TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER
080188PCTUS

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US2009/039754	07 April 2009	07 April 2008

TITLE OF INVENTION
WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

APPLICANT(S) FOR DO/EO/US
Michael J. Pelland, Michael J. Koss, Michael Sagan, Steven Reckamp, Greg Hollingstad, Jeff Bovee, Morgan Lowery

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☑ This is a **FIRST** submission of items concerning a submission under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a submission under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☑ The US has been elected (Article 31).
5. ☑ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☑ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☑ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☑ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☑ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☑ A preliminary amendment.
14. ☐ An Application Data Sheet under 37 CFR 1.76.
15. ☐ A substitute specification.
16. ☐ A power of attorney and/or change of address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.3 and 37 CFR 1.821- 1.825.
18. ☐ A second copy of the published International Application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).

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	PCT/US2009/039754	080188PCTUS

20. Other items or information:

The following fees have been submitted	CALCULATIONS	PTO USE ONLY
21. ☑ Basic national fee (37 CFR 1.492(a)) $330	$ 330.00	
22. ☑ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) .... **$0** All other situations **$220**	$ 220.00	
23. ☑ Search fee (37 CFR 1.492(b)) If the written opinion of the ISA/US or the International preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) .... **$0** Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority .... **$100** International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB .... **$430** All other situations **$540**	$ 100.00	
TOTAL OF 21, 22 and 23 =	$650.00	
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)). The fee is **$270** for each additional 50 sheets of paper or fraction thereof.		

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round **up** to a whole number)	RATE	
- 100 =	/50 =		x **$270**	$ -0-

Surcharge of **$130.00** for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).	$ -0-	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$	
Total claims	33 - 20 =	13	x **$ 52**	$ 676.00	
Independent claims	3 - 3 =	-0-	x **$220**	$ -0-	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$390**	$ -0-	
			TOTAL OF ABOVE CALCULATIONS =	$ 1,326.00	
☑ Applicant claims small entity status. See 37 CFR 1.27. Fees above are reduced by ½.					
			SUBTOTAL =	$ 663.00	
Processing fee of **$130.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). +				$ -0-	
			TOTAL NATIONAL FEE =	$ 663.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ -0-	
			TOTAL FEES ENCLOSED =	$ 663.00	
				Amount to be refunded:	$
				Amount to be charged	$

a. ☐ A check in the amount of $ __________ to cover the above fees is enclosed.

b. ☑ Please charge my Deposit Account No. 11-1110 in the amount of $ 663.00 to cover the above fees.

c. ☑ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 11-1110 .

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR**. To protect your information, it is recommended paying fees online by using the electronic payment method.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:

Mark G. Knedeisen, Esquire
K&L Gates LLP
K&L Gates Center
210 Sixth Avenue
Pittsburgh, PA 15222-2613

Customer No. 26285

Mark Kn

SIGNATURE

Mark G. Knedeisen

NAME

42,747

REGISTRATION NUMBER

PTO-1390 (Rev. 09-08)
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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371		ATTORNEY'S DOCKET NUMBER 080188PCTUS U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
INTERNATIONAL APPLICATION NO. PCT/US2009/039754	INTERNATIONAL FILING DATE 07 April 2009	PRIORITY DATE CLAIMED 07 April 2008

TITLE OF INVENTION
WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

APPLICANT(S) FOR DO/EO/US
Michael J. Pelland, Michael J. Koss, Michael Sagan, Steven Reckamp, Greg Hollingstad, Jeff Bovee, Morgan Lowery

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

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Bose Exhibit 1014
Bose v. Koss

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210 Sixth Avenue
Pittsburgh, PA 15222-2613

Customer No. 26285

Mark Kn
SIGNATURE

Mark G. Knedeisen
NAME

42,747
REGISTRATION NUMBER

PATENT

THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Pelland et el.	)	**Examiner:** TBD
		)	
Serial No.:	TBD	)	**Art Unit:** TBD
		)	
Filing Date:	TBD	)	**Atty. Docket No.** 080188PCTUS

Title: WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

PRELIMINARY AMENDMENT

K&L Gates LLP
Pittsburgh, PA 15222
October 5, 2010

Mail Stop PCT
Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Prior to examination and prior to determination of the applicable application filing fees, please amend the above-referenced application as follows, wherein:

Claim Amendments begin on page 2; and

Remarks begin on page 9.

PI-2445241 v1

Amendments to the Claims

Please amend the claims as follows. This listing of claims will replace all prior versions and listing of claims in the application.

1-47. (Canceled)

48. An earphone comprising:

a body, wherein the body comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:

receive digital audio wirelessly from a data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network;

transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; and

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive digital audio via an infrastructure wireless network.

49. The earphone of claim 48, wherein the data source comprises a digital audio player.

50. The earphone of claim 48, wherein the transceiver circuit comprises:

a wireless communication module;
a processor unit in communication with the wireless communication module;
a non-volatile memory unit in communication with the processor unit; and
a volatile memory unit in communication with the processor unit.

51. The earphone of claim 50, wherein the wireless communication module comprises a Wi-Fi communication module.

52. The earphone of claim 48, wherein the infrastructure wireless network comprises a WLAN.

53. The earphone of claim 48, wherein the transceiver circuit is for receiving digital audio from the data source via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

54. The earphone of claim 53, wherein the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

55. The earphone of claim 48, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

56. The earphone of claim 48, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

57. The earphone of claim 56, wherein the earphone is for receiving streaming digital audio from the host server via the infrastructure wireless network.

58. The earphone of claim 56, wherein the earphone is for receiving a first network address for a first streaming digital audio content server from the host server via the infrastructure wireless network.

59. The earphone of claim 58, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

60. The earphone of claim 59, wherein the user control comprises a button.

61. A system comprising:

a data source for wirelessly transmitting streaming digital audio; and

a wireless earphone that comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:

receive the streaming digital audio wirelessly from the data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network;

transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; and

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive streaming digital audio via an infrastructure wireless network.

62. The system of claim 61, wherein the data source comprises a digital audio player.

63. The system of claim 61, further comprising a host server that is in communication with the wireless earphone via the infrastructure wireless network.

64. The system of claim 63, wherein the firmware of the transceiver circuit of the wireless earphone, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to the host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

65. The system of claim 63, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

66. The system of claim 63, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network

67. The system of claim 66, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

68. The earphone of claim 67, wherein the user control comprises a button.

69. The system of claim 64, further comprising a web page for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone.

70. The system of claim 61, wherein the infrastructure wireless network comprises a WLAN.

71. The system of claim 61, wherein the firmware, when executed by the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

72. The system of claim 61, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

73. The system of claim 72, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

74. The system of claim 72, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network

75. The system of claim 74, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

76. The earphone of claim 75, wherein the user control comprises a button.

77. A method comprising:

receiving, by a wireless earphone, via an ad hoc wireless network, digital audio from a data source when the data source is in wireless communication with the earphone via the ad hoc wireless network;

transmitting data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks;

converting, by the wireless earphone, the digital audio to sound; and

when the data source is not in wireless communication with the earphone, transitioning automatically, by the earphone, to receive digital audio via an infrastructure wireless network.

78. The method of claim 77, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from the data source via an infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

79. The method of claim 77, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from a host sever via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network

80. The method of claim 77, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises:

receiving, by the wireless earphone via the infrastructure wireless network, from a host server connected to the infrastructure wireless network, a network address for a streaming digital audio content server; and

connecting, by the wireless earphone, to the streaming digital audio content server using the network address received from the host server.

