005, 3:15-18; EX1003, ¶135.) The external microphone points away from the user and detects ambient noise, including environmental sounds and other speakers. (EX1005, 9:53-58; EX1003, ¶135.) Thus, in the combination, the internal microphone captures user-generated audio, while the external microphone captures outward, environmental audio. (EX1003, ¶135.)

A POSITA would have understood this microphone arrangement to provide directional audio pickup based on placement. (EX1003, ¶136.) Nemirovski explains that the internal microphone, positioned toward the ear canal, detects user speech while being shielded from external noise; whereas the external microphone, oriented outward, detects ambient sound. (EX1005, 9:19-35; EX1003, ¶136.) Although the microphones themselves may be omnidirectional, their placement relative to the ear and housing configures them for directional pickup. (EX1005,

3:34-36, 7:13-14, 9:43-44; EX1003, ¶136.) For example, the internal microphone is “shielded from environmental noise” by the housing and the user’s head, while the external microphone detects ambient sound as a result of its outward orientation. (EX1005, 7:8-14, 9:51-55; EX1003, ¶136.)

D. Claim 7

1. [Preamble]

See claim 6. (EX1003, ¶137.)

2. [A]

The external microphone of the array is oriented away from the ear canal to directionally detect sounds in the external environment, including the user’s voice, as described for claim 6[A]. (EX1004, 5:3-6, 6:8-15, 25:29-30; EX1003, ¶138.) The POSITA would have understood this directional audio pickup to include a direction in front of the user. (EX1003, ¶138.) As Anderson explains, the pinnae (external ear cartilage) shield sounds from behind the user, such that sounds from in front are less attenuated and more strongly detected. (EX1004, 20:6-8; EX1003, ¶138.) Although Anderson describes this effect in the context of the earpiece’s antenna, a POSITA would have understood that co-located microphone 12 is subject to the same directional shielding. (EX1004, 3:53-60, FIG. 1; EX1003, ¶138.) This directionality is consistent with Anderson’s detection of speech signals, including the user’s own speech, which are typically emitted in front of the

user. (EX1004, 5:3-21; EX1003, ¶138.)

E. Claim 8

1. [Preamble]

See claim 6. (EX1003, ¶139.)

2. [A]

See claim 6[A]; the external microphone is oriented outward to directionally detects ambient sound outside the ear. (EX1005, 7:8-14, 9:51-55; EX1003, ¶140.)

F. Claim 9

1. [Preamble]

See claim 1. (EX1003, ¶141.)

2. [A]

See claim 6[A]. (EX1003, ¶142.)

G. Claim 10

1. [Preamble]

See claim 9. (EX1003, ¶143.)

2. [A]

See claim 6[A], *i.e.*, the internal microphone. (EX1003, ¶144.)

3. [B]

See claim 6[A], *i.e.*, the external microphone. (EX1003, ¶145.)

H. Claim 11

1. [Preamble]

See claim 10. (EX1003, ¶146.)

2. [A]

Nemirovski teaches using the unique signals generated by the internal microphone 20 and the external microphone 70 “to distinguish between user produced speech and externally produced sounds.” (EX1005, 10:8-26; EX1003, ¶147.) This process can “cancel externally generated noise,” detected by the external microphone, from the “detections of the internal microphone 20” to produce a “relatively noise-free speech signal.” (EX1005, 10:8-26; EX1003, ¶147.)

I. Claim 12

1. [Preamble]

See claim 11. (EX1003, ¶148.)

2. [A]

Nemirovski teaches “cancel[ing] externally generated noise from the detections of the internal microphone 20” to produce a “relatively noise-free speech signal.” (EX1005, 10:8-26, 10:48-58; EX1003, ¶149.) For example, in the below linear system, the internal and external microphone audio signals (Y_I and Y_E , respectively) each include a sound component S (user speech) and a noise

component N (ambient noise such as from passing vehicles and machinery) picked up by the microphones:

$$F_{MI} * S + F_{MI} * N = Y_I \quad (\text{Eq. 1})$$

$$F_{ME} * S + F_{ME} * N = Y_E \quad (\text{Eq. 2})$$

(EX1005, 10:28-47; EX1003, ¶149.)

The terms F_{MI} and F_{ME} represent the impulse responses of the internal and external microphones, respectively. (EX1005, 10:30-34; EX1003, ¶150.) The linear system is solved for the speech component S and the ambient noise component N, such that the noise component (*e.g.*, including a portion of the audio detected by the external microphone) can be subtracted from the microphone signals (*e.g.*, including audio detected by the internal microphone), thus isolating the speech component. (EX1005, 10:20-26; EX1003, ¶150.)

J. Claim 13

1. [Preamble]

See claim 12. (EX1003, ¶151.)

2. [A]

This element is met by Anderson in view of Nemirovski. (EX1003, ¶152.) For example, Anderson discloses that enhanced audio signals received from the RPU are transmitted to the earpiece, “where they are converted by a speaker 15 to sounds that can only be heard by the user 11.” (EX1004, 23:11-14; EX1003,

¶152.)

K. Claim 50

1. [Preamble]

See claim 42. (EX1003, ¶153.)

2. [A]

As described above, the POSITA would have incorporated Nemirovski's microphone teachings into Anderson's head-worn structure, such that the earpiece includes analogous microphones to improve speech detection and noise cancellation. (EX1003, ¶154.)

In the combination, as taught by Nemirovski, an internal microphone detects “sounds emanating or coming out of the ear (or air pressure changes occurring within the ear) to accurately and reliably detect the speech of the user.” (EX1005, 3:6-23; EX1003, ¶155.) FIG. 5 illustrates:

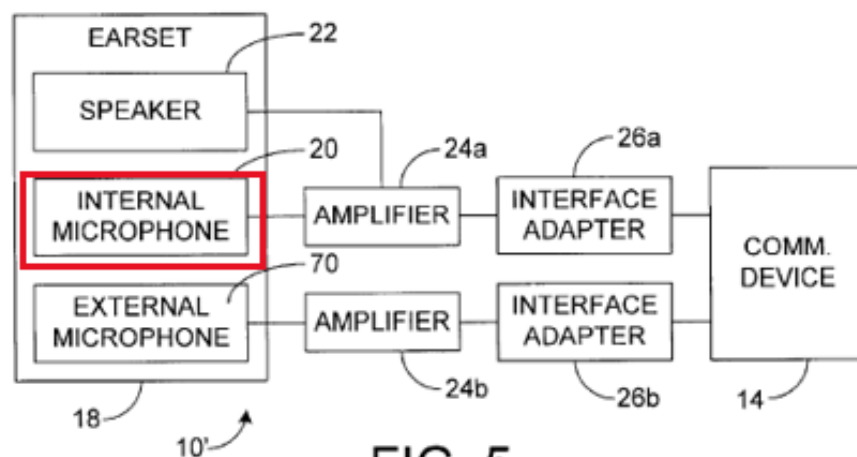


FIG. 5

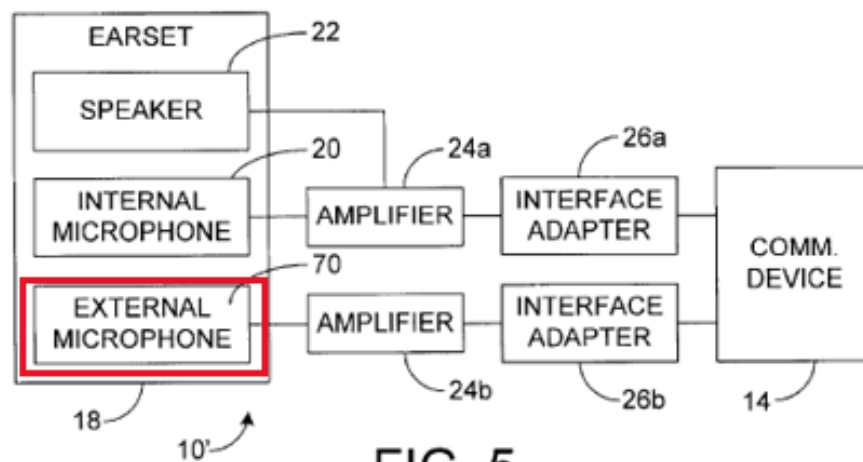
(EX1005, 9:46-50, FIG. 5 (annotated); EX1003, ¶155.)

Similarly, Anderson teaches detecting speech for voice commands and mobile telephone functionality, including communication with a cellular phone system. (EX1004, 23:19-26, 24:45-25:50, FIG. 1, FIG. 2; EX1003, ¶156.)

Nemirovski further discloses that the internal microphone is disposed within the earset housing and directed toward the ear canal to capture user-generated sound. (EX1005, 3:15-18, 6:36-37, 9:46-50, FIG. 5; EX1003, ¶157.) A POSITA would therefore have understood that, when incorporated into Anderson’s head-worn structure, the internal microphone is at least partially within the structure and oriented toward the user to pick up audio input from the user. (EX1003, ¶157.)

3. [B]

In the combination, as taught by Nemirovski, an external microphone “points away from the person wearing the earset.” (EX1005, 9:46-53, FIG. 5; EX1003, ¶158.) FIG. 5 illustrates:



(EX1005, 9:46-50, FIG. 5 (annotated); EX1003, ¶158.)

The external microphone detects air pressure changes outside of the ear that result from “externally generated noise (other people’s speech, environmental noise, etc.)”—that is, ambient sound from the environment in the vicinity of the wearer. (EX1005, 9:53-58; EX1003, ¶159.)

L. Claim 61

1. [Preamble]

See claim 42. (EX1003, ¶160.)

2. [A]

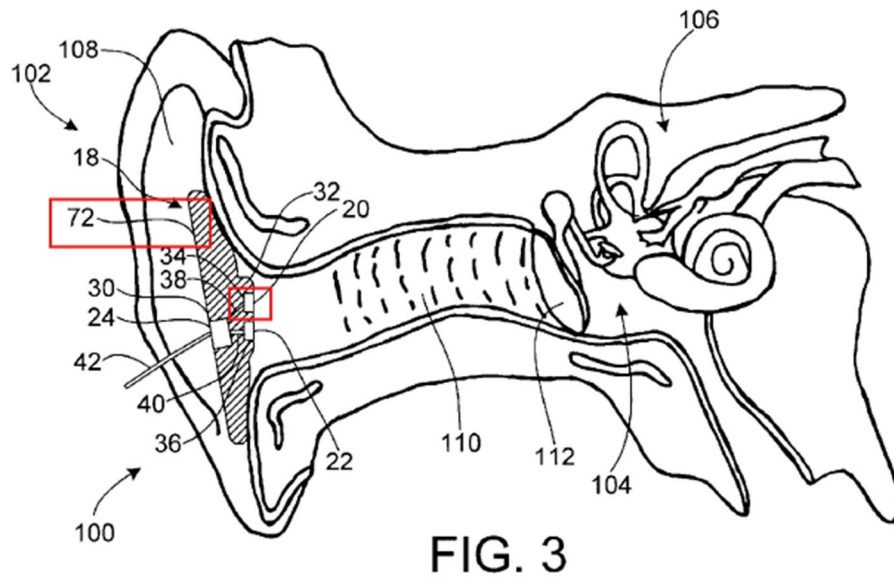
See claim 50[A]. (EX1003, ¶161.)

3. [B]

See claim 50[B]. (EX1003, ¶162.)

4. [C]

Nemirovski’s external microphone 70 is disposed on an “exterior portion 72 of the housing 30” of the apparatus, while the internal microphone 20 is disposed on an “interior portion 32 of the housing 30” that is configured to be inserted into the ear (e.g., into the concha or ear canal). (EX1005, 6:36-49, 9:33-35; EX1003, ¶163.) FIG. 3 illustrates:



(EX1005, FIG. 3 (annotated); EX1003, ¶163.)

FIG. 3, illustrating the user's ear, shows that exterior portion 72 (and thus external microphone 70) is disposed further than interior portion 32 (and internal microphone 20) from the user's mouth. (EX1003, ¶164.) As the POSITA would have understood, this placement is a consequence of the microphones' different purposes: the internal microphone is closer to the mouth, to better detect speech while remaining insulated from external sounds; conversely, the external microphone is further from the mouth, to better detect such external sounds. (EX1005, 6:30-35, 9:19-31; EX1003, ¶164.)

M. Claim 76

1. [Preamble]

See claim 75. (EX1003, ¶165.)

2. [A]

Anderson discloses that the earpieces (and thus their respective speakers) can be worn “completely-in-the-canal” and thus inserted into the user’s ears.

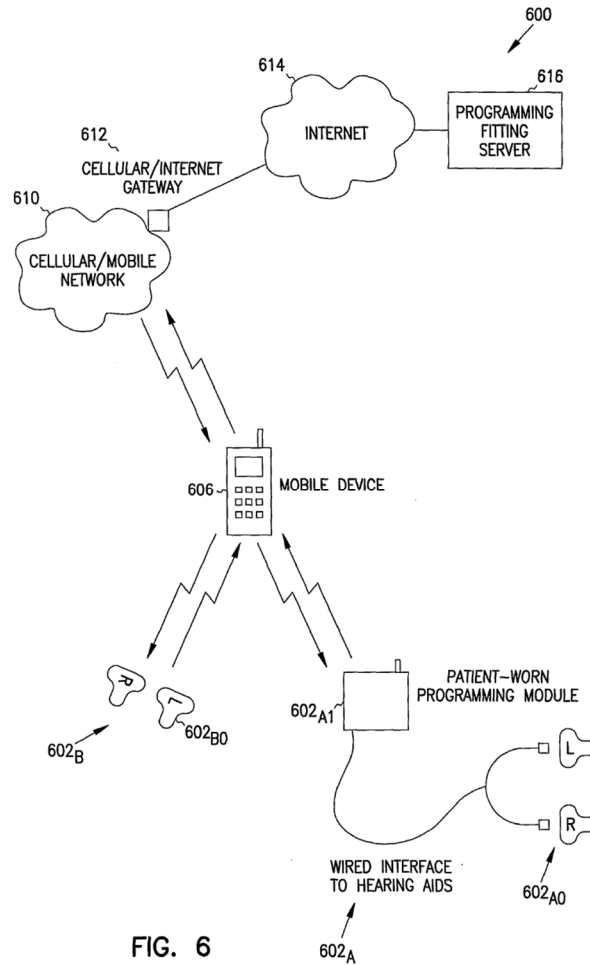
(EX1004, 1:6-10, 3:53-58; EX1003, ¶166.)

VII. GROUND 3: CLAIMS 20-22 AND 29 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF EATON

A. Summary of Eaton

Eaton is the July 26, 2001, publication of a PCT application that was filed on January 18, 2001. (EX1006.) Eaton is thus prior art to the ’693 patent under at least 35 U.S.C. §§102(a) and (b). Eaton was not cited during prosecution.

Eaton discloses a hearing aid system and a mobile device adapted to program it. (EX1006, 2:28-30; EX1003, ¶168.) FIG. 6 illustrates an embodiment:



(EX1006, FIG. 6; EX1003, ¶168.)

The system communicates with a mobile device that executes software to interact with the patient during fitting. (EX1006, 6:31-33, 11:9-19, FIG. 6; EX1003, ¶169.) The software sends audio test signals to the hearing aid, and the patient's aural responses are used to generate an audiogram reflecting the extent of hearing loss. (EX1006, 11:19-31; EX1003, ¶169.) These responses are used to determine audiological parameters, which in turn program the hearing aid for tailored therapy. (EX1006, 2:15-20, 11:30-33; EX1003, ¶169.)

Eaton is analogous art to the '693 patent because both concern wearable devices with electrical components that provide audio output. (EX1001, Abstract, 2:66-3:9; EX1006, Abstract, 2:10-45; EX1003, ¶170.) For example, Eaton discloses hearing aid devices, including implementations in headsets or eyeglasses, analogous to the devices of the '693 patent. (*See* EX1001, 2:66-9:62; EX1006, 2:7-33, 6:8-10; EX1003, ¶170.) It is also reasonably pertinent to the problem addressed by the '693 patent—providing “enhanced hearing”—because it determines user-specific audiological parameters to enable tailored hearing therapy. (EX1001, 2:66-3:9; EX1006, 2:15-20, 11:30-33; EX1003, ¶170.)

B. Motivation to Combine with Reasonable Expectation of Success

The POSITA would have been motivated to combine Anderson with Eaton with a reasonable expectation of success. (EX1003, ¶171.) Anderson discloses that its RPU executes a software-based hearing test to determine signal-enhancement parameters, but does not detail how the user interacts with the software. (EX1004, 27:4-24; EX1003, ¶171.) A POSITA would have looked to Eaton, which discloses an analogous software-based hearing test and provides implementation details—such as user interfaces—not expressly found in Anderson. (EX1006, 11:16-33; EX1003, ¶171.) Eaton’s benefits, such as simplified operation, would have further motivated the combination. (EX1006, 5:1-19; EX1003, ¶171.)

Eaton's software would have been readily integrated into Anderson's system. (EX1003, ¶172.) Both references disclose analogous, well-understood components, including hearing aid devices with speakers that communicate wirelessly with mobile devices running DSP-based hearing-test software. (EX1004, 1:6-10, 3:58-60, FIG. 1, FIG. 8; EX1006, 5:20-6:25, 11:6-15, FIG. 6; EX1003, ¶172.) And Eaton provides specific guidance, including flow charts and data structure diagrams, to guide the implementation. (EX1006, 10:16-12:5; FIGS. 2-5; EX1003, ¶172.) The combination would thus apply known components and techniques to achieve predictable results. (EX1003, ¶172.)

C. Claim 20

1. [Preamble]

See claim 1. (EX1003, ¶173.)

2. [A]

See claim 1[B]. (EX1003, ¶174.) Anderson's hearing test program is loaded into the RPU's DSP 948 and executed by the DSP to establish the user's hearing profile. (EX1004, 2:46-47, 27:4-17; EX1003, ¶174.) The program is stored in a memory (a storage device) of the DSP 948. (EX1004, 27:13-20; EX1003, ¶174.)

3. [B]

Anderson's hearing test program is executed by the RPU's DSP 948 as

described above. (EX1003, ¶175.) Eaton teaches that the user interacts with the hearing test program to profile the extent of the user's hearing loss. (EX1006, 11:17-31; EX1003, ¶175.) The POSITA would have combined these teachings of Eaton with Anderson's hearing test as described above. (EX1003, ¶175.)

D. Claim 21

1. [Preamble]

See claim 20. (EX1003, ¶176.)

2. [A]

See claim 20[B]. (EX1003, ¶177.) In the combination, the hearing test program interacts with the user by sending audio test signals to the user's hearing aid and receiving aural responses from the user, as taught by Eaton. (EX1006, 11:16-33; EX1003, ¶177.) The hearing test results are used to establish the user's hearing profile as described for claim 1[B]. (EX1004, 27:4-24; *see* EX1006, 11:16-33; EX1003, ¶177.)

E. Claim 22

1. [Preamble]

See claim 21. (EX1003, ¶178.)

2. [A]

See claim 21[A]. (EX1003, ¶179.) Anderson's hearing test program generates tones of varying frequencies and amplitudes that are converted to

acoustic waves by the earpiece. (EX1004, 27:9-13; EX1003, ¶179.) In the combination, as described for claim 21[A], the program guides the user to interactively respond to the tones, *i.e.*, via aural input, to establish the hearing profile. (EX1004, 27:4-24; EX1006, 11:17-24; EX1003, ¶179.)

F. Claim 29

1. [Preamble]

See claim 27. (EX1003, ¶180.)

2. [A]

Anderson's RPU and earpiece are wirelessly networked via two-way wireless link 17. (EX1004, 1:50-63, 4:1-4; EX1003, ¶181.) Eaton teaches that in the combination, the network may be a Bluetooth network, which "provides a short-range, low-cost radio communication link." (EX1006, 6:17-19; EX1003, ¶181.) The POSITA would have understood Bluetooth to be a suitable technology for the short distances (*e.g.*, two feet) preferred by Anderson. (EX1004, 6:60-63; EX1003, ¶181.)

VIII. GROUND 4: CLAIMS 23, 30, 36-38, AND 54-58 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF IRVIN

A. Summary of Irvin

Irvin is a U.S. patent that was filed on Feb. 21, 2000, and issued on March 7, 2006. (EX1007.) Irvin is thus prior art to the '693 patent under at least 35 U.S.C. §§102(a) and (e).

Irvin discloses wireless headsets with “automatic on/off capabilities to maximize battery life,” such as headset 100 shown in FIG. 1:

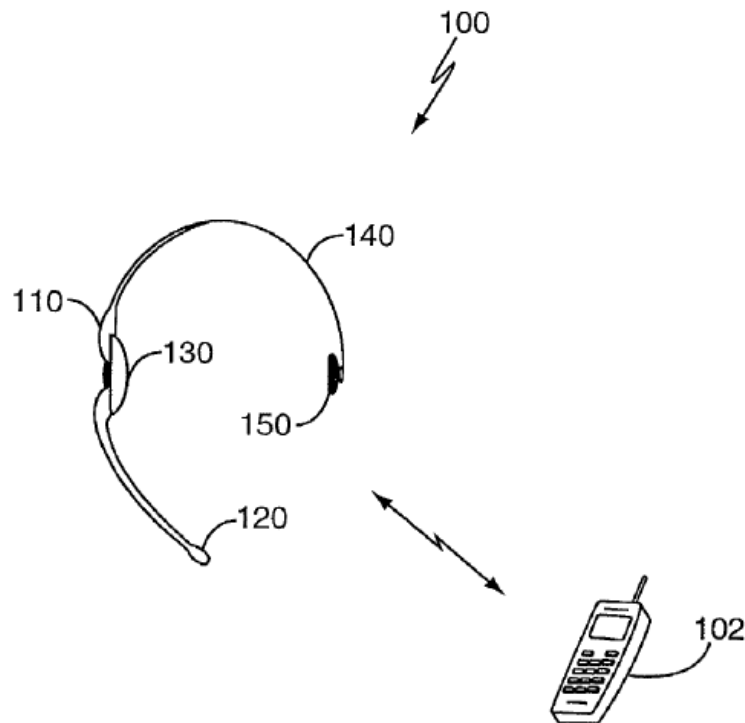


FIG. 1

(EX1007, Abstract, 1:13-51, FIG. 1; EX1003, ¶183.)

Irvin’s headset is head-worn: it is “secur[ed] ... to the user’s head,” *e.g.*, via a retaining member, and automatically transitions between inactive, sleep, and active states depending on whether it is being worn. (EX1007, Abstract, 2:16-51, 3:35-39, 8:11-50, 9:40-43; EX1003, ¶184.) A communications circuit 230 provides wireless and audio interfaces that are selectively enabled or disabled by a

power control circuit 210 depending on the device state. (EX1007, 3:28-4:10, 8:11-9:39, FIG. 2A; EX1003, ¶184.) FIG. 2A illustrates:

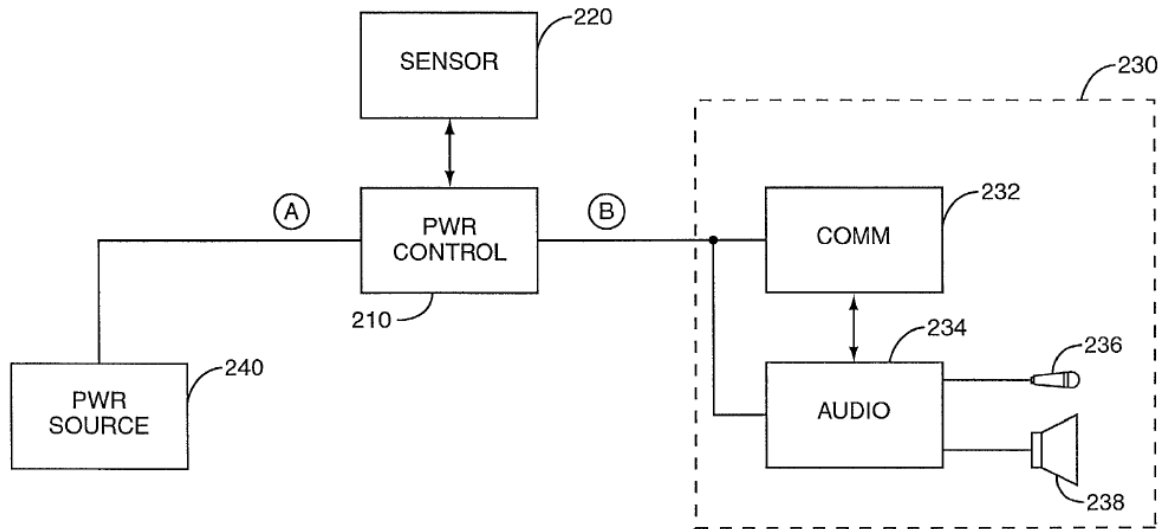
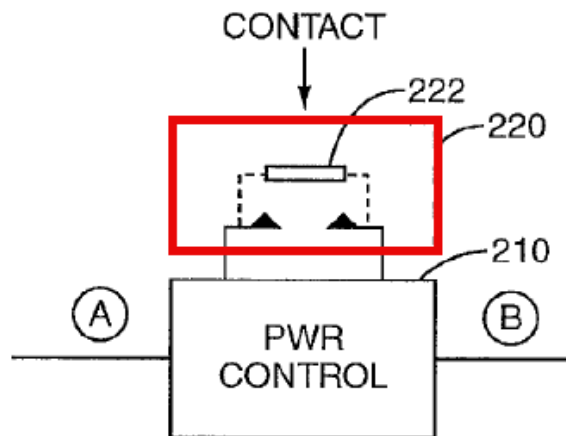
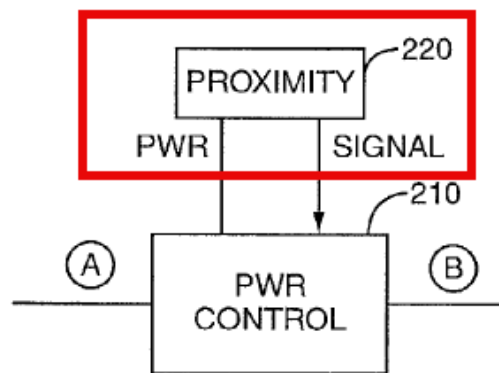


FIG. 2A

(EX1007, FIG. 2A; EX1003, ¶184.)

Transitions between the states are controlled by a sensor 220 (*e.g.*, a contact sensor or proximity sensor), which detects when the user is wearing the headset. (EX1007, Abstract, 2:16-51, 5:1-6:67, 8:11-50; EX1003, ¶185.) Figures 4C and 4D illustrate sensor 220 embodiments:

**FIG. 4C****FIG. 4D**

(EX1007, FIG. 4C (annotated), FIG. 4D (annotated); EX1003, ¶185.)