REMARKS

Claims 1-47 have been canceled and new claims 48-80 have been added. Support for the new claims may be found throughout the application as originally filed.

A representative of the Office is invited to contact the undersigned with any questions regarding this application.

Respectfully submitted,

Date: October 5, 2010

Mark K

Mark G. Knedeisen
Reg. No. 42,747

K&L GATES LLP
K&L Gates Center
210 Sixth Avenue
Pittsburgh, Pennsylvania 15222

Ph. (412) 355-6342
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Pelland et al.	)	**Examiner:** TBD
	)	
Serial No.: TBD	)	**Art Unit:** TBD
	)	
Filing Date: October 5, 2010	)	**Atty. Docket No.** 080188PCTUS

Title : WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

INFORMATION DISCLOSURE STATEMENT

Mail Stop: Amendment
Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicants, in accordance with their duty of disclosure pursuant to 37 C.F.R. § 1.56, hereby advise the United States Patent and Trademark Office of the references listed on the accompanying forms PTO/SB/08A and PTO/SB/08B. Copies of the non-U.S. patent documents, if any, are enclosed.

Applicants note that although the cited references may be relevant to the examination of the above-referenced application, under 37 C.F.R. § 1.97(h), the filing of this *Information Disclosure Statement* "shall not be construed to be an admission that the information cited in the statement is, or is considered to be, material to patentability as defined in § 1.56(b)." Applicants further note that the filing of this *Information Disclosure Statement* is not an admission that the references cited herein constitute prior art under 35 U.S.C. §§ 102-103 with respect to the captioned application.

Applicants submit that no additional fee is necessary for consideration of this *Information Disclosure Statement* under 37 C.F.R. § 1.97(b)(1). Nevertheless, the Office is hereby authorized to charge Account No. 11-1110 for any fees necessary for consideration of this *Information Disclosure Statement*.

Respectfully submitted,

Date: Oct 5, 2010

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210 Sixth Avenue
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Customer No. 26285

Ph. (412) 355-6342
Fax (412) 355-6501

PI-2446334 v1

Substitute for form 1449/PTO	*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	TBD
	Filing Date	October 5, 2010
	First Named Inventor	Pelland et al.
	Art Unit	TBD
(use as many sheets as necessary)	Examiner Name	TBD
Sheet 1 of 3	Attorney Docket Number	080188PCTUS

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number - Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2005/0198233 A1	09-08-2005	Manchester	
		2006/0206487 A1	09-14-2006	Harada	
		2006/0212442 A1	09-21-2006	Conrad	
		2006/0212444 A1	09-21-2006	Handman	
		2007/0008984 A1	01-11-2007	Phillips	
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		2007/0116316 A1	05-24-2007	Goldberg	
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	Application Number	TBD
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	October 5, 2010
	First Named Inventor	Pelland et al.
	Art Unit	TBD
(use as many sheets as necessary)	Examiner Name	TBD
Sheet 2 of 3	Attorney Docket Number	080188PCTUS

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Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
		WO 2007/136620 A2	11-29-2007	Autonet Mobile Inc.		
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Sheet 3 of 3	Attorney Docket Number	080188PCTUS

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]
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Examiner Signature		Date Considered	

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If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 November 2007 (29.11.2007)

PCT

(10) International Publication Number
WO 2007/136620 A2

(51) International Patent Classification:
H01Q 15/00 (2006.01)

(21) International Application Number:
PCT/US2007/011631

(22) International Filing Date: 15 May 2007 (15.05.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/800,749 16 May 2006 (16.05.2006) US
60/800,679 16 May 2006 (16.05.2006) US
60/800,750 16 May 2006 (16.05.2006) US

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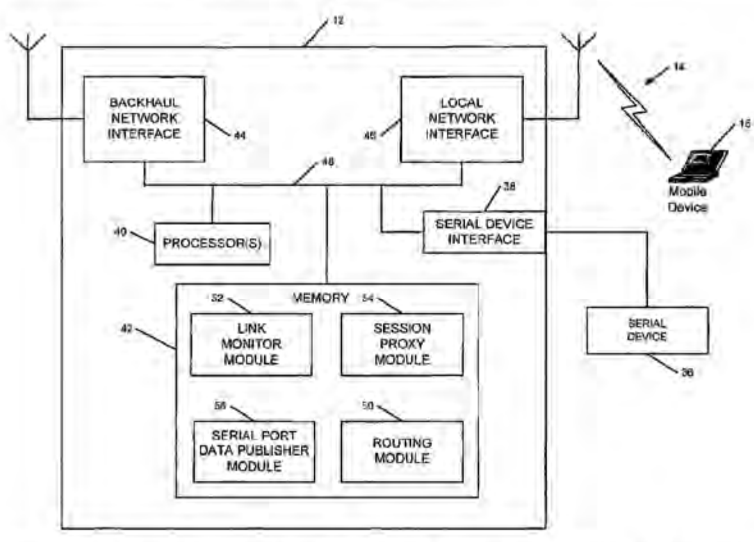
(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

[Continued on next page]

(54) **Title:** MOBILE ROUTER WITH SERIAL DEVICE INTERFACE



(57) **Abstract:** A mobile router having a serial interface is disclosed. According to various embodiments, the mobile router may comprise a serial port data publisher module that may take data received from a serial device connected to a serial port of the mobile router and make the data from the serial device available via a TCP stream. In that way, the serial port data publisher module may be used, for example, to populate a remote database with the data from the serial device. That way, the data from the serial device may be remotely accessed via the Internet, for example. In addition, the mobile router can be used to output a received signal from the device connected to its serial interface.

WO 2007/136620 A2

MOBILE ROUTER WITH SERIAL DEVICE INTERFACE

Inventor: Douglas S. Moeller

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority to the following U.S. provisional applications:

(1) U.S. provisional application Serial No. 60/800,679, filed May 16, 2006, entitled "Mobile Router With Serial Interface," by Douglas S. Moeller;

(2) U.S. provisional application Serial No. 60/800,749, filed May 16, 2006, entitled "Mobile Router That Monitors Links," by Douglas S. Moeller; and

(3) U.S. provisional application Serial No. 60/800,750, filed May 16, 2006, entitled "Mobile Router With Session Proxy," by Douglas S. Moeller.

The present application is related to the following, contemporaneously-filed PCT applications:

(1) PCT application entitled "Mobile Router With Session Proxy," by Douglas S. Moeller, Attorney Docket No. 060275PCT; and

(2) PCT application entitled "Mobile Router That Monitors Links," by Douglas S. Moeller, Attorney Docket No. 060274PCT.

BACKGROUND

Many people use mobile or wireless end-user computer-type devices for a variety of purposes. These devices include smartphones, handheld computer-type devices, personal digital assistants (PDAs), laptop computers equipped with a wireless network interface card, etc. Users often use such devices to read and write email messages, access the Internet, download and view image or video files, run applications, etc.

In order to use such mobile devices, the mobile devices must be able to connect to a wireless network. Conventional wireless local area networks (WLANs) are often deployed inside structures such as homes, offices, public and commercial buildings, etc. The WLAN typically comprises one or more wireless access points, such as a wireless router or hot spot, which communicates wirelessly with the mobile device, and allows the mobile device to connect to a wired network (or other network) that is also in communication with the access point. In order to stay connected to such WLANs, the mobile user must usually stay with the range of the access points. This often constrains the effective mobility of a wireless user. The mobile user must stay in the home, office or building to have wireless access to the WLAN, but if the mobile user leaves the premises, the mobile user may leave the range of the wireless access points and thereby lose connectivity to the network. For the IEEE 802.11 standard, also known as Wi-Fi, the range of such access points is about 50 meters for indoor environments and 100 meters for outdoor environments.