Irvin is analogous art to the '693 patent because it is directed to the same field of endeavor—wearable devices with electrical components that provide audio output. (EX1001, Abstract, 2:66-3:9; EX1007, 3:28-45; EX1003, ¶186.) Irvin is also reasonably pertinent to the problems addressed by the '693 patent: both relate

to determining when a wearable device is being worn so that the device can be controlled accordingly. (EX1001, 92:20-93:37; EX1007, 2:16-51; EX1003, ¶186.)

Both further seek to minimize power consumption and extend battery life.

(EX1001, 70:7-19; EX1007, 2:16-51; EX1003, ¶186.)

Irvin was not cited during prosecution.

B. Motivation to Combine with Reasonable Expectation of Success

A POSITA would have been motivated to combine Anderson with Irvin to meet the claim limitations. (EX1003, ¶188.) Anderson recognizes the importance of minimizing power consumption to extend battery life in its hearing aid device. (EX1004, 6:55-57; EX1003, ¶188.) Lower power consumption improves usability by extending operation time and enabling smaller, lighter batteries—critical for head-worn devices. (EX1003, ¶188.) Irvin similarly emphasizes that “battery life is a key component of operator convenience” and should be maximized in wireless headsets. (EX1007, 2:1-5; EX1003, ¶188.)

Although Anderson proposes reducing power usage and using rechargeable batteries, those approaches are incomplete because the device cannot be used while charging. (EX1004, 22:35-39; EX1003, ¶189.) The POSITA would have sought further improvements to reduce charging time and avoid periods of non-use—particularly problematic for hearing aids, where the device’s unavailability can pose health and safety risks. (EX1003, ¶189.)

Irvin provides such improvements by teaching automatic transitions between active and low-power states based on user activity. (EX1007, 2:8-51; EX1003, ¶190.) Irvin discloses sensors responsive to natural user stimuli (e.g., motion, orientation, or proximity) to control device state, enabling automatic, hands-free operation without mechanical switches. (EX1007, 1:13-2:51; EX1003, ¶190.) Incorporating these teachings into Anderson would improve power efficiency, reliability, and usability by enabling the device to determine when it is in use (e.g., being worn or in motion) and adjust power accordingly—an improvement over Anderson’s reliance on manual controls. (EX1007, 1:13-2:51, 21:20-25, 22:14-20; EX1003, ¶190.)

Irvin’s sensor 220 can be, *e.g.*, a contact sensor (such as a contact switch), a movement sensor (such as an accelerometer), or a proximity sensor. (EX1007, 2:27-28, 5:1-6:33; EX1003, ¶191.) A POSITA would have selected an appropriate sensor based on the hearing aid’s use conditions—for instance, a contact sensor for reliable detection when worn, or a proximity or movement sensor where contact sensing is less reliable. (EX1007, 5:1-17, 6:3-8; EX1003, ¶191.)

The POSITA would also have had a reasonable expectation of success. (EX1003, ¶192.) Anderson and Irvin disclose analogous head-worn devices with familiar components—batteries, programmable logic, power electronics, sensors, microphones, and speakers—and similar headset form factors, and Anderson

already contemplates multiple sensors. (EX1004, 2:55-59, 24:23-26; EX1007, 3:28-4:38, 8:4-10, FIG. 2A; EX1003, ¶192.) Irvin further teaches integrating sensors into headset components, such as placing sensor 220 in the earpiece or retaining structure, consistent with Anderson’s design. (EX1007, 3:29-32, 6:10-13, FIG. 1B; EX1003, ¶192.) The combination would therefore apply known techniques to well-understood components to achieve predictable results. (EX1003, ¶192.)

C. Claim 23

1. [Preamble]

See claim 1. (EX1003, ¶193.)

2. [A]

Irvin discloses that its proximity sensor 220 can be an “active or passive [infrared] sensor,” which the POSITA would have understood to include a detector for detecting capturing infrared radiation data (*i.e.*, an amount of infrared radiation detected by the infrared sensor). (*See* EX1001, 104:9-12; EX1007, 6:22-24; EX1019, 216-17; EX1003, ¶194.) The POSITA would have combined Irvin’s proximity sensor 220 with Anderson’s in-ear earpiece as described above, such that the earpiece includes the proximity sensor. (EX1003, ¶194.)

3. [B]

Irvin teaches that electronic circuitry processes data received from sensor

220 (*e.g.*, an infrared proximity sensor indicating the distance to the user's head) to enable or disable the headset's electronic circuitry based on whether the headset is being worn:

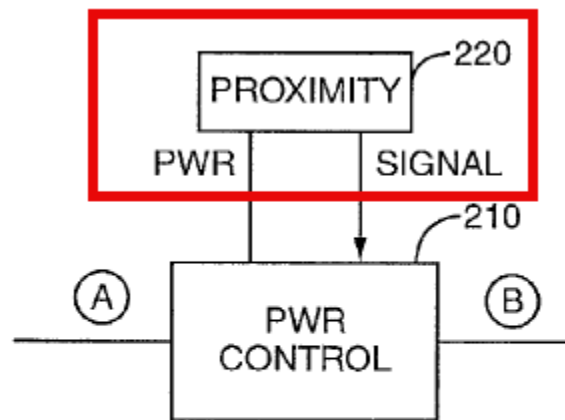


FIG. 4D

(EX1007, 4:3-10, 4:39-49, 6:20-33, FIG. 4D (annotated); EX1003, ¶195.)

For example, communications circuit 230 transitions to an active state 620 after the sensor 220 indicates a stimulus (*e.g.*, infrared radiation data indicating that the device is worn); and transitions to an inactive state 610 or a sleep state 720 after the indication is no longer provided. (EX1007, 8:11-9:39, FIG. 6, FIG. 7; EX1003, ¶196.) The POSITA would have understood that in the combination, the electronic circuitry would electrically connect to the sensor, to receive the sensor's electrical signals; and would be implemented by Anderson's earpiece (*e.g.*, ASIC 845) and/or RPU (*e.g.*, DSP 645), at least because Anderson discloses these

components as configured to interface with sensors. (EX1004, 24:23-26; EX1003, ¶196.)

4. [C]

See element [B]. (EX1003, ¶197.)

D. Claim 30

1. [Preamble]

See claim 24. (EX1003, ¶198.)

2. [A]

Irvin teaches that sensor 220 can include an accelerometer to detect movement; in the combination of Anderson and Irvin, the accelerometer would indicate whether the device is being worn, as described in Section VIII.A and for claim 23. (EX1007, 5:1-10; EX1003, ¶199.)

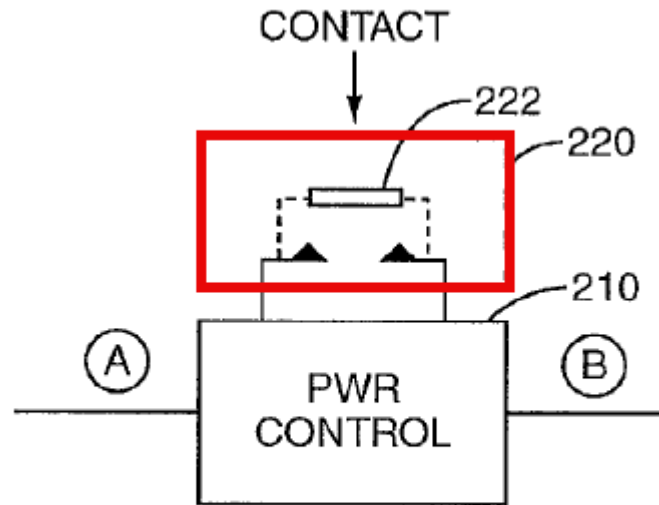
E. Claim 36

1. [Preamble]

See claim 24. (EX1003, ¶200.)

2. [A]

Irvin teaches that electronic circuitry processes data received from contact sensor 220 (*e.g.*, a contact switch activated by the application of force) to enable or disable the headset's electronic circuitry based on whether the headset is being worn:

**FIG. 4C**

(EX1007, 4:3-10, 4:39-49, 6:20-33, FIG. 4C (annotated); EX1003, ¶201.)

Contact sensor 220 is “ideally” placed in the wireless headset. (EX1007, 6:3-13, FIG. 1; EX1003, ¶202.) Irvin’s communications circuit 230 transitions between states based on whether the contact sensor 220 indicates a stimulus (*e.g.*, that force has been applied to the contact switch). (EX1007, 8:11-9:39, FIG. 6, FIG. 7; EX1003, ¶202.)

F. Claim 37

1. [Preamble]

See claim 36. (EX1003, ¶203.)

2. [A]

Irvin’s sensor 220 can be a contact switch that is “actuated when the user

places the wireless headset 100 on their body,” and is “[i]deally” placed in the earpiece 130, in the retaining member 140, or in the retaining pad 150, as shown in FIG. 1:

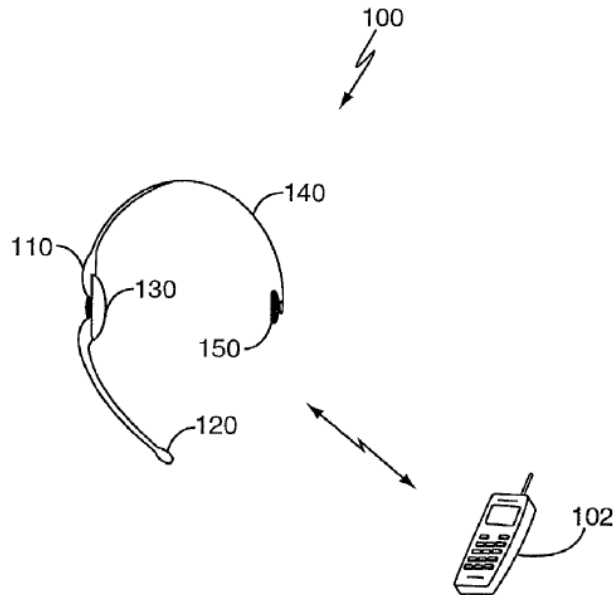


FIG. 1

(EX1007, 6:3-13, FIG. 1; EX1003, ¶204.)

These elements correspond to headset components of Anderson (*e.g.*, earpiece 22, headset 21), such that in combination with Anderson, the contact switch will be activated when the user places the headset on his or her head.

(EX1003, ¶205.) The POSITA would have understood the contact switch to be a force sensor configured to detect user input (*i.e.*, application of force against the switch by the user’s head), consistent with the ’693 patent’s characterization of

such mechanical switches as force sensors. (EX1001, 103:22-47, FIGS. 78, 79; EX1003, ¶205.) The user input alters an operation of the combined head-worn apparatus, at least by causing transitions between states as described for claim 36[A]. (EX1003, ¶205.)

G. Claim 38

1. [Preamble]

See claim 37. (EX1003, ¶206.)

2. [A]

See claim 24[A] and [E]. (EX1003, ¶207.)

3. [B]

See claim 23[B]. (EX1003, ¶208.) In the combination, the operation of the apparatus being altered includes transitioning between active and inactive states based on sensor 220, as described for claim 23[A]. (EX1003, ¶208.) The POSITA would have understood this to include controlling the audio output provided to the user, which is disabled in the inactive state (in which the audio interface 234 of the communications circuit 230 is disconnected from the power source), and re-enabled in the active state. (EX1007, 2:17-23, 3:53-4:2, 8:11-50, FIG. 8; EX1003, ¶208.)

H. Claim 54**1. [Preamble]**

See claim 42. (EX1003, ¶209.)

2. [A]

Irvin's proximity sensor 220 can be an *active* infrared sensor. (EX1007, 6:22-24; EX1003, ¶210.) The POSITA would have understood that such sensors "put out energy in the environment," *i.e.*, "emit near-infrared energy and measure whether any significant amount of the IR light is returned" to determine whether an object is present. (See EX1019, 196, 216-217; EX1003, ¶210.) For example, the infrared radiation can be emitted by an LED. (EX1019, 216; EX1003, ¶210.) Accordingly, in the combination, the POSITA would have understood the headset to include an active infrared sensor with an emitter (*e.g.*, an LED) configured to emit infrared radiation toward the user when the headset is worn; and an infrared detector to measure an amount of IR radiation reflected toward the sensor by the user. (EX1019, 216-17; EX1003, ¶210.)

3. [B]

See element [A]. (EX1003, ¶211.)

I. Claim 55**1. [Preamble]**

See claim 54. (EX1003, ¶212.)

2. [A]

See claim 23[B] and claim 54[A]. (EX1003, ¶213.) The POSITA would have understood the detected IR radiation to indicate whether the device is being worn, *i.e.*, because the user reflects the IR radiation toward the detector when wearing the device. (EX1019, 216-17; EX1003, ¶213.) The POSITA would have further understood the electronic circuitry determining whether the device is worn to be implemented by Anderson's head-worn structure (*e.g.*, earpiece ASIC 845), at least because Anderson discloses the ASIC as configured to interface with sensors. (EX1004, 24:23-26; EX1003, ¶213.)

J. Claim 56

1. [Preamble]

See claim 42. (EX1003, ¶214.)

2. [A]

See claim 54[A]. (EX1003, ¶215.)

3. [B]

See claim 23[B]. (EX1003, ¶216.) The POSITA would have understood the electronic circuitry to be implemented by Anderson's head-worn structure (*e.g.*, earpiece ASIC 845), at least because Anderson discloses the ASIC as configured to interface with sensors. (EX1004, 24:23-26; EX1003, ¶216.)

K. Claim 57**1. [Preamble]**

See claim 56. (EX1003, ¶217.)

2. [A]

See claim 55[A]. (EX1003, ¶218.)

L. Claim 58**1. [Preamble]**

See claim 57. (EX1003, ¶219.)

2. [A]

The POSITA would have understood Irvin’s infrared sensor to comprise a photodetector, because infrared sensors are devices that detect infrared radiation, and photodetectors are devices that detect radiated energy (such as infrared). (EX1016, 557; EX1007, 6:22-24; *see* EX1019, 216-217; EX1003, ¶220.) This understanding is consistent with the ’693 patent, which describes an infrared photodiode capturing reflected infrared radiation as an infrared detector; and describes (via an incorporated reference) that the Sharp PD100MCOMP infrared photodiode is a “suitable” photodetector. (EX1001, 2:15-19, 93:60-94:3; EX1021, 37:52-59; EX1020, 1, 3; EX1003, ¶220.) It is also consistent with Patent Owner’s position in the parallel litigation that the claimed radiation detector can comprise “an infrared detector configured to sense infrared light using a photodetector.”

(EX1022, 589; EX1003, ¶220.)

IX. GROUND 5: CLAIMS 31, 32, 43, AND 44 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF PACZKOWSKI

A. Summary of Paczkowski

Paczkowski is a U.S. Patent that was filed on February 23, 2001, published on November 8, 2001, and issued on January 6, 2004. (EX1013.) Paczkowski is thus prior art to the '693 patent under at least 35 U.S.C. §§102(a), (b), and (e). Paczkowski was not cited during prosecution.

Paczkowski discloses manufacturing a circuit for a hearing aid earpiece by using flex circuits, which can include circuit boards and integrated circuits. (EX1013, 3:17-19; EX1003, ¶243.) In an example flex circuit module of a hearing aid, a flex circuit can be coupled to a battery, a microphone, and two or more integrated circuits, as illustrated in FIG. 5:

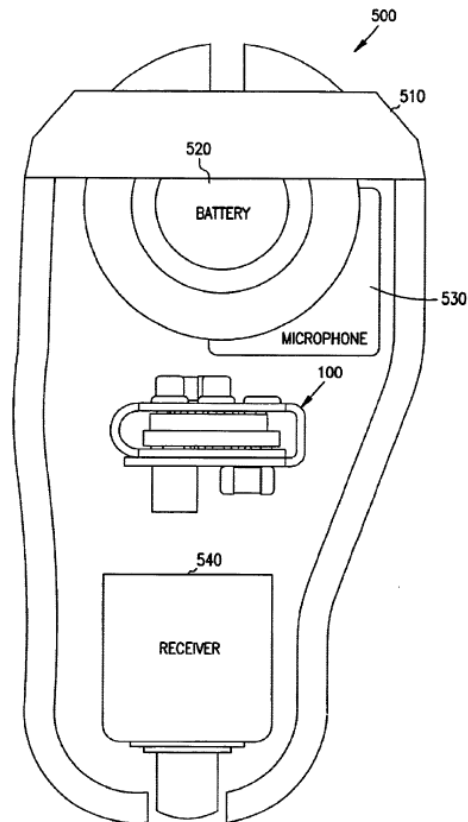


FIG. 5

(EX1013, 4:15-22, FIG. 5; EX1003, ¶243.)

The flex circuit includes a flexible base material and can be folded, permitting it to efficiently occupy a small housing. (EX1013, 2:44-61; EX1003, ¶244.)

B. Motivation to Combine with Reasonable Expectation of Success

The POSITA would have been motivated to combine the teachings of Anderson and Paczkowski. (EX1003, ¶245.) Anderson describes earpiece embodiments, including binaural embodiments in which each of two earpieces includes an integrated circuit (*i.e.*, ASIC 845); but does not include details how the

earpiece circuitry would be manufactured or made to fit in a head-worn enclosure. (EX1004, 12:38-46, 23:36-39, FIG. 8; EX1003, ¶245.) The POSITA would thus have been motivated to combine Anderson with Paczkowski, which describes circuitry fabrication details for hearing aid circuitry analogous to those of Anderson. (EX1003, ¶245.) The POSITA would have found Paczkowski particularly relevant because it addresses needs specific to hearing aids, including their small size, and is compatible with integrated circuits such as used in Anderson. (EX1013, 1:30-41; EX1003, ¶245.) The POSITA would have combined Anderson's head-worn earpiece with Paczkowski's teachings of flex circuits, in order to realize Paczkowski's advantages of low cost and space efficiency. (EX1013, 1:30-41; EX1003, ¶245.)

The POSITA would have had a reasonable expectation of success in making the combination. (EX1003, ¶246.) Anderson and Paczkowski are directed to analogous devices (hearing aids) that include analogous and conventional electronic components, such as integrated circuits, batteries, and microphones; and Paczkowski couples and mounts these components using "conventional" methods. (EX1004, 12:38-46, FIG. 8; EX1013, 3:17-21, 3:41-47; EX1003, ¶246.) Anderson provides a circuit diagram (FIG. 8) for the earpiece, including by identifying specific components and connections; in view of this guidance, the POSITA thus would have found it a predictable endeavor to implement the earpiece circuit using

Paczkowski's circuit board teachings, especially given their conventional nature. (EX1004, 12:38-46, FIG. 8; EX1003, ¶246.)

C. Claim 31

1. [Preamble]

See claim 24. (EX1003, ¶247.)

2. [A]

Anderson discloses binaural embodiments in which the head-worn device includes left and right earpieces. (EX1004, 23:36-39, FIG. 2; EX1003, ¶248.) Each earpiece of the device includes an application-specific integrated circuit (ASIC) 845 to control the earpiece functions. (EX1004, 12:38-46, FIG. 8; EX1003, ¶248.)

Paczkowski teaches that in a hearing aid earpiece, integrated circuits such as the two ASICs 845 can be mounted to a flexible circuit. (EX1013, 4:15-22, FIG. 5; EX1003, ¶249.) The POSITA would have combined Anderson and Paczkowski to implement Anderson's earpiece circuits (*e.g.*, as in FIG. 8) using Paczkowski's flexible circuits as described in Section IX.B. (EX1004, FIG. 8; EX1003, ¶249.) For example, each of the left and right earpieces would include a respective flexible circuit to which a respective ASIC 845 is mounted. (EX1003, ¶249.)

The POSITA would have understood each flexible circuit to include a circuit board; Paczkowski discloses that all of the components mounted to the flexible

circuit can be integrated into circuit boards. (EX1013, 3:52-56; EX1003, ¶250.)

Additionally, the POSITA would understand the flexible circuit itself to be a type of circuit board: for example, FIG. 1 depicts flexible circuit 110 as a circuit board to which electrical components 120 are mounted:

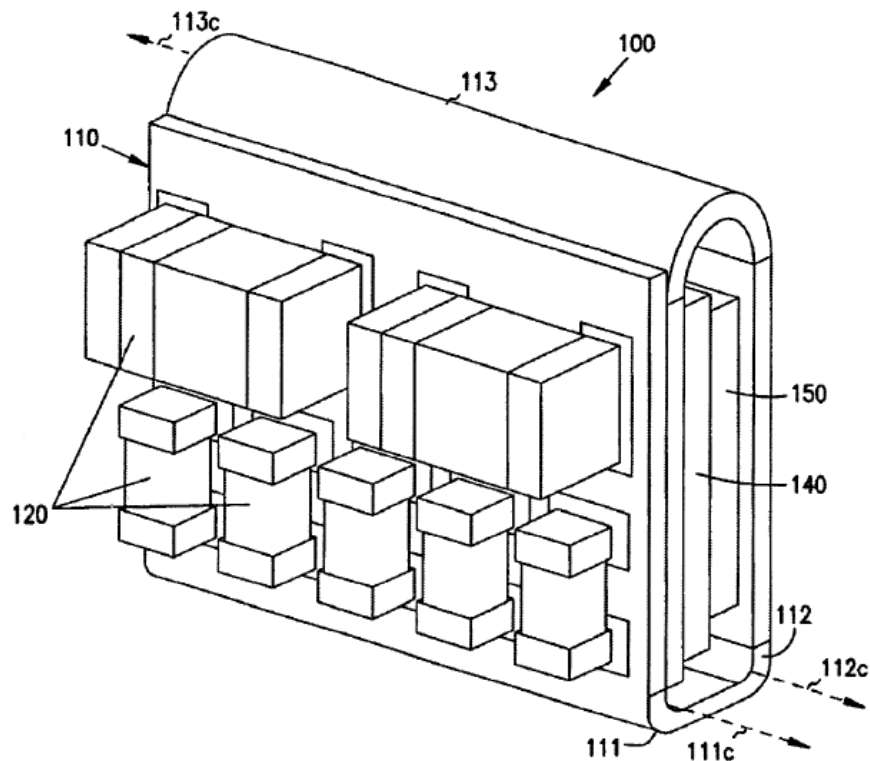


FIG. 1

(EX1013, 2:29-43, FIG. 1; EX1003, ¶250.)

D. Claim 32

1. [Preamble]

See claim 31. (EX1003, ¶251.)

2. [A]

See claim 31[A]. (EX1003, ¶252.)

E. Claim 43

1. [Preamble]

See claim 42. (EX1003, ¶253.)

2. [A]

See claim 31[A]. (EX1003, ¶254.)

3. [B]

Paczkowski discloses that a flexible circuit can include two integrated circuits. (EX1013, 4:20-22; EX1003, ¶255.) In combination with Anderson, the flexible circuit would implement Anderson's earpiece circuit (FIG. 8) as described for claim 31[A], with the circuit components attached to a circuit board of the flexible circuit. (EX1004, FIG. 8; EX1003, ¶255.)

The POSITA would understand those components to include at least two integrated circuits as described for claim 31[A]. (EX1003, ¶256.) The POSITA would understand that in Anderson's earpiece circuit, in addition to ASIC 845, components such as the video amplifier 810 and video pulse quantizer 815 could be preferably implemented as integrated circuits. (EX1003, ¶256.) For example, these components are described in a reference document as including RAM, microprocessors, and A/D converters, which were typically packaged as integrated

circuits. (EX1004, 12:6-13; EX1023; EX1024, 213-217; EX1003, ¶256.)

4. [C]

See element [B]. (EX1003, ¶257.) In the earpiece circuit diagram (FIG. 8), at least ASIC 845 is electrically connected to other electronic components in the circuit, such as a storage 870 and a 4-bit A/D converter 865:

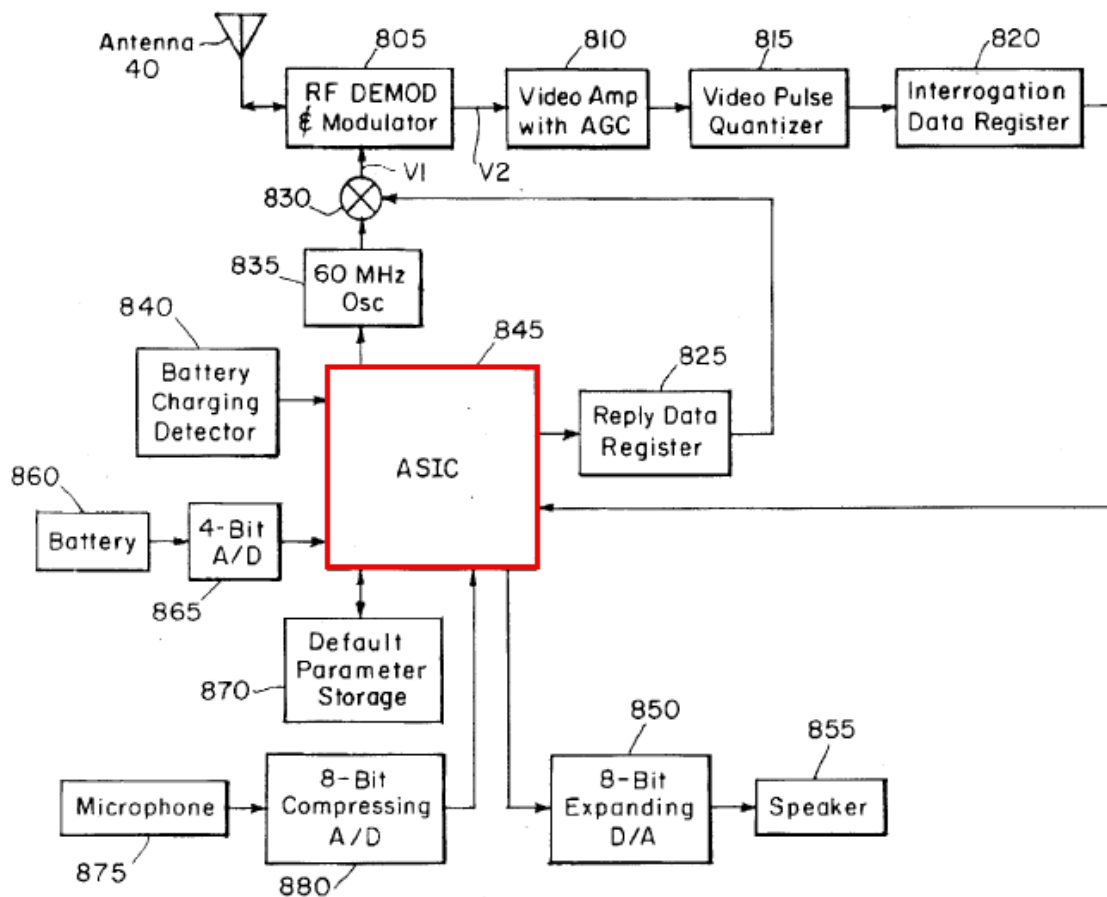


FIG. 8

(EX1004, 12:38-46, FIG. 8 (annotated); EX1003, ¶257.)

F. Claim 44**1. [Preamble]**

See claim 43. (EX1003, ¶258.)