Some campuses and urban areas provide broader W-Fi coverage areas by placing a number of cooperating Wi-Fi hot spots throughout the campus or urban area. This provides the mobile user with greater wireless access as the mobile user generally can move around the campus/urban area while maintaining wireless connectivity. However, when the mobile user leaves the campus/urban area, the user may lose connectivity, thus constraining the wireless mobility of the user.

This dilemma has been addressed somewhat by cellular networks that allow mobile devices to communicate wireless data with such cellular networks using data communication standards, such as GSM/GPRS (Global System for Mobile Communications/General Packet Radio Service) or EDGE (Enhanced Data rates for GSM Evolution). Such cellular networks generally provide much broader coverage areas than WLANs or Wi-Fi area, so a mobile user will ordinarily have fewer restrictions on mobility when accessing such a cellular network. Further, cellular networks typically can accommodate roaming users by allowing users to stay connected as they travel from one cellular network to another.

Nevertheless, mobile end-user devices often experience interruptions in service due to drop-offs by the network (either Wi-Fi or cellular network). This problem is exacerbated when the user is quickly moving between network cells, hot spots or networks. This can be caused, for example, (i) because the user's wireless access provider/protocol is not compatible with the new cell, hot spot or network, (ii) because the new cell, hot spot or network is overly congested with traffic, (iii) because of faulty hand-off procedures between the cells, hot spots, or networks, or many other reasons.

In addition, a mobile end-user may experience other types of performance problems, including a change of bit rate or bandwidth during the data transmission, and a change in the quality of service (e.g., jitter, latency, data loss, etc.).

Accordingly, there exists a need for a way to alleviate or mitigate the problems experienced by a user of mobile end-user device.

SUMMARY

In one general aspect, the present invention is directed to a mobile router. The mobile router may communication with one or more mobile devices via a local wireless network, such as a Wi-Fi or Wi-MAX network. The mobile router may further act as a gateway for communications from the mobile device to a backhaul network, which also in communication with the mobile router via a wireless communication link. The backhaul network may comprise a cellular network, such as a GSM/GPRS or UTMS network, or some other type of wireless network. The backhaul network may be connected to the Internet or other network (e.g., WAN). That way, the mobile device can communicate with a destination device connected to the Internet (or other network) via the mobile router and the backhaul network.

Further, because the mobile router wirelessly communicates with the backhaul network, it can move with the mobile device as the mobile device moves to provide enhanced mobile wireless connectivity for the mobile device. For example, the mobile router can be installed, affixed or otherwise placed in a vehicle, such as a car, bus, boat, rail car, etc., where the end user of the mobile device is a passenger (or driver). That way, the end user can maintain wireless activity as the user moves about.

According to various embodiments, the mobile router may comprise a session proxy module establishes two transport protocol sessions – one between the mobile router and the mobile device, and one between the mobile router and a destination device – when the end user seeks to communicate with the destination device through the mobile router. That way, if the session between the mobile router and a destination device goes down, the session between the mobile router and the mobile device may remain active, thereby allowing the mobile device to believe that the session is still active while the mobile router works to restore the session. Also, the two sessions may use different protocols. For example, the session between the mobile device and the mobile router may use the TCP protocol, whereas the session between the mobile router and the destination device may use a different protocol, such as HS-TCP or SCPS. Moreover, the establishment of the two sessions by the mobile router may be transparent to the end user. Also, the end user could have the option of disabling the session proxy functionality in certain embodiments. This may be desirable when the end user is using an application that encrypts the TCP headers.

Another potential benefit is that when the backhaul network goes down, the session proxy module may prevent the TCP session for the link to the mobile device 16 from

starting its back-off timers. This is advantageous because, under the TCP protocol, the mobile device would normally assume that it cannot forward packets because of network congestion and it would accordingly start to slow down the user's session. In contrast, with the session proxy module maintaining a session between the mobile router and the mobile device that is separate from the session between the mobile router and the backhaul network, the mobile device may not assume that network congestion is a problem and the TCP session between mobile router and the mobile device may not slow down. Another potential benefit is that the TCP timers and congestion windows can be adjusted dynamically so that the link may be optimized for the particular characteristics of the backhaul network (e.g., packet loss, latency jitter, etc.).

In addition, the mobile router may comprise a session link module that monitors the layer 2 and/or layer 3 links of the mobile router with the backhaul network. That way, when the link monitor module detects a drop-off, the link monitor module can reestablish the link as quickly as possible in order to minimize the interruption in service to the end user. According to various embodiments, the link monitor module does this by sending and monitoring test (or probing) data packets over the backhaul wireless communication link. That way, the user does not have to restart his/her applications or sessions. The user just typically notices that the applications/sessions slowed for a brief period of time while the connection was being reestablished.

In addition, according to various embodiments, the mobile router may include a serial data port for communicating with a serial data device connected thereto. In addition, the mobile router may include a serial device data publication module which transmits data from the serial device over the backhaul network to a destination device, such as a server/database, such that remote users could access the database to retrieve the data from the serial device. The serial device could be, for example, a GPS receiver that records location data for the mobile router, or another type of serial data device. In addition, rather than transmitting the data to a server/database, a remote user could access the mobile router to access the data from the serial device directly. Additionally, the serial interface of the mobile router could be used to output data/command signals to the connected serial device.

These and other benefits will be apparent from the description to follow.

FIGURES

Various embodiments of the present invention are described herein by way of example in conjunction with the following figures, wherein:

Figure 1 is a block diagram of a network including a mobile router according to various embodiments of the present invention;

Figure 2 is a block diagram of a mobile router according to various embodiments of the present invention; and

Figure 3 is a block diagram of the process flow of the link monitor module of the mobile router according to various embodiments of the present invention.

DESCRIPTION

Figure 1 is a diagram of a network 10 according to various embodiments of the present invention. As shown in Figure 1, the network 10 comprises a mobile router 12 in communication with a mobile device 16 via a wireless communication link 14 (referred to sometimes hereinafter as the "local wireless communication link 14"). The wireless communication link 14 may be provided as part of the wireless network 15 including the mobile router 12 and the mobile device 16. The wireless network 15 (referred to sometimes hereinafter as the "local wireless network 15") may be, for example, a WiFi network (e.g., IEEE 802.11 network), a WiMAX network (IEEE 802.16), a Bluetooth network, or any other suitable wireless network.

The mobile device 16 may be any computer-based device capable of receiving and transmitting data via the wireless communication link 14. For example, the mobile device 16 may be a laptop (or notebook) computer (as shown in the example of Figure 1) equipped with a wireless network interface card, a wireless-enabled PDA, a pocket or palmtop computer, a WiFi phone (e.g., a Skype phone or VoIP phone), a WiFi appliance, a Sony PlayStation PSP or some other portable, network-enabled gaming station, a video screen, a digital camera, an audio player, a navigation device, a security camera, an alarm device, a wireless payment or POS device, etc.

The mobile router 12, as explained further hereinbelow, may act as a gateway between the wireless network 15 and a backhaul network 20. The backhaul network 20 in turn may be connected to the Internet 18 or any other network (such as an intranet or another WAN) via a gateway 24.