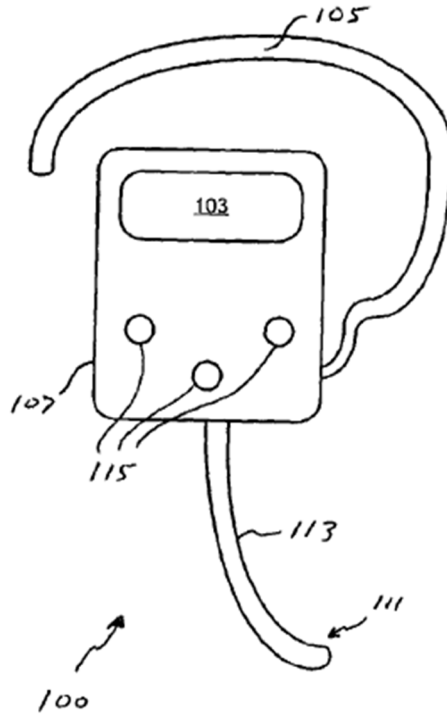
2. [A]

See claim 43[B]. (EX1003, ¶259.)

X. GROUND 6: CLAIMS 33-35 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF BODLEY**A. Summary of Bodley**

Bodley is a U.S. Patent that was filed on January 15, 2003, published on July 15, 2004, and issued on November 17, 2009. (EX1009.) Bodley is thus prior art to the '693 patent under at least 35 U.S.C. §§102(a) and (e). Bodley was not cited during prosecution.

Bodley discloses a headset for wireless communication that includes an earpiece, a microphone, a speaker, and an integral display. (EX1009, 1:47-57, 2:38-50; EX1003, ¶261.) Bodley's headset attaches to the user using "any of a variety of means," including a headband for head support. (EX1009, 2:38-40; EX1003, ¶261.) FIG. 1 illustrates an ear-worn embodiment:



(EX1009, FIG. 1; EX1003, ¶261.)

The headset preferably connects to a “communications system” “that enables both voice and hearing data transfer,” such as a cell phone. (EX1009, 2:28-37; EX1003, ¶262.) The body of the headset houses electronic components, and includes a touch sensitive display for presenting information (such as battery level) and receiving touch input (such as for entering phone numbers or operating the cell phone). (EX1009, 2:44-46, 2:65-67, 3:5-43; EX1003, ¶262.)

Bodley is analogous art to the '693 patent because it is directed to the same field of endeavor: wearable devices with electrical components, including those that provide audio output. (EX1001, Abstract, 2:66-3:9; EX1009, Abstract, 1:47-67, 2:28-50; EX1003, ¶263.) For example, Bodley relates to wearable headsets in

which audio signals are presented to a user—analogous to the wearable audio devices of the '693 patent. (*See* EX1001, 2:66-3:22; EX1009, 2:28-50; EX1003, ¶263.) Similarly, by disclosing devices with electrical components to configure audio operation (*e.g.*, headset volume, voice dialing, ring mode), Bodley is reasonably pertinent to a problem faced by the '693 patent inventors—using wearable devices with electrical components to “facilitate audio support.” (EX1001, 2:66-3:9; EX1009, 1:47-67; EX1003, ¶263.)

B. Motivation to Combine with Reasonable Expectation of Success

The POSITA would have been motivated to combine the teachings of Bodley with those of Anderson. (EX1003, ¶264.) Anderson discloses that the RPU includes pushbuttons (*e.g.*, a keyboard) for data entry and parameter control, and may also support voice input for functions such as dialing telephone numbers. (EX1004, 2:51-55, 20:52-21:30, 25:15-29, FIG. 7; EX1003, ¶264.) However, a POSITA would have recognized drawbacks to both approaches; pushbuttons and keyboards rely on moving parts prone to failure and require force and fine motor control, which may be difficult for users with impairments, particularly given the device’s small size. (EX1003, ¶264.) Voice control likewise is limited, as Anderson discloses only “limited-vocabulary” commands. (EX1004, 25:22-34; EX1003, ¶264.) It also requires the user to speak, making it unsuitable for covert operation, noisy environments, or users with speech impairments. (EX1004, 1:10-

18, 20:48-60; EX1003, ¶264.)

A POSITA would have been motivated to address these usability issues by combining Anderson with Bodley's touch input teachings for wearable audio devices. (EX1003, ¶265.) For example, integrating Bodley's touch sensitive sensor into the earpiece, as taught by Bodley, would eliminate moving parts, improving reliability and durability—particularly for hearing aid devices used daily in varied environments. (EX1009, FIG. 1; EX1003, ¶265.) Touch controls also enable low-force input and are suitable for noisy or covert operation. (EX1003, ¶265.)

The POSITA would have had a reasonable expectation of success in making the combination. (EX1003, ¶266.) Anderson and Bodley disclose structurally and functionally similar head-worn audio devices that use analogous and well-understood components (*e.g.*, microphones, speakers, wireless transceivers, and control circuitry), making their teachings readily combinable. (EX1004, FIG. 1, FIG. 2; EX1009, 1:47-67, 2:38-50, 3:44-4:3, FIG. 1, FIG. 9; EX1003, ¶266.) Because Anderson already provides user controls (*e.g.*, dialing) for the earpiece, using Bodley's known touch interface to perform similar functions would have been straightforward, applying known components and techniques to yield predictable results. (EX1003, ¶266.)

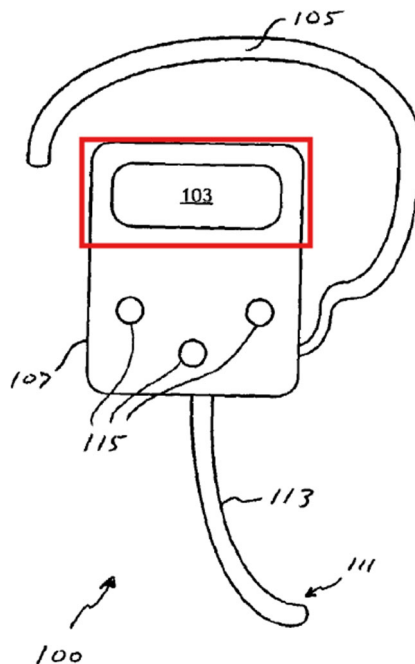
C. Claim 33

1. [Preamble]

See claim 24. (EX1003, ¶267.)

2. [A]

Bodley discloses a headset 100 that includes a “touch sensitive” display panel 103 for data input, as shown in FIG. 1:



(EX1009, FIG. 1 (annotated), 2:28-3:23; EX1003, ¶268.)

The POSITA would have incorporated Bodley’s touch-sensor teachings into the Anderson headset, such that the head-worn earpiece includes a touch sensitive surface for controlling the hearing aid. (EX1003, ¶269.) Although Bodley describes the touch sensor as part of a display, a POSITA would have understood that the touch sensitive surface could be implemented with or without a display,

while retaining the same advantages. (EX1003, ¶269.)

D. Claim 34

1. [Preamble]

See claim 33. (EX1003, ¶270.)

2. [A]

In the combination of Bodley with Anderson, the POSITA would have understood the touch sensitive surface to provide at least the input functionality of Anderson's pushbuttons and/or voice control. (EX1003, ¶271.) For example, the touch sensitive surface would be used to control parameter settings such as volume, or to perform operations such as telephone dialing, as disclosed by Anderson, thereby altering operation of the head-worn device. (EX1004, 20:52-55, 25:15-29; EX1003, ¶271.) These operations are consistent with behavior of the touch display in Bodley, *i.e.*, adjusting headset volume or dialing a telephone. (EX1009, 3:15-20; EX1003, ¶271.)

E. Claim 35

1. [Preamble]

See claim 34. (EX1003, ¶272.)

2. [A]

See claim 24[A] and [E]. (EX1003, ¶273.)

3. [B]

See claim 34[A]. (EX1003, ¶274.) For example, the touch sensitive surface

would be used to control volume settings, such as headset volume. (EX1004, 20:52-55, 25:15-29; EX1009, 3:15-20; EX1003, ¶274.)

XI. GROUND 7: CLAIMS 45-48 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF BODLEY AND ZADESKY

A. Summary of Zadesky

Zadesky is a U.S. Patent that was filed on July 1, 2002, published on April 24, 2003, and issued on May 16, 2006. (EX1010.) Zadesky is thus prior art to the '693 patent under at least 35 U.S.C. §§102(a), (b), and (e). Zadesky was not cited during prosecution.

Zadesky describes that a portable audio device can include a touch sensitive surface (touchpad) for receiving user touch input. (EX1010, 1:47-3:22; EX1003, ¶276.) The touchpad can control the media player based on a sliding input from the user, as shown in FIG. 3C:

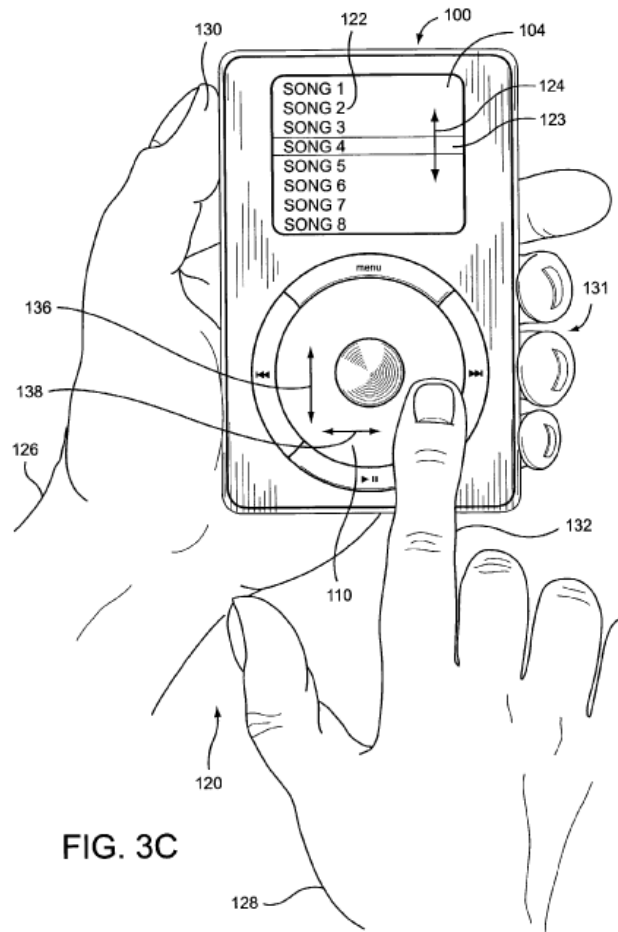


FIG. 3C

(EX1010, FIG. 3C; EX1003, ¶276.)

Zadesky is analogous art to the '693 patent because it is directed to the same field of endeavor: portable devices with electrical components, including those that provide audio output. (EX1001, Abstract, 2:66-3:9; EX1010, 3:38-4:3; EX1003, ¶277.) For example, Zadesky discloses a handheld media player in which audio is presented to a user—analogue to the audio devices of the '693 patent. (See EX1001, 2:66-3:22; EX1010, 3:38-46, 4:60-5:26; EX1003, ¶277.) Similarly, by disclosing that such handheld devices include electrical components (*e.g.*,

touchpads) for providing audio control functions (*e.g.*, volume), Zadesky is reasonably pertinent to a problem faced by the '693 patent inventors—using wearable devices with electrical components to “facilitate audio support.” (EX1001, 2:66-3:9; EX1010, 10:34-51; EX1003, ¶277.)

B. Motivation to Combine with Reasonable Expectation of Success

The POSITA would have been motivated to combine the teachings of Anderson and Bodley with Zadesky with a reasonable expectation of success. (EX1003, ¶278.) As discussed above, the combined Anderson-Bodley system includes a headset with a touch sensitive surface for controlling earpiece functions. (EX1003, ¶278.) However, those references do not detail how a user interacts with the touch surface, motivating a POSITA to look to Zadesky to supply these details. (EX1003, ¶278.) Zadesky teaches touchpad input techniques that “facilitate user interaction” with audio devices, and provide “numerous” advantages such as ease and speed of use, accessibility, and ergonomics. (EX1010, 3:26-37, 4:37-40, 5:61-6:8, 13:36-60; EX1003, ¶278.)

Zadesky further discloses using sliding input on a touch surface to control functions such as volume. (EX1010, 10:40-51; EX1003, ¶279.) The POSITA would have incorporated such sliding input to achieve faster, more intuitive, and ergonomic control—particularly beneficial in wearable devices, such as in Anderson and Bodley, where the user may be unable to see the interface (*e.g.*, if

worn on the user’s head). (EX1003, ¶279.)

Zadesky also emphasizes applicability to a wide range of portable audio devices, compatibility with “widely varied” types of touchpads, and implementation using common components (e.g., processors and memory), consistent with Anderson and Bodley. (EX1010, 5:27-45, 6:4-8, 13:61-14:20; EX1003, ¶280.) Thus, combining Zadesky would have required only modifying the existing touch surface to recognize sliding input, as taught by Zadesky—a straightforward and predictable change supporting a reasonable expectation of success. (EX1003, ¶280.)

C. Claim 45

1. [Preamble]

See claim 42. (EX1003, ¶281.)

2. [A]

Zadesky’s portable media player device includes a touchpad 110 configured to “receive input from a finger moving across the surface of the touch pad 110” and control the media player accordingly, *e.g.*, by scrolling through a list of media files on the player, or “vary[ing] a characteristic of the media player,” such as changing the volume. (EX1010, 5:61-6:8, 10:40-51; EX1003, ¶282.) The POSITA would have understood Zadesky’s “finger moving across the surface” to disclose a sliding action. (EX1003, ¶282.)

Zadesky's touch input sensing is based on "capacitive sensing." (EX1010, 2:29-34; EX1003, ¶283.) Such capacitive touchpads were in "popular" use as input devices by the priority date. (EX1025, 5, 138; EX1003, ¶283.) The POSITA would have understood the touch surface (a user input device) to be based on a capacitive effect in that it receives the user touch input, which induces a capacitive change and produces an electrical response (*i.e.*, output signals provided to the RPU). (*See* EX1025, 1, 5, 138-139; EX1003, ¶283.)

D. Claim 46

1. [Preamble]

See claim 45. (EX1003, ¶284.)

2. [A]

See claim 45[A]. (EX1003, ¶285.) Zadesky teaches distinguishing a direction of the user input with respect to the touch sensitive surface; for example, the "direction that the finger moves may be arranged to control the direction of scrolling," *i.e.*, by moving "vertically up when the finger is moved in a first direction and vertically down when the finger is moved in a second direction." (EX1010, 6:38-59; EX1003, ¶285.)

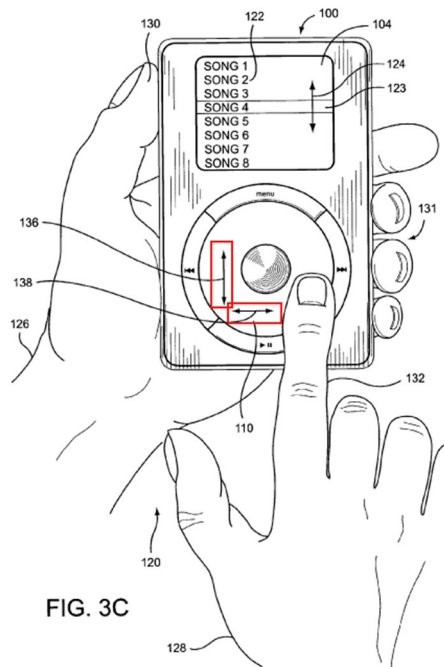
E. Claim 47

1. [Preamble]

See claim 46. (EX1003, ¶286.)

2. [A]

See claim 45[A]. (EX1003, ¶287.) As shown in FIG. 3C below, a user can “*slide* his or her finger 132 substantially tangentially from all sides of the touch pad,” such that the touchpad is “actuated forwards and backwards as shown by arrows 136 and side to side by arrows 138.” (EX1010, 9:17-21 (emphasis added); EX1003, ¶287.)



(EX1010, FIG. 3C (annotated); EX1003, ¶287.)

F. Claim 48

1. [Preamble]

See claim 45. (EX1003, ¶288.)

2. [A]

See claim 47[A]. (EX1003, ¶289.)

**XII. GROUND 8: CLAIM 49 IS RENDERED OBVIOUS BY ANDERSON
IN VIEW OF BODLEY, ZADESKY, AND PACZKOWSKI**

A. Claim 49

1. [Preamble]

See claim 48. (EX1003, ¶290.)

2. [A]

See claim 31[A]. (EX1003, ¶291.)

3. [B]

See claim 43[B]. (EX1003, ¶292.) As described for claim 43[B], in the combination, a first earpiece of the head-worn device implements Anderson's earpiece circuit using a first circuit board with first and second integrated circuits. (EX1003, ¶292.) In binaural embodiments of a head-worn device featuring left and right earpieces, the second earpiece would implement its respective earpiece circuit using a second circuit board with third and fourth integrated circuits, such as described for claim 31[A]. (EX1004, 12:38-46, FIG. 8; EX1003, ¶292.)

4. [C]

See element [B]; at least the ASIC 845 of the second circuit board is electrically connected to another electronic component as described for claim 43[C]. (EX1003, ¶293.)

5. *Motivation to Combine*

The POSITA would have been motivated to combine the teachings of

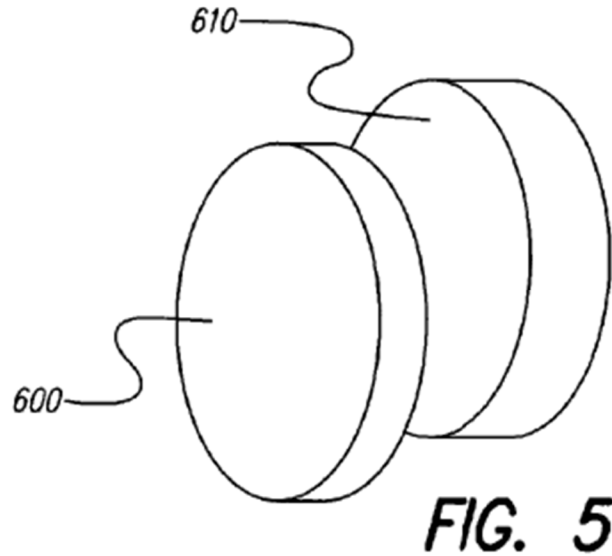
Anderson, Bodley, Zadesky, and Paczkowski as described in Sections X.B, XI.B, and IX.B. (EX1003, ¶294.)

XIII. GROUND 9: CLAIM 51 IS RENDERED OBVIOUS BY ANDERSON IN VIEW OF LYNCH AND PACZKOWSKI

A. Summary of Lynch

Lynch is a U.S. Patent that was filed on April 14, 2004 and issued on October 6, 2009. (EX1011.) Lynch is thus prior art to the '693 patent under at least 35 U.S.C. §§102(a) and (e). Lynch was not cited during prosecution.

Lynch discloses a wireless assistive listening device cap (“ALD Cap”) for a hearing aid device. (EX1011, 1:61-2:23; EX1003, ¶296.) The ALD Cap includes electronics that supplement or replace hearing aid components and is compatible with various hearing aid types, including head-mounted devices with or without BTE units. (EX1011, 1:61-2:23, 3:1-4; EX1003, ¶296.) The ALD Cap improves the comfort, ergonomics, and aesthetics of the hearing aid by fastening electronic components of the hearing aid to the top of the user’s head. (EX1011, 1:17-57, 2:20-23; EX1003, ¶296.) The ALD Cap is attached on top of head-mounted components of a hearing aid system, *e.g.*, via a magnet; and can communicate wirelessly with those components. (EX1011, 2:63-66, 3:5-12, 3:34-44; EX1003, ¶296.) FIG. 5 illustrates an ALD Cap 600 connected to an external component 610 of a hearing aid system:



(EX1011, 4:37-41, FIG. 5; EX1003, ¶296.)

Lynch is analogous art to the '693 patent because it is directed to the same field of endeavor: wearable devices with electrical components, including devices that provide audio output. (EX1001, Abstract, 2:66-3:9; EX1011, Abstract, 1:10-2:23; EX1003, ¶297.) For example, Lynch relates to head-wearable hearing aid systems in which audio signals are presented to a user—analogue to the head-wearable audio devices of the '693 patent. (See EX1001, 2:66-9:62; EX1011, 1:61-2:23; EX1003, ¶297.) Similarly, by disclosing wearable systems that “provide[] access to assistive listening technology,” Lynch is reasonably pertinent to a problem faced by the '693 patent inventors—using wearable devices to provide users with “enhanced hearing.” (EX1001, 2:66-3:9; EX1011, 2:20-23; EX1003, ¶297.)

B. Motivation to Combine Anderson and Lynch with Reasonable Expectation of Success

A POSITA would have been motivated to combine the teachings of Anderson and Lynch. (EX1003, ¶298.) In Anderson’s hearing aid, the earpiece wirelessly communicates with an RPU worn or carried by the user (*e.g.*, in a pocket), enabling reduced size and power consumption in the earpiece. (EX1004, 1:51-2:4, 4:4-7; EX1003, ¶298.) Anderson acknowledges the RPU may be small and “easily misplaced,” and addresses this problem by entering a limited stand-alone mode while the RPU is located. (EX1004, 21:31-22:2; EX1003, ¶298.)

This solution is suboptimal because remote processing and communication features are unavailable, and only default parameters are used. (EX1004, 21:57-62; EX1003, ¶299.) A POSITA would have sought to reduce the risk of misplacing the RPU without sacrificing its size or wireless advantages. (EX1003, ¶299.) Lynch provides such a solution by mounting hearing aid electronics on the user’s head via an ALD Cap, thereby minimizing separation between components and improving comfort, ergonomics, and aesthetics. (EX1011, 1:61-2:23; EX1003, ¶299.)

Lynch expressly contemplates use with head-worn hearing aids and emphasizes providing assistive listening functionality without undesirable ear-worn components. (EX1011, 1:61-2:23; EX1003, ¶300.) Further, Anderson broadly discloses that the RPU may be “carried on” the user without specifying

location, making head mounting an obvious option among a finite set of locations. (EX1004, 6:1-3; EX1003, ¶300.) Using Lynch’s ALD Cap to mount the RPU would preserve Anderson’s advantages, including wireless operation and “complete freedom of movement” while the hearing aid is worn. (EX1004, 2:32-35; EX1003, ¶300.)

The POSITA would have had a reasonable expectation of success. (EX1003, ¶301.) Lynch’s ALD Cap is designed to integrate with various hearing aids, including head-mounted hearing aids that do not use BTE components—the same type of hearing aid (*e.g.*, featuring headset 21) disclosed in Anderson. (EX1011, 2:15-23; EX1003, ¶301.) Anderson further teaches that many system variations and RPU implementations are possible using “well known” components. (EX1004, 12:48-49; EX1003, ¶301.) Additionally, Anderson’s RPU may be small and have a “wide variety of form factors,” suggesting that it could be flexibly and easily repositioned. (EX1004, 20:48-52, 21:31-34; EX1003, ¶301.) These disclosures indicate that adapting Anderson’s RPU in view of Lynch would have been a predictable modification. (EX1003, ¶301.)

C. Claim 51

1. [Preamble]

See claim 42. (EX1003, ¶302.)

2. [A]

As described above, in the combination of Anderson and Lynch, the RPU would be located in the ALD Cap of the head-worn structure. (EX1003, ¶303.) Anderson discloses that the RPU includes multiple integrated circuits, such as the Motorola DSP56L002 digital signal processor, as well as various other electronic components as shown in FIG. 9. (EX1004, 12:48-53, FIG. 9; EX1003, ¶303.) Paczkowski teaches that in hearing aid systems such as the Anderson/Lynch combination, integrated circuits can be attached to a circuit board, for stability (“circuit-bearing substrate”) and to form specific functions (*e.g.*, the specific functions of the RPU). (EX1013, 3:52-56; EX1003, ¶303.) The POSITA would have incorporated these teachings and used a circuit board in the RPU as a substrate to attach the integrated circuits and other electrical components. (EX1003, ¶303.)

The POSITA would have combined the Anderson/Lynch head-worn structure with Paczkowski, with a reasonable expectation of success, for the reasons described in Section IX.B; *e.g.*, to provide manufacturing details omitted for Anderson’s RPU, and to benefit from circuit manufacturing techniques suitable for compact hearing aid systems. (EX1003, ¶304.) Similarly, the POSITA would have understood such circuit boards to be a “reliable fabrication technique,” and “routinely used” in applications such as medical devices, where “high reliability is

essential,” further motivating the successful combination. (EX1026, 830; EX1003, ¶304.)

3. [B]

See element [A]. (EX1003, ¶305.)

4. [C]

In Anderson, an auxiliary microphone of the RPU measures background noise “for the purpose of automatically setting hearing aid parameters”. (EX1004, 7:10-13; EX1003, ¶306.) The POSITA would have understood this to include the RPU determining an ambient sound level (a background noise level) and setting the parameters based on that level. (EX1003, ¶306.)

5. [D]

See element [C]. (EX1003, ¶307.) One such hearing aid parameter, set by the RPU based on the ambient sound level, is the amplification level. (EX1004, 23:26-35; EX1003, ¶307.)

XIV. GROUND 10: CLAIMS 64-71 ARE RENDERED OBVIOUS BY ANDERSON IN VIEW OF LYNCH AND NEMIROVSKI

A. Motivation to Combine

The POSITA would have been motivated to combine the Anderson/Lynch system with Nemirovski with a reasonable expectation of success for the reasons described in Section VI.B. (EX1003, ¶308.)

B. Claim 64**1. [Preamble]**

See claim 24. (EX1003, ¶309.)

2. [A]

The head-worn device includes the RPU (processing unit) as described for claim 51[A]. (EX1003, ¶310.) It additionally includes internal and external microphones as described for claim 50[A] and [B] and a speaker as described for claim 24[A]. (EX1003, ¶310.)

3. [B]

See claim 50[A]. (EX1003, ¶311.)

4. [C]

See claim 50[B]. (EX1003, ¶312.)

5. [D]

See claim 12[A]. (EX1003, ¶313.) In the combination, the POSITA would understand subtracting the noise component to be performed by Anderson's RPU, which is the component that performs noise cancellation operations in binaural systems. (EX1004, 23:55-24:4; EX1003, ¶313.)

C. Claim 65**1. [Preamble]**

See claim 64. (EX1003, ¶314.)

2. [A]

See claim 12[A], *i.e.*, sound component S. (EX1005, 10:28-47; EX1003, ¶315.)

3. [B]

See claim 12[A], *i.e.*, noise component N. (EX1005, 10:28-47; EX1003, ¶316.)

D. Claim 66

1. [Preamble]

See claim 64. (EX1003, ¶317.)

2. [A]

See claim 12[A]; the operation is performed by the RPU as described for claim 64[D]. (EX1003, ¶318.)

E. Claim 67

1. [Preamble]

See claim 64. (EX1003, ¶319.)

2. [A]

See claim 50[A]. (EX1003, ¶320.)