The mobile router 12 may communicate with the backhaul network 20 via a backhaul wireless communication link 22 (sometimes referred to hereinafter as the "backhaul wireless communication link"). The backhaul wireless communication link 22 may be provided by a wireless network that is part of the backhaul network 20, such as a cellular wireless network. The cellular wireless network may be, for example: a Global

System for Mobile Communications/General Packet Radio Service (GSM/GPRS) link; a UMTS (Universal Mobile Telecommunications System) link; a Code Division Multiple Access (CDMA) link; an Evolution-Data Optimized (EV-DO) link; an Enhanced Data Rates for GSM Evolution (EDGE) link; a 3GSM link; a Digital Enhanced Cordless Telecommunications (DECT) link; a Digital AMPS (IS-136/TDMA) link; an Integrated Digital Enhanced Link (iDEN) link; a WiMAX link; or any other suitable wireless link. That way, the mobile router 12 may provide wireless access for the mobile device 16 to the Internet 18 (or other desired network).

According to various embodiments, the mobile router 12 and the mobile device 16 are co-located in a moving vehicle so that mobile router 12 is mobile and so that end-users of the mobile device 16 can enjoy wireless connectivity to the Internet 18 via the mobile router 12 as the vehicle (not shown) moves through cells or nodes associated with the wireless network 22. The moving vehicle could be, for example, a car, a truck, a bus, a boat, a train or rail car, etc. The mobile router 12 may be mounted to the vehicle in a secure and generally tamper-resistant location. For example, the mobile router 12 may be mounted in the trunk of an automobile, and the end-user of the mobile device 16 may be a passenger or driver of the automobile. That way, the end-user could enjoy wireless connectivity as the automobile moves between cells of the wireless network 22.

Also, although only one mobile device 16 is shown in communication with the mobile router 12 in Figure 1, it should be noted that numerous mobile devices 16 may be in communication with the mobile router 12 via the network 14. For example, in a scenario where the mobile router 12 is routed in an automobile, more than one passenger may be using an end-user mobile device 16 that communicates with the Internet 18 (or some other network) via the mobile router 12 and the backhaul network 20. For example, one passenger could be checking email on a palmtop computer device, while another passenger may be surfing the World Wide Web, etc.

It should also be recognized, however, that the mobile router 12 does not necessarily need to be installed in, affixed to, or otherwise placed in a mobile vehicle. For example, a user could use the mobile router 12 at home, work, or any other stationary location, or carry the mobile router 12 around with him/her.

As shown in Figure 1, a transceiver 30 may receive and transmit the wireless signals to the mobile router 12 via the wireless communication link 22. A communication network 32 of the backhaul network 20 may communicate with the Internet 18 (or other network) via one or more gateways 24. The communication network 32 may include conventional network elements such as servers, routers, switch, etc., and may provide wireless network service for the mobile router 12. Of course, although only one transceiver 30 is shown in Figure 1, it should be recognized that the backhaul network 20 may comprise a number of such transceivers, located in different areas serviced by the backhaul network 20, such that the mobile router 12 may stay in communication with the backhaul network 20 as the mobile router 12 moves between cells or nodes of the backhaul network 20.

As shown in Figure 1, third party servers 26 may be in communication with the Internet (or other network) 18. That way, the mobile device 16 can access the third party servers 26 through the mobile router 12 and the backhaul network 20.

Figure 2 is a simplified block diagram of the mobile router 12 according to various embodiments of the present invention. As shown in Figure 2, the mobile router 12 may comprise one or more processors 40, one or more memory units 42, a backhaul network interface 44, and a local network interface 46, that may be connected via a system bus 48.

The backhaul network interface 44 is for interfacing with the backhaul network 20. The local network interface 26 for interfacing with the wireless network 15. The type of backhaul network interface 44 may depend on the types of backhaul wireless communication link 22 used. For example, the backhaul interface network 44 may be a GSM/GPRS interface, a UTMS interface, an EDGE interface, a Wi-MAX interface, etc. Similarly, the type of local network interface 46 may depend on the type of wireless network 15 used. For example, the local network interface 15 may be a Wi-Fi, Wi-MAX, or Bluetooth interface.

The processor(s) 40 may execute instruction code stored in the memory 42. The memory 42 may be embodied as one or more computer-readable media, including Read-Only-Memory (ROM) and/or Random-Access-Memory (RAM). As such, the memory 42 may comprise one or more memory chips, optical memory devices (e.g., CD-ROM), magnetic memory devices (e.g., disk drives), etc. The memory 42 may include a number of software modules, including a routing module 50, a link monitor module 52, a session proxy module 54 and a serial port data publisher module 56, that may be implemented as software code to be executed by the processor(s) using any suitable computer instruction type. The software code may be stored as a series of instructions or commands, or as a program, in the memory 42.

The routing module 50 may include the code for allowing the mobile router 12 to route data packets from the wireless network 15 to the backhaul network 20, and vice versa, as is known in the art. The link monitor module 52, as explained further below, may monitor the layer 2 (data link or cellular layer) and layer 3 (IP or network layer) links of the mobile router 12 with the backhaul network 20 by sending test or probing data packets. By monitoring the packets, the link monitor module 52 can detect if either (or both) of the links fails. That way, the mobile router 12 can take appropriate action when one of the links fails.

According to various embodiments, both the local wireless communication link 14 and the backhaul wireless communication link 22 may use the TCP (Transmission Control Protocol) transport protocol for the session layer of the network protocols. TCP is one of the core protocols of the Internet protocol suite, often simply referred to as "TCP/IP." Using TCP, applications on networked hosts can create connections to one another, over which they can exchange streams of data using stream sockets. Stream sockets are a type of internet socket which provides a connection-oriented, sequenced, and unduplicated flow of data without record boundaries. The TCP protocol guarantees reliable and in-order delivery of data from sender to receiver.

The TCP protocol also uses a network congestion avoidance algorithm in order to achieve congestion avoidance. A number of such algorithms exists and can be used. In general, according to some algorithms, the TCP protocol specifies a maximum segment size (MSS). The sender maintains a congestion window, limiting the total number of unacknowledged packets that may be in transit end-to-end. To avoid congestion collapse, TCP makes a slow start when the connection is initialized and after a timeout. It starts with a window of 2 MSS. Although the initial rate is low, the rate of increase is very rapid: for every packet ACKed, the congestion window increases by 1 MSS so that for every round trip time, the congestion window has doubled. When the congestion window exceeds a threshold, or a packet is lost, the algorithm enters a new state, called congestion avoidance. As long as non-duplicate ACKs are received, the congestion window is additively increased by one MSS every round trip time. When a packet is lost, duplicate ACKs will be received. The congestion window is reduced to 1 MSS on a timeout event.

The session proxy module 54, as explained further below, may act as a TCP proxy for all TCP sessions going through the mobile router 12. That way, according to various embodiments as described below, all end-user traffic between the end-user mobile device 16 and the destination (e.g., a server connected to the Internet or other network 18) may be transparently routed through the mobile router 12. Of course, in other embodiments, the local and backhaul wireless links 14, 22 may use a different transport protocol, and, in such embodiments, the the session proxy module 54 may similarly act as a proxy for such other transport protocol sessions.

The serial port data publisher module 56 may make data received from a serial device 36, connected to a serial port 38 of the mobile router 12, available from the mobile router 12 via a TCP stream (or any other type of data stream available from the mobile router 12).