3. [B]

See claim 50[B]. (EX1003, ¶321.) The external microphone can be disposed in a recess of the housing 30 and thus at least partially in the head-worn structure. (EX1005, 9:32-35; EX1003, ¶321.)

F. Claim 68**1. [Preamble]**

See claim 67. (EX1003, ¶322.)

2. [A]

See claim 66[A]. (EX1003, ¶323.)

G. Claim 69**1. [Preamble]**

See claim 68. (EX1003, ¶324.)

2. [A]

See claim 65[A]. (EX1003, ¶325.)

3. [B]

See claim 65[B]. (EX1003, ¶326.)

H. Claim 70**1. [Preamble]**

See claim 24. (EX1003, ¶327.)

2. [A]

See claim 64[A]. (EX1003, ¶328.)

3. [B]

See claim 50[A] and [B]. (EX1003, ¶329.)

4. [C]

See claim 64[D]. (EX1003, ¶330.)

5. [D]

See claim 12[A]. (EX1003, ¶331.) Anderson teaches using the RPU to set the amplification level based on an ambient sound level, as described for claim 51[C] and [D]. (EX1004, 7:10-13, 23:26-35; EX1003, ¶331.) The POSITA would have understood that the environmental sound level is an ambient sound level and is determined as described for claim 12[A]. (EX1003, ¶331.) Further, the POSITA would have understood the amplification level to amplify at least the sound component S, which is picked up by the first microphone and isolated as described for claim 12[A]. (EX1003, ¶331.)

I. Claim 71**1. [Preamble]**

See claim 24. (EX1003, ¶332.)

2. [A]

See claim 70[A]. (EX1003, ¶333.)

3. [B]

See claim 70[B]. (EX1003, ¶334.)

4. [C]

See claim 70[C]. (EX1003, ¶335.)

5. [D]

See claim 70[D]. (EX1003, ¶336.)

XV. NOTICES AND STATEMENTS

Pursuant to 37 C.F.R. § 42.8(b)(1), Apple Inc. is the real party-in-interest for Petitioner.

Pursuant to 37 C.F.R. § 42.8(b)(2), Petitioner identifies the following related matters. The '693 Patent is asserted in the following litigation matter: *IngenioSpec, LLC v. Apple, Inc.*, Case No. 1:25-cv-00867 (W.D. Tex.).

Additionally, Petitioner files this Petition concurrently with another petition (IPR2026-00340) challenging the '693 patent.

Pursuant to 37 C.F.R. § 42.8(b)(3), Petitioner identifies the following counsel (and a power of attorney accompanies this Petition).

Lead Counsel	Backup Counsel
Alex S. Yap Registration No.: 60,609 MORRISON & FOERSTER LLP 707 Wilshire Boulevard, Suite 6000 Los Angeles, CA 90017 Tel: (213) 892-5688 Fax: (213) 892-5454 Email: AYap@mofo.com	Mehran Arjomand Registration No.: 48,231 MORRISON & FOERSTER LLP 707 Wilshire Boulevard, Suite 6000 Los Angeles, CA 90017 Tel: (213) 892-5630 Fax: (213) 892-5454 Email: MArjomand@mofo.com
Backup Counsel	
Bryan Blumenkopf Registration No.: 73,282 MORRISON & FOERSTER LLP 12531 High Bluff Drive, Suite 200 San Diego, CA 92130 Tel: (213) 892-5269 Fax: (213) 892-5454 Email: BBlumen@mofo.com	

Pursuant to 37 C.F.R. § 42.8(b)(4), service information for lead and back-up counsel is provided above. Petitioner consents to electronic service by email to Apple-IngenioSpec-IPR@mofo.com.

Pursuant to 37 C.F.R. § 42.104(a), Petitioner certifies that the '693 patent is available for *inter partes* review and that Petitioner is not barred or estopped from requesting an *inter partes* review challenging the patent claims on the grounds identified in this Petition.

XVI. CONCLUSION

Petitioner requests that the Board initiate *inter partes* review and cancel all challenged claims of the '693 Patent.

The USPTO is authorized to charge any required fees, including the fee as set forth in 37 C.F.R. § 42.15(a) and any excess claim fees, to Deposit Account No. **03-1952** referencing Docket No. **10684-0000910**.

Dated: April 24, 2026

Respectfully submitted,

By /Alex S. Yap/

Alex S. Yap
Registration No.: 60,609
MORRISON & FOERSTER LLP
707 Wilshire Boulevard, Suite 6000
Los Angeles, CA 90017
Tel: (213) 892-5688
Fax: (213) 892-5454
Email: AYap@mofo.com

CLAIMS APPENDIX**Claim 1**

[Preamble] *A personal audio system operable to at least generate customized audio output, comprising:*

[A] *a pair of ear buds, each configured to be placed in an ear of a user; and*

[B] *a mobile communication device at least for supporting audio output, the mobile communication device configured to store at least a hearing profile associated with the user, the stored hearing profile associated with the user at least characterizes hearing impairment regarding the user's ability to hear,*

[C] *the mobile communication device configured to produce audio output signals customized for the user based on at least the stored hearing profile associated with the user such that the customized audio output signals at least compensate for the hearing impairment regarding the user's ability to hear,*

[D] *the mobile communication device configured to produce the customized audio output signals using at least signal amplification,*

[E] *and the mobile communication device configured to transmit the customized audio output signals to the pair of ear buds,*

[F] *wherein each of the ear buds is configured to receive at least a portion of the customized audio output signals transmitted by the mobile communication device, and*

[G] *wherein each of the ear buds is configured to generate at least a portion of the customized audio output for the user in accordance with at least the portion of the customized audio output signals being received.*

Claim 2

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein the mobile communication device is configured to establish the hearing profile for the user.*

Claim 3

[Preamble] *A personal audio system as recited in claim 2,*

[A] *wherein the hearing profile for the user is established by the mobile communication device at least via generating audio tones and outputting such to one or more of the ear buds and receiving a user indication corresponding to the user's ability to hear the generated audio tones.*

Claim 4

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein the signal amplification is frequency-dependent amplification.*

Claim 5

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein each of the earbuds includes a speaker, and*

[B] *wherein the at least a portion of the customized audio output being generated by each of the ear buds is generated by the corresponding speaker.*

Claim 6

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein at least one of the earbuds in the pair of earbuds comprises an array of microphones configured for directional audio pickup.*

Claim 7

[Preamble] *A personal audio system as recited in claim 6,*

[A] *wherein direction of the directional audio pickup is in front of the user.*

Claim 8

[Preamble] *A personal audio system as recited in claim 6,*

[A] *wherein direction of the directional audio pickup is outward from the user.*

Claim 9

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein at least one of the earbuds in the pair of earbuds comprises a plurality of microphones configured for audio pickup.*

Claim 10

[Preamble] *A personal audio system as recited in claim 9,*

[A] *wherein the plurality of microphones includes at least: a first microphone configured to receive audio pickup from the user; and*

[B] *a second microphone configured to receive audio pickup outward away from the user.*

Claim 11

[Preamble] *A personal audio system as recited in claim 10,*

[A] *wherein the audio pickup from at least the second microphone is used at least for noise cancelation.*

Claim 12

[Preamble] *A personal audio system as recited in claim 11,*

[A] *wherein at least a portion of the audio pickup from the second microphone is subtracted from the audio pickup from the first microphone.*

Claim 13

[Preamble] *A personal audio system as recited in claim 12,*

[A] *wherein each of the ear buds includes at least a speaker and is configured to generate at least a portion of the customized audio output for the user via the*

speaker.

Claim 14

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein the mobile communication device is or includes a mobile phone.*

Claim 15

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein the customized audio output includes music.*

Claim 16

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein the customized audio output includes a voice conversation.*

Claim 17

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein at least one of the earbuds in the pair of earbuds comprises a plurality of microphones configured for audio pickup,*

[B] *wherein at least one of the microphones is configured to pick up an audio command, and*

[C] *wherein the mobile communication device is configured to induce an operation or action based on the audio command.*

Claim 18

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein the customized audio output signals are produced based on amplifying or attenuating different frequency bands differently according to at least the stored hearing profile.*

Claim 19

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein the hearing profile associated with the user is self-determined by the user.*

Claim 20

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein the mobile communication device includes computing capabilities and a storage device, the storage device storing at least a software program executed by the mobile communication device to enable the user to establish the hearing profile associated with the user, and*

[B] *wherein the mobile communication device is configured to establish the hearing profile associated with the user via the software program executed by the mobile communication device based on the user interacting with the software program via the mobile communication device.*

Claim 21

[Preamble] *A personal audio system as recited in claim 20,*

[A] *wherein the software program at least interactively guides the user to establish the hearing profile for the user.*

Claim 22

[Preamble] *A personal audio system as recited in claim 21,*

[A] *wherein the software program at least interactively guides the user to establish the hearing profile for the user by at least causing various audio tones to be output to the user via at least one of the earbuds, prompting the user to provide a hearing input with respect to one or more of the various audio tones being output, and receiving the hearing user input pertaining to one or more of the various audio tones being output.*

Claim 23

[Preamble] *A personal audio system as recited in claim 1,*

[A] *wherein at least one of the earbuds in the pair of earbuds comprises: a radiation detector configured to capture radiation data; and*

[B] *first electronic circuitry electrically connected to the radiation detector, the first electronic circuitry configured to process at least the radiation data captured by the radiation detector,*

[C] *wherein the first electronic circuitry is configured to determine whether the earbud is being worn by a user based on at least the processed radiation data.*

Claim 24

[Preamble] *A personal audio system operable to at least generate customized audio output, comprising:*

[A] *a head-worn wearable electronic device including at least a pair of speakers, each of the speakers being configured to be wearable proximate to an ear of a user; and*

[B] *a mobile communication device at least for supporting audio output, the mobile communication device configured to store at least a hearing profile associated with the user, the stored hearing profile associated with the user at least characterizes hearing impairment regarding the user's ability to hear,*

[C] *the mobile communication device configured to produce audio output signals customized for the user based on at least the stored hearing profile associated with the user such that the customized audio output signals at least compensate for the hearing impairment regarding the user's ability to hear,*

[D] *the mobile communication device configured to produce the customized audio output signals using at least signal amplification,*

[E] *and the mobile communication device configured to transmit the customized audio output signals to the pair of speakers,*

[F] *wherein each of the speakers is configured to receive at least a portion of the customized audio output signals transmitted by the mobile communication device, and*

[G] wherein each of the speakers is configured to generate at least a portion of the customized audio output for the user in accordance with at least the portion of the customized audio output signals being received.

Claim 25

[Preamble] A personal audio system as recited in claim 24,

[A] wherein the head-worn wearable electronic device includes at least a rechargeable battery, and

[B] wherein the rechargeable battery is able to be charged when the head-worn wearable electronic device is coupled to a docking station.

Claim 26

[Preamble] A personal audio system as recited in claim 24,

[A] wherein the head-worn wearable electronic device includes at least a rechargeable battery and at least one conductive element,

[B] wherein the rechargeable battery is able to be electrically coupled via the at least one conductive element to a charging apparatus and charged when the head-worn wearable electronic device is placed within the charging apparatus, and

[C] wherein the electrical coupling of the at least one conductive element with the charging apparatus is supported by at least a magnetic element.

Claim 27

[Preamble] A personal audio system as recited in claim 24,

[A] wherein the mobile communication device is configured to wirelessly communicate with the head-worn wearable electronic device over a wireless network.

Claim 28

[Preamble] A personal audio system as recited in claim 27,

[A] *wherein the wireless network is a short-range wireless network.*

Claim 29

[Preamble] *A personal audio system as recited in claim 27,*

[A] *wherein the short-range wireless network is a Bluetooth network.*

Claim 30

[Preamble] *A personal audio system as recited in claim 24,*

[A] *wherein the head-worn wearable electronic device includes an accelerometer.*

Claim 31

[Preamble] *A personal audio system as recited in claim 24,*

[A] *wherein the head-worn wearable electronic device includes a plurality of circuit boards, each circuit board including at least one integrated circuit mounted thereto.*

Claim 32

[Preamble] *A personal audio system as recited in claim 31,*

[A] *wherein at least one of the circuit boards is a flexible printed circuit board.*

Claim 33

[Preamble] *A personal audio system as recited in claim 24,*

[A] *wherein the head-worn wearable electronic device includes a touch sensitive surface.*

Claim 34

[Preamble] *A personal audio system as recited in claim 33,*

[A] wherein the touch sensitive surface is configured to detect a user input, the detected user input operating to at least alter operation of the head-worn wearable electronic device.

Claim 35

[Preamble] A personal audio system as recited in claim 34,

[A] wherein the head-worn wearable electronic device is configured to support audio output to the user, and

[B] wherein the at least one operation of the head-worn electronic device being altered concerns control of the audio output being provided to the user.

Claim 36

[Preamble] A personal audio system as recited in claim 24,

[A] wherein the head-worn wearable electronic device includes a force sensor configured to receive a user input based at least on sensing force applied to the force sensor.

Claim 37

[Preamble] A personal audio system as recited in claim 36,

[A] wherein the force sensor is configured to detect the user input, the detected user input operating to alter at least an operation of the head-worn wearable electronic device.

Claim 38

[Preamble] A personal audio system as recited in claim 37,

[A] wherein the head-worn wearable electronic device is configured to support audio output to the user, and

[B] wherein the at least one operation of the head-worn electronic device being altered concerns control of the audio output being provided to the user.