Other, conventional components of a router, such as a memory controller, are not illustrated in Figure 2 for the sake of convenience.

As mentioned before, the link monitor module 52 may monitor the mobile router's layer 2 (data link or cellular layer) and layer 3 (IP or network layer) links with the backhaul network 20. That way, when the link monitor module 52 detects a drop-off, the link monitor module 52 can reestablish the link as quickly as possible in order to minimize the interruption in service to the end user. For example, in typical present-day mobile computing scenarios, when the network drops off, the end-user's applications and network sessions are ordinarily terminated. Consequently, the user has to restart the applications and/or session when the network connection is reestablished. Moreover, it typically is not predictable when the network connection will be reestablished.

The link monitor module 52 overcomes these drawbacks by monitoring the layer 2 and 3 links, and reestablishing the connections when connectivity is lost. As explained in more detail below, the link monitor module 52 may do this by sending and monitoring test (or probing) data packets over the backhaul wireless communication link 22. When it detects a failure in one or both of the links, the link monitor module 52 can take remedial action, such as attempting to reestablish the link. It may reestablish the link before applications on the mobile device 16 have to be restarted. That way, the user does not have to restart his/her applications or sessions. The user just typically notices that the applications/sessions slowed for a brief period of time while the connection was being reestablished.

The link monitor module 52 may utilize adaptive programming according to various embodiments. That is, for example, if the backhaul network interface 44 is receiving packets over the backhaul wireless communication link 22, the link monitor module 52 may send less probing packets and, conversely, if the interface 44 is not receiving packets the link monitor module 52 may send more probing packets. By monitoring packets coming in on the interface 44, the link monitor module 52 may draw the assumption that the interface is functioning. This means that the link monitor module 52 does not have to send test packets across the backhaul wireless communication link 22 to verify connectivity (and hence not wasting precious network resources). However, just because the link monitor module 52 may assume that the interface 44 is functioning does not mean that the link monitor module 52 does not send test packets; it may just send them less frequently in certain embodiments.

The link monitor module 52 may monitor the interface 44 to see if it is receiving data packets. If it is not, then the link monitor module 52 may sleep "A" number of seconds and then proceed to the next step of doing an active probe. If the interface 44 is receiving packets, the link monitor module 52 may then sleep longer (e.g., 10 x A seconds) before it proceeds to the next step of doing an active probe. So if the backhaul wireless communication link 22 looks like it is working, then the link monitor module 52 may send fewer active probes on the backhaul network 20.

The remote devices that the link monitor module 52 is to monitor may be configured to allow the link monitor module 52 to ensure whether the link to the particular remote device is available. For example, links to the default route, domain name server (DNS), and/or authentication server 19 (see Figure 1) may be monitored, as well as any device other device on the Internet so configured.

Figure 3 is a flow chart of the process flow of the link monitor module 52 according to various embodiments of the present invention. This process may be continually running in the background to monitor the layer 2 and layer 3 links on the backhaul wireless communication link 22 of the mobile router 12.

At block 80, the link monitor module 52 may determine what its backhaul network 20 is (e.g. whether it is a GSM/GPRS network interface, a UTMS network interface, etc.). Next, at block 82, the link monitor module 52 may determine if the appropriate backhaul network driver is loaded. If not, at block 96, the driver is reloaded and, if successful, the process returns to block 92 (described further below). If at block 82 it is determined that the driver is loaded, the process advances to block 84, where the link monitor module 52 determines whether packets are being received on the backhaul network interface 44. This is a check of its layer 3 -- or network layer – status (OCI Model). If so, the process advances to block 86, where the link monitor module 52 goes into sleep mode for a brief period of time (xx seconds) because the network connection is active.

If at block 84 it is determined that packets are not being received over the backhaul wireless connection 22, the process advances to block 88, where the link monitor module 52 may determine if the layer 2, or data link layer, is established with a particular remote device (e.g., a device that is part of the communications network 32 or connected to the Internet 18). In one embodiment, the point-to-point protocol ("PPP") may be used for the layer 2 link (OCI Model). PPP is a protocol used to establish a direct connection between two nodes and is described by described by Internet Engineering Task Force (IETF) RFC 1661. Thus, at block 88, the link monitor module 52 may determine of the PPP link is established. Of course, in other embodiment, a different direct link protocol could be used.

If the PPP link is not established, the process may advance to block 92, where the PPP is restarted to establish the PPP link to the remote device. If that operation is successful, or if at block 88 it is determined that the PPP link is established, the process advances to block 90 where the link monitor module 52 determines if it has a default route to the remote device. In routing technology, a default route, also sometimes called a "gateway of last resort," is the network route used by a router when no other known route exists for a given data packet's destination address. All the packets for destinations not known by the router's routing table are sent to the default route. This route generally leads to another router, which treats the packet the same way. If the route is known, the packet will get forwarded to the known route. If not, the packet is forwarded to the default-route of the router which generally leads to another router, and so on. Once the router with a known route to a host destination is reached, the router determines which route is valid by finding the most specific match. The network with the longest subnet mask that matches the destination IP address wins.

Hence, the default route may be a connection to the remote device that is different from the direct connection. If there is a default route, the process may advance to block 94, where the link monitor module 52 may determine whether the remote device is reachable via the default route. If, at block 90 it is determined that there is no default route, the process may return to block 88 where the PPP link is attempted to be established.

The process also advances to block 90 from block 86 after the brief sleep period. If at block 90 it is determined that the mobile router 12 has a default route, the process advances to block 94 where the link monitor module 52 determines if the default route is reachable. If the default route is not reachable, the process returns to block 88, wherein the PPP link is attempted to be reestablished.

If at block 92 the PPP protocol is unable to be restarted after x number of attempts, the process advances to block 96, where the card driver for the backhaul network interface 44 is reloaded. If at block 66 the card driver is not successfully loaded after a number ("x") of attempts, the process advances to block 98, where the link monitor module 52 attempts to reload the CardBus driver (or other similar driver for mobile routers that do not use CardBus). A CardBus is PCMCIA (Personal Computer Memory Card International

Association) 5.0 or later (e.g., JEIDA 4.2 or later) 32-bit PCMCIA card. CardBus is effectively a 32-bit, 33 MHz PCI (Peripheral Component Interconnect) bus in the PC card form factor. CardBus includes bus mastering, which allows a controller on the bus to talk to other devices or memory without going through the CPU.

If that process is successful, the process returns to block 96, where the card driver is again attempted to be reloaded. If at block 98 attempts are unsuccessful in reloading the CardBus driver (or other similar driver), the process, according to various embodiments, advances to block 100, wherein the mobile router 12 is rebooted. From there, the process may return back to block 80.

Returning to block 94, where it is determined if the default route is reachable, if it is not available, the process may advance, according to various embodiments, to block 102, where the domain name server (DNS) for the mobile router is determined. Then, at block 104, it is determined whether the DNS is reachable. If it is, according to various embodiments, at block 106, the authentication server 19 (see Figure 1) for the mobile router 12 is determined. Then, at block 108, it is determined whether the authentication server 19 is reachable. If so, the process advances to block 110, where the link monitor module 52 enters brief sleep mode, during which no test packets are sent. After the brief sleep, the process returns to block 84 for a re-check of the layer 3 link.

If the DNS server is not reachable at block 104 or if the authentication server is not reachable at block 108, the process returns to block 88, where the PPP link (layer 2 link) is assessed, as explained above.

Some parameters in the process may be configurable. For example, certain time periods used by the various timers may be configurable. The parameters may be factory configurable, remotely configurable over a network, and/or self-adapting. In addition, in various embodiments, the user may be able to configure certain parameters.

In addition, the process can be fine-tuned and optimized for a particular backhaul network and/or usage pattern. The objective of the tuning and optimization may be to deliver the highest data throughput, fastest network drop-off detections, and fastest network reconnection. For example, the targets being probed can be changed. For example, the mobile router 12 may probe the session manager 29 in a network operations center (NOC) 30 (see Figure 1), or other devices connected to the network 18. Also, rather than active probing, the mobile router 12 may only listen to the backhaul network interface 44. This latter approach may be advantageous when the network 18 is a WAN (or other type of network) with low bandwidth.

The point-to-point protocol ("PPP") startup script may execute continuously until it makes a successful connection. The failure that is shown in Figure 3 at block 88 is if the PPP startup script is not successful in communicating with the backhaul network card x number of times. If the PPP startup script cannot make a connection it likely is because the mobile router 12 is out of coverage and not because it or the network failed. However, if PPP connection is unable to be established after a relatively long duration (e.g., over one hour), the link monitor module 52 may proceed with the failure path (step 92).

A common problem experienced in the prior art by cellular network users is that the data connection is sometimes lost. When this occurs, applications running on the mobile device (that is connected to the cellular network) stop running, and have to be restarted when the TCP session is re-established.

This problem can be overcome by the session proxy module 54 of the mobile router 12. Returning to Figure 2, the session proxy module 54 may act as a session proxy for all sessions (e.g., TCP sessions) going through the mobile router 12. That is, for example, when a local end-user seeks to establish a TCP session from their local end-user device (such as the mobile device 14 Figure 1) with a destination (such as a third party server 26 connected to the network 18, see Figure 1), the session proxy module 54 may terminate the TCP session coming from the mobile device 16 and, instead, establish a TCP (or some other protocol) session on the backhaul network interface 26 with the destination 26. The mobile router 12 may also maintain a separate TCP session with the mobile device 16 over the local wireless communication link 14. That way, all end-user traffic between the end-user and the destination may be transparently routed through the mobile router 12 on the two separate sessions. That way, one session going down (such as the backhaul wireless communication link 22) need not negatively affect the other session (such as the session between the mobile router 22 and the mobile device 16).

By doing this, several benefits may be achieved. For example, when the backhaul network link 22 goes down (which is sometimes not uncommon for cellular networks), the session proxy module 54 can maintain a TCP session to the local end user (e.g., at the mobile device 16). That way, if applications running on the mobile device 16 are dependent upon a TCP session, the applications may continue to run because there is a TCP session with the mobile router 12, even though the TCP session over the backhaul wireless communication link 22 is lost. When the backhaul network communication link 22 comes back, the end-user may be able to keep running its applications and session without having to restart the applications.

Another potential benefit is that when the backhaul network link 22 goes down, the session proxy module 54 can prevent the TCP session for the link to the mobile device 16 from starting its back-off timers. This is advantageous because, under the TCP protocol, the mobile device 16 would normally assume that it cannot forward packets because of network congestion and it would accordingly start to slow down the user's session. In contrast, with the session proxy module 54 maintaining a TCP session between the mobile router 12 and the mobile device 16, the mobile 16 device would not assume that network congestion is a problem and the TCP session between mobile router 12 and the mobile device 16 the should not slow down.

Another potential benefit is that the TCP timers and congestion windows can be adjusted dynamically so that the link is optimized for the particular characteristics of the backhaul network (e.g., packet loss, latency jitter, etc.). For example, if the network has a high packet loss, the MTU (maximum transmission unit) may be made smaller to increase the likelihood that sent data packets will successfully reach their destination. "MTU" refers to the size (in bytes) of the largest data packet that a given layer of a communications protocol can pass onwards. Alternatively, if the network has relatively little packet loss and high throughput, the MTU may be increased so as to further increase throughput.

In another embodiment, instead of a TCP session, the session proxy module 54 could establish a different type of protocol session with the user's destination that is designed to run over high latency links. Such high-latency links may be HS-TCP (High Speed TCP) or SCPS (Space Communications Protocol Specifications). HS-TCP uses a new congestion control algorithm for TCP that is described in RFC 3649. The SCPS is set of extensions to existing protocols and new protocols developed by the Consultative Committee for Space Data Systems (CCSDS). The SCPS protocol is defined in ISO Standards 15894 (file transfer), 15893 (transport layer), 15892 (security layer) and 15891 (network layer).

In such an embodiment, therefore, there may be a TCP session between the mobile device 16 and the mobile router 12 over the local wireless communication link 14, and a separate high latency protocol session (e.g., HS-TCP or SCPS) between the mobile router 12 and the destination over the backhaul network 20. Moreover, the establishment of the high-latency link on the backhaul network 20 may be done transparently to the local end-user by the session proxy module 54.

In addition, in various embodiments, the local end-user could be given the option of disabling the session proxy module 54. A user of the mobile device 16 may disable the session proxy module 54, for example, through a control panel for the mobile router 12 displayed on the mobile device. Also, the mobile router 12 may have a switch or push-button that allows a user to disable the session proxy module 54. It may be desirable for a user to disable the session proxy module 54 when the user wants to maintain a TCP session with the destination. For example, certain types of virtual private networks (VPNs), such as IPSEC VPNs, encrypt the TCP headers. IPSEC (IP security) is a suite of protocols for securing Internet Protocol (IP) communications by authenticating and/or encrypting each IP packet in a data stream. If the TCP headers were encrypted, the session proxy module 54 would ordinarily not be able to decrypt the headers of the TCP data packets and, therefore, could not appropriately transmit the packets on a non-TCP session. In such a circumstance, the user may desire to disable the session proxy module 54. Other types of VPNs, however, such as secure sockets layer (SSL) VPNs, do not encrypt the TCP headers, so the local end-user may not want or need to disable the session proxy module 54 when such a SSL VPN is being used.

Referring to Figure 2, the serial port data publisher module 56 may take data received from the serial device 36 connected to the serial port 38 of the mobile router 12 and make the data available via a TCP stream (or some other type of data stream, such as HS-TCP or SCPS data stream). The serial port data publisher module 56 and, via the backhaul network 20 and Internet 18, populate a remote database 25 with the data from the device 36. That way, the data from the serial device 36 can be remotely accessed via the Internet 18.

The serial device 36 may communicate with the mobile router 12 using any suitable serial data protocol, including the USB (Universal Serial Bus) standard, the RS-232 standard, the RS-485 standard, or the IEEE 1394 (FireWire) standard, for example.

The serial device 36 may be any suitable type of serial device, such as, for example, a GPS receiver. In an embodiment where the serial device 36 is a GPS receiver, this allows the location data for the GPS receiver (and hence the location data for the mobile router 12) to be remotely accessible by others. In an application where the mobile router 12 is installed in a mobile vehicle such as a car or truck, such location data could be used for a variety of applications, including:

- a company could access the database 25 to determine the current location of its vehicles;

- a company could determine and analyze where its vehicles have been, including such things as determining time spent in traffic jams, loading docks, etc.;
- track a stolen vehicle;
- determining optimal routes for delivery companies;
- collection of real-time traffic data, which can be analyzed and/or shared with traffic condition publication services; or
- collection of historical traffic data, which could be used for traffic planning purposes.