Claim 42

[Preamble] *A personal audio system as recited in claim 24,*

[A] *wherein the head-worn wearable electronic device comprises: a first head-worn structure including at least a first speaker of the pair of speakers, the first speaker being wearable proximate to a first ear of the user; and*

[B] *a second head-worn structure including at least a second speaker of the pair of speakers, the second speaker being wearable proximate to a second ear of the user.*

Claim 43

[Preamble] *A personal audio system as recited in claim 42,*

[A] *wherein the first head-worn structure comprises: a first circuit board internal to the first head-worn structure,*

[B] *the first circuit board supporting at least a first integrated circuit and a second integrated circuit, the first integrated circuit and the second integrated circuit being physically attached to the first circuit board,*

[C] *and the first integrated circuit being electrically connected to the second integrated circuit or another electronic component.*

Claim 44

[Preamble] *A personal audio system as recited in claim 43,*

[A] *wherein the first circuit board is a flexible circuit board.*

Claim 45

[Preamble] *A personal audio system as recited in claim 42,*

[A] *wherein the first head-worn structure comprises: a user input device, the user input device being configured to receive a user input, the user input device is based on at least capacitive effect, wherein the user input being received induces at least a capacitive change to produce at least an electrical response.*

Claim 46

[Preamble] *A personal audio system as recited in claim 45,*

[A] *wherein the user input device is configured to distinguish at least a direction of the user input with respect to the user input device.*

Claim 47

[Preamble] *A personal audio system as recited in claim 46,*

[A] *wherein the user input device is configured to detect at least a sliding of a finger action with respect to the user input device.*

Claim 48

[Preamble] *A personal audio system as recited in claim 45,*

[A] *wherein the user input device is configured to distinguish at least whether the user input pertains to a forward sliding action or a backward sliding action with respect to the user input device.*

Claim 49

[Preamble] *A personal audio system as recited in claim 48,*

[A] *wherein the head-worn wearable electronic device comprises: a second circuit board internal to the second head-worn structure,*

[B] *the second circuit board supporting at least a third integrated circuit and a fourth integrated circuit, the third integrated circuit and the fourth integrated circuit being physically attached to the second circuit board, and*

[C] *the third integrated circuit being electrically connected to the fourth integrated circuit or another electronic component.*

Claim 50

[Preamble] *A personal audio system as recited in claim 42,*

[A] wherein the first head-worn structure of the head-worn wearable electronic device comprises: a first microphone configured to pick up at least audio input from at least the user, the first microphone being at least partially in the first head-worn structure and is positioned to be directed towards the user when the first head-worn structure is being worn by the user; and

[B] a second microphone configured to pick up at least ambient sound input associated with an environment in the vicinity of the first head-worn structure, the second microphone being positioned to be directed away from the user when the head-worn wearable electronic device is being worn by the user.

Claim 51

[Preamble] A personal audio system as recited in claim 42,

[A] wherein the first head-worn structure comprises: a first circuit board internal to the first head-worn structure, the first circuit board supporting at least a first integrated circuit, the first integrated circuit being physically attached to the first circuit board,

[B] wherein the first integrated circuit includes at least a processing unit, and

[C] wherein the processing unit is configured to: determine an ambient sound level; and

[D] amplify audio output from the first speaker dependent at least in part on the ambient sound level.

Claim 52

[Preamble] A personal audio system as recited in claim 42,

[A] wherein the first head-worn structure of the wearable electronic device comprises: a battery internal to the first head-worn structure; and

[B] at least one conductive element that facilitates electrical coupling with the battery, the at least one conductive element is at least partially internal to the first head-worn structure but remains at least partially exposed external to the first head-worn structure, and the at least one conductive element comprises at least one conductive pad,

[C] wherein the battery is able to be electrically coupled via the at least one conductive element to a charging apparatus and charged when at least the first head-worn structure of the head-worn wearable electronic device is placed within the charging apparatus, and

[D] wherein the electrical coupling of the at least one conductive element with the charging apparatus is supported by at least a magnetic element.

Claim 53

[Preamble] A personal audio system as recited in claim 52,

[A] wherein the head-worn wearable electronic device comprises: a microphone at least partially internal to the first head-worn structure,

[B] wherein the head-worn wearable electronic device is configured to receive a voice input via the microphone, determine a requested operation from the voice input using voice recognition, and control an operation by the head-worn wearable electronic device based on the requested operation.

Claim 54

[Preamble] A personal audio system as recited in claim 42,

[A] wherein the first head-worn structure comprises: an infrared emitter configured to at least direct infrared signals towards the user when at least the first head-worn structure of the head-worn wearable electronic device is being worn; and

[B] an infrared detector configured to detect infrared radiation reflected back from the user when at least the first head-worn structure of the head-worn wearable electronic device is being worn.

Claim 55

[Preamble] A personal audio system as recited in claim 54,

[A] wherein electronic circuitry within the first head-worn structure is configured to facilitate determining whether the first head-worn structure is

being worn by the user based on at least the detected infrared radiation.

Claim 56

[Preamble] *A personal audio system as recited in claim 42,*

[A] *wherein the first head-worn structure comprises: a radiation detector configured to capture radiation data; and*

[B] *first electronic circuitry provided within the first head-worn structure and electrically connected to the radiation detector, the first electronic circuitry configured to process at least the radiation data captured by the radiation detector.*

Claim 57

[Preamble] *A personal audio system as recited in claim 56,*

[A] *wherein the first electronic circuitry is configured to determine whether the first head-worn structure is being worn by a user based on at least the processed radiation data.*

Claim 58

[Preamble] *A personal audio system as recited in claim 57,*

[A] *wherein the radiation detector comprises a photodetector.*

Claim 59

[Preamble] *A personal audio system as recited in claim 42,*

[A] *wherein the first head-worn structure comprises first electronic circuitry configured to provide audio alerts to the user via the first speaker.*

Claim 60

[Preamble] *A personal audio system as recited in claim 59,*

[A] wherein the audio alerts are dependent on one or more user preference settings.

Claim 61

[Preamble] A personal audio system as recited in claim 42,

[A] wherein the first head-worn structure of the head-worn wearable electronic device comprises: a first microphone configured to pick up at least audio input from at least the user, the first microphone being at least partially in the first head-worn structure; and

[B] a second microphone configured to pick up at least ambient sound input associated with an environment in the vicinity of the first head-worn structure,

[C] wherein the second microphone is positioned to be further away from mouth of the user than the first microphone when at least the first head-worn structure of the head-worn wearable electronic device is being worn.

Claim 62

[Preamble] A personal audio system as recited in claim 42,

[A] wherein the first head-worn structure comprises: a physical condition sensor configured to acquire data pertaining to a physical condition of the user, the physical condition sensor being provided at least partially internal to the first head-worn structure.

Claim 63

[Preamble] A personal audio system as recited in claim 62,

[A] wherein the acquired data by the physical condition sensor includes data pertaining to or dependent on heart beats of the user.

Claim 64

[Preamble] A personal audio system as recited in claim 24,

[A] wherein the head-worn wearable electronic device comprises: a head-worn structure including at least a first microphone, a second microphone, a speaker and a processing unit;

[B] wherein the first microphone is configured to pick up at least audio input from at least the user,

[C] wherein the second microphone is configured to pick up at least environmental audio input associated with an environment in the vicinity of the head-worn wearable electronic device, and

[D] wherein the processing unit is configured to process the audio input from at least the user via the first microphone to remove at least a portion of the environmental audio input associated with the environment picked up via the second microphone.

Claim 65

[Preamble] A personal audio system as recited in claim 64,

[A] wherein the audio input from at least the user picked-up via the first microphone includes at least a voice input, and

[B] wherein the environmental audio input associated with the environment includes at least ambient noise.

Claim 66

[Preamble] A personal audio system as recited in claim 64,

[A] wherein the processing unit is configured to process the audio input from at least the user picked-up via the first microphone to remove at least a portion of the environmental audio input picked-up via the second microphone.

Claim 67

[Preamble] A personal audio system as recited in claim 64,

[A] wherein the first microphone is at least partially in the head-worn structure and is positioned so as to be directed towards the user of the head-worn structure, and

[B] wherein the second microphone is at least partially in the head-worn structure so as to be directed away from the user of the head-worn structure.

Claim 68

[Preamble] A personal audio system as recited in claim 67,

[A] wherein the processing unit is configured to process the audio input picked-up via at least the first microphone to remove at least a portion of the environmental audio input picked-up via the second microphone.

Claim 69

[Preamble] A personal audio system as recited in claim 68,

[A] wherein the audio input from at least the user includes at least a voice input, and

[B] wherein the environmental audio input includes at least ambient noise.

Claim 70

[Preamble] A personal audio system as recited in claim 24,

[A] wherein the head-worn wearable electronic device comprises: a head-worn structure comprising at least two microphones and a processing unit,

[B] wherein the at least two microphones are configured to pick up (i) at least audio input from at least the user and (ii) at least environmental audio input associated with environmental sound in the vicinity of the head-worn structure, and

[C] wherein the processing unit is configured to: determine an environmental sound level based on at least the environmental audio input; and

[D] amplify at least a portion of the audio input from the first microphone, with the amplification being at least in part dependent on the environmental sound level.

Claim 71

[Preamble] *A personal audio system as recited in claim 24,*

[A] *wherein the head-worn wearable electronic device comprises at least a first microphone, a second microphone and a processing unit,*

[B] *wherein the first microphone is configured to pick up at least audio sound from at least the user, wherein the second microphone is configured to pick up at least ambient noise associated with an environment in the vicinity of the head-worn wearable electronic device, and*

[C] *wherein the processing unit is configured to: determine an ambient noise level based on at least the ambient noise; and*

[D] *modify at least a portion of the audio sound picked-up via the first microphone, with the modification being at least in part dependent on the ambient noise level.*

Claim 72

[Preamble] *A personal audio system as recited in claim 24,*

[A] *wherein the head-worn wearable electronic device comprises at least a first microphone, a second microphone and a processing unit,*

[B] *wherein the first microphone is configured to pick up at least audio sound from at least the user,*

[C] *wherein the second microphone is configured to pick up at least ambient noise associated with an environment in the vicinity of the head-worn wearable electronic device,*

[D] *wherein the processing unit is configured to: determine an ambient noise level based on at least the ambient noise; and*

[E] *modify at least a portion of the audio sound picked-up via the first microphone, with the modification being at least in part dependent on the ambient noise level,*

[F] *wherein the head-worn wearable electronic device comprises at least a rechargeable battery and at least one conductive element,*

[G] *wherein the rechargeable battery is able to be electrically coupled via the at least one conductive element to a charging apparatus and charged when the head-worn wearable electronic device is placed within the charging apparatus,*

[H] *wherein the mobile communication device is configured to wirelessly communicate with the head-worn wearable electronic device over a wireless network, and*

[I] *wherein the mobile communication device is or includes a mobile phone,*

[J] *wherein the head-worn wearable electronic device is configured to receive a voice input via the first microphone, determine a requested operation from the voice input using voice recognition, and control an operation by the head-worn wearable electronic device based on the requested operation.*

Claim 73

[Preamble] *A personal audio system as recited in claim 72,*

[A] *wherein the head-worn wearable electronic device comprises: an infrared emitter configured to at least direct infrared signals towards the user when the head-worn wearable electronic device is being worn;*

[B] *an infrared detector configured to detect infrared radiation reflected back from the user when the head-worn wearable electronic device is being worn; and*

[C] *electronic circuitry configured to facilitate determining whether the head-worn wearable electronic device is being worn by the user based on at least the detected infrared radiation.*

Claim 74

[Preamble] *A personal audio system as recited in claim 73,*

[A] *wherein the electrical coupling of the at least one conductive element with the charging apparatus is supported by at least a magnetic element.*

Claim 75

[Preamble] *A personal audio system operable to at least generate customized audio output, comprising:*

[A] a pair of speakers, each of the speakers being configured to be wearable proximate to an ear of a user; and

[B] a mobile communication device at least for supporting audio output, the mobile communication device configured to store at least a hearing characteristic associated with the user, the stored hearing characteristic associated with the user at least characterizes hearing impairment regarding the user's ability to hear,

[C] the mobile communication device configured to produce customized audio output signals for the user based on at least the stored hearing characteristics associated with the user such that the customized audio output signals at least compensate for the hearing impairment regarding the user's ability to hear,

[D] the mobile communication device configured to produce the customized audio output signals using at least signal amplification, and

[E] the mobile communication device configured to transmit the customized audio output signals to the pair of speakers,

[F] wherein each of the speakers is configured to receive at least a portion of the customized audio output signals transmitted by the mobile communication device, and

[G] wherein each of the speakers is configured to generate at least a portion of the customized audio output for the user in accordance with at least the portion of the customized audio output signals being received.

Claim 76

[Preamble] A personal audio system as recited in claim 75,

[A] wherein each of the speakers being configured to be at least partially inserted into an ear of the user.

Certification of Word Count (37 C.F.R. § 42.24)

I hereby certify that this Petition for *Inter Partes* Review has 13,902 words (as counted by the “Word Count” feature of the Microsoft Word™ word-processing system), exclusive of “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.”

Dated: April 24, 2026

By: /Bryan Blumenkopf/
Bryan Blumenkopf

Certificate of Service (37 C.F.R. § 42.6(e)(4) and 42.205(a))

I hereby certify that the attached Petition for *Inter Partes* Review and supporting materials were served as of the below date via UPS, a means as fast and reliable as Priority Mail Express®, on the Patent Owner at the correspondence address indicated for U.S. Patent No. 11,644,693.

IPVENTURE, INC.
4010 Moorpark Avenue
Suite 211
San Jose, CA 95117

Dated: April 24, 2026

By: /Bryan Blumenkopf/
Bryan Blumenkopf