In various embodiments, the stream produced by the serial port data publisher module 56 may be compliant with a protocol standard, such as the RFC 2217 "Telnet Com Port Control Option" protocol, so that end-user devices that support the standard could use the data. This may be useful for Windows-based computers, because such computers could use standard, off-the-shelf mapping applications with a GPS device to be attached to the local machine. The end-user could install a RFC 2217 compliant driver on their Windows computer and could make the GPS data from the mobile router 12 appear as local GPS data on their Windows computer. And since the GPS data from the mobile router 12 would be accessible over an IP network (e.g., the Internet 18), the remote user's Windows computer could access the data from anywhere on the Internet.

The above-described examples were based on a GPS device as the serial device 36 connected to the mobile router 12. It should be recognized that other types of serial data devices 36 may be used and similar data publication processes could be used for such serial data devices so that the data from the serial device may be accessed via the Internet (or other network) 18. For example, in other embodiments the serial device 36 may be a vehicle telematics device. Such a vehicle telematics device may capture data regarding the performance and operation of the vehicle (e.g., diagnostic data) in which the device is installed. Such data may then be published by the mobile router 12 and stored in the database 25, for example, such that it is accessible by third parties via the Internet 18.

In another embodiment, the serial device 36 may be a point-of-sale (POS) device that captures sale or payment information. That way, the POS data may be published to the database 25 such that it is accessible via the Internet 18.

In other embodiments, the serial data device 36 could be, for example, a remote control for an in-car entertainment system (e.g., downloading music, video, games, etc., to third party systems) or a device for interfacing to existing communication systems (e.g., police radios, etc.).

In addition, rather than transmitting the data to a central server (e.g., database 25), a remote user could access the mobile router 12 to access the data from the serial device 36 directly. For example, in one embodiment, an authenticated remote user could access an authentication server 23 (see Figure 1) to determine the address of the mobile router 12. The remote user could then use that address to communicate with the mobile router 12 directly. Similarly, a local end-user of the mobile router 12 could access the data from the serial device via the local wireless network 14.

Additionally, according to various embodiments, the serial interface 38 of the mobile router 12 can be used to output data/command signals to the connected serial device 36. For example, from a remote location a signal/message can be sent to the mobile router 12 in order to have the signal/message sent output by the serial port 38 to the serial device, where the signal/message causes the serial device 36 to take some sort of action. For instance, the signal/message may activate the serial device 36. For example, where the mobile router 12 is installed in a car, the serial device 36 may be device capable of controlling components and/or systems of the car. For example, the serial device 36 may be able to shut of the engine (such as in the case of theft), unlock the doors in case of inadvertent locking, activate alarm functions, etc. The serial device 36 may also, according to various embodiments, perform payment functions, download data, receive advertising, entertainment, gaming, and/or information, as well as perform network management and control.

While various embodiments of the present invention have been described herein, it should be recognized that other modifications, substitutions and alternatives may be apparent to one of ordinary skill in the art. For example, certain of the steps of Figure 3 may be performed in different order or simultaneously. Such modifications, substitutions and alternatives can be made without departing from the spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A mobile router comprising:

a local network interface for wirelessly communicating with a mobile device via a local wireless network;

a backhaul network interface for wirelessly communicating with a backhaul network;

one or more processors;

a serial data device interface for communicating with a serial data device connected to the interface; and

a memory in communication with the one or more processors and the serial data device interface, wherein the memory stores instructions which, when executed by the one or more processors, cause the one or more processors to transmit data received from the serial data device over the backhaul network to a destination device.

2. The mobile router of claim 1, wherein:

the serial data device connected to the serial data device interface comprises a GPS receiver; and

the data transmitted by the mobile router over the backhaul network to the destination device comprises location data from the GPS receiver.

3. The mobile router of claim 1, wherein the serial data device comprises a serial data device selected from the group consisting of a GPS receiver, a vehicle telematics device, a point-of-sale (POS) device, and a remote control.

4. The mobile router of claim 1, wherein the memory additionally stores instructions which, when executed by the one or more processors, cause the one or more processors to:

monitor the layer 2 and layer 3 links of the mobile router for the backhaul network; and

reestablish the network connection to the backhaul network when a failure of the layer 2 and/or layer 3 link is detected.

5. The mobile router of claim 4, wherein the memory stores instructions which, when executed by the one or more processors, cause the one or more processors to monitor the

layer 2 and layer 3 links by sending test packets to a destination device over the backhaul network.

6. The mobile router of claim 5, wherein the memory stores instructions which, when executed by the one or more processors, cause the one or more processors to adapt the frequency at which test packets are sent to the destination device based on whether the network connection to the backhaul network is active.

7. The mobile router of claim 6, wherein the memory stores instructions which, when executed by the one or more processors, cause the one or more processors to send test packets to the destination device less frequently when the network connection to the backhaul network is active.

8. The mobile router of claim 1, wherein the memory additionally stores instructions which, when executed by the one or more processors, cause the one or more processors to:

detect an attempt by the mobile device to establish a transport protocol session between the mobile device and a destination device through the mobile router over the local wireless network and the backhaul network; and

initiate, when the attempt to establish the protocol session is detected, a first replacement transport protocol session between the mobile router and the mobile device over the local wireless network and a second replacement transport protocol session between the mobile router and the destination device over the backhaul network.

9. The mobile router of claim 7, wherein the memory additionally stores instructions which, when executed by the one or more processors, cause the one or more processors to:

detect an attempt by the mobile device to establish a transport protocol session between the mobile device and a destination device through the mobile router over the local wireless network and the backhaul network; and

initiate, when the attempt to establish the protocol session is detected, a first replacement transport protocol session between the mobile router and the mobile device over the local wireless network and a second replacement transport protocol session between the mobile router and the destination device over the backhaul network.

10. The mobile router of claim 1, wherein the local wireless network comprises a Wi-Fi network.

11. The mobile router of claim 1, wherein the local wireless network comprises a Wi-MAX network.

12. The mobile router of claim 1, wherein the backhaul network comprises a cellular network.

13. The mobile router of claim 12, wherein the cellular network comprises a GSM/GPRS network.

14. The mobile router of claim 12, wherein the cellular network comprises a UMTS network.

15. The mobile router of claim 9, wherein the backhaul network comprises a cellular network.

16. The mobile router of claim 15, wherein the cellular network comprises a GSM/GPRS network.

17. The mobile router of claim 15, wherein the cellular network comprises a UMTS network.

18. The mobile router of claim 15, wherein the local wireless network comprises a Wi-Fi network.

19. The mobile router of claim 15, wherein the local wireless network comprises a Wi-MAX network.

20. The mobile router of claim 1, wherein the mobile device is a wireless-enabled computer device selected from the group consisting of a laptop equipped with a wireless network interface card, a wireless-enabled PDA, a pocket computer, a WiFi phone, a WiFi

appliance, a portable, network-enabled gaming station, a video screen, a digital camera, an audio player, a navigation device, a security camera, an alarm device, a wireless payment device, and a wireless POS device.

21. The mobile router of claim 1, wherein the mobile router is installed in a vehicle.

22. The mobile router of claim 21, wherein the vehicle is a vehicle selected from the group consisting of an automobile, a truck, a rail car, a bus, and a boat.

23. A method comprising:

receiving, by a mobile router from a serial data device that is connected to a serial data device interface of the mobile router, data from the serial data device, wherein the mobile router is in communication with a mobile device via a local wireless communication link and wherein the mobile router is in communication with a backhaul network; and

transmitting, by the mobile router; the serial data received from the serial data device to a destination device over the backhaul network.

24. The method of claim 23, wherein:

the serial data device connected to the serial data device interface comprises a GPS receiver; and

transmitting the data comprises transmitting location data from the GPS receiver.

25. The method of claim 23, wherein the serial data device comprises a serial data device selected from the group consisting of a GPS receiver, a vehicle telematics device, a point-of-sale (POS) device, and a remote control.

26. The method of claim 23, further comprising:

monitoring the layer 2 and layer 3 links of the mobile router for the backhaul network; and

reestablishing the network connection to the backhaul network when a failure of the layer 2 and/or layer 3 link is detected.

27. The method of claim 26, wherein monitoring the layer 2 and layer 3 links comprises sending test packets to a destination device over the backhaul network.

28. The method of claim 27, further comprising adapting the frequency at which test packets are sent to the destination device based on whether the network connection to the backhaul network is active.

29. The method of claim 28, wherein adapting comprises sending test packets to the destination device less frequently when the network connection to the backhaul network is active.

30. The method of claim 23, further comprising:

detecting an attempt by the mobile device to establish a transport protocol session between the mobile device and a destination device through the mobile router over the local wireless network and the backhaul network; and

initiating, when the attempt to establish the protocol session is detected, a first replacement transport protocol session between the mobile router and the mobile device over the local wireless network and a second replacement transport protocol session between the mobile router and the destination device over the backhaul network.

31. The method of claim 29, further comprising:

detecting an attempt by the mobile device to establish a transport protocol session between the mobile device and a destination device through the mobile router over the local wireless network and the backhaul network; and

initiating, when the attempt to establish the protocol session is detected, a first replacement transport protocol session between the mobile router and the mobile device over the local wireless network and a second replacement transport protocol session between the mobile router and the destination device over the backhaul network.

32. The method of claim 23, wherein the local wireless network comprises a Wi-Fi network.

33. The method of claim 23, wherein the local wireless network comprises a Wi-MAX network.

34. The method of claim 23, wherein the backhaul network comprises a cellular network.

35. The method of claim 34, wherein the cellular network comprises a GSM/GPRS network.

36. The method of claim 34, wherein the cellular network comprises a UMTS network.

37. The method of claim 31, wherein the backhaul network comprises a cellular network.

38. The method of claim 37, wherein the cellular network comprises a GSM/GPRS network.

39. The method of claim 37, wherein the cellular network comprises a UMTS network.

40. The method of claim 37, wherein the local wireless network comprises a Wi-Fi network.

41. The method of claim 37, wherein the local wireless network comprises a Wi-MAX network.

42. The method of claim 23, wherein the mobile device is a wireless-enabled computer device selected from the group consisting of a laptop equipped with a wireless network interface card, a wireless-enabled PDA, a pocket computer, a WiFi phone, a WiFi appliance, a portable, network-enabled gaming station, a video screen, a digital camera, an audio player, a navigation device, a security camera, an alarm device, a wireless payment device, and a wireless POS device.

43. The method of claim 23, wherein the mobile router is installed in a vehicle.

44. The method of claim 43, wherein the vehicle is a vehicle selected from the group consisting of an automobile, a truck, a rail car, a bus, and a boat.

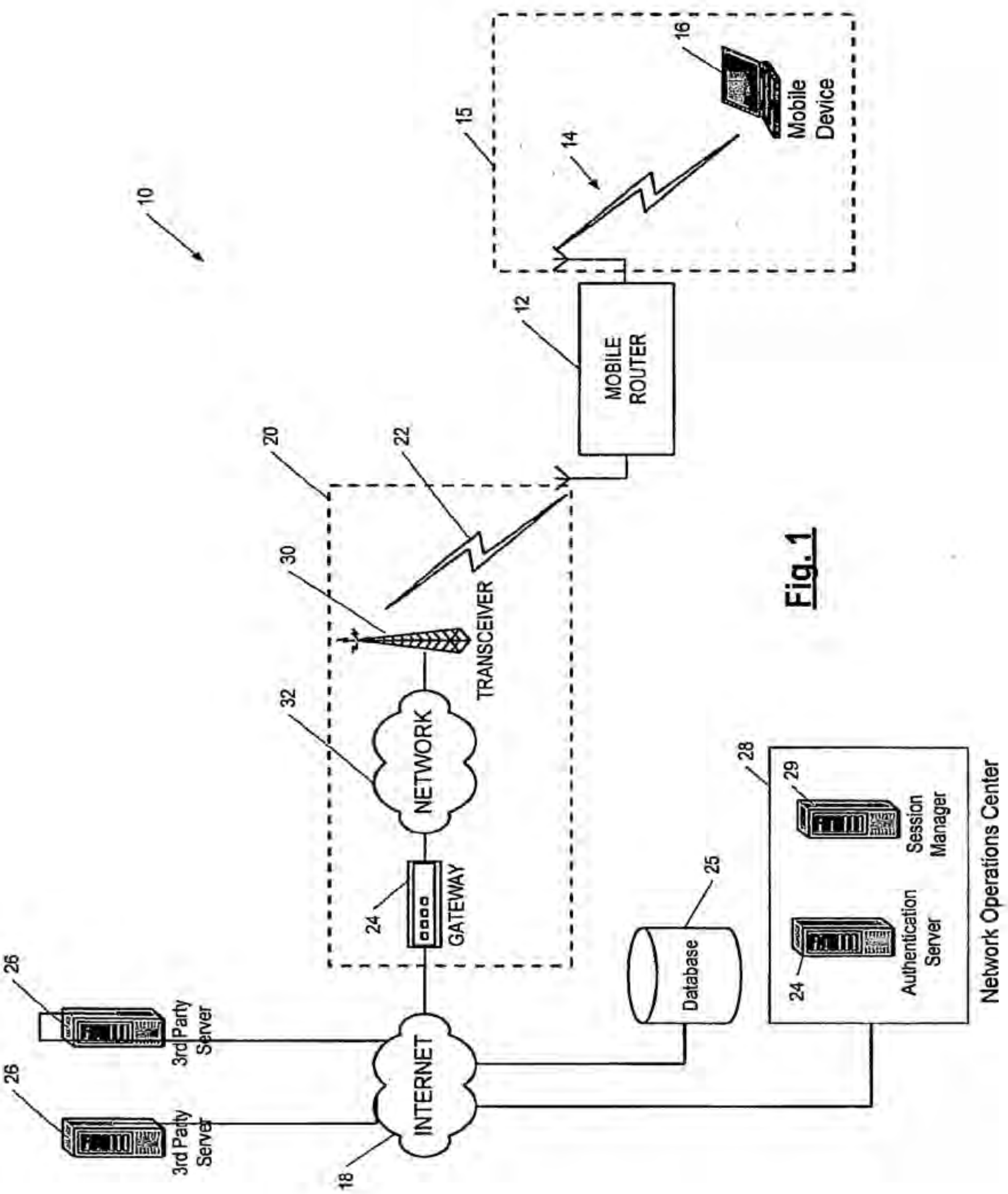

10
15
16
Mobile Device
14
12
MOBILE ROUTER
20
22
30
TRANSCEIVER
32
NETWORK
24
GATEWAY
26
3rd Party Server
26
3rd Party Server
INTERNET
18
Database
25
28
29
Session Manager
24
Authentication Server
Network Operations Center

Fig. 1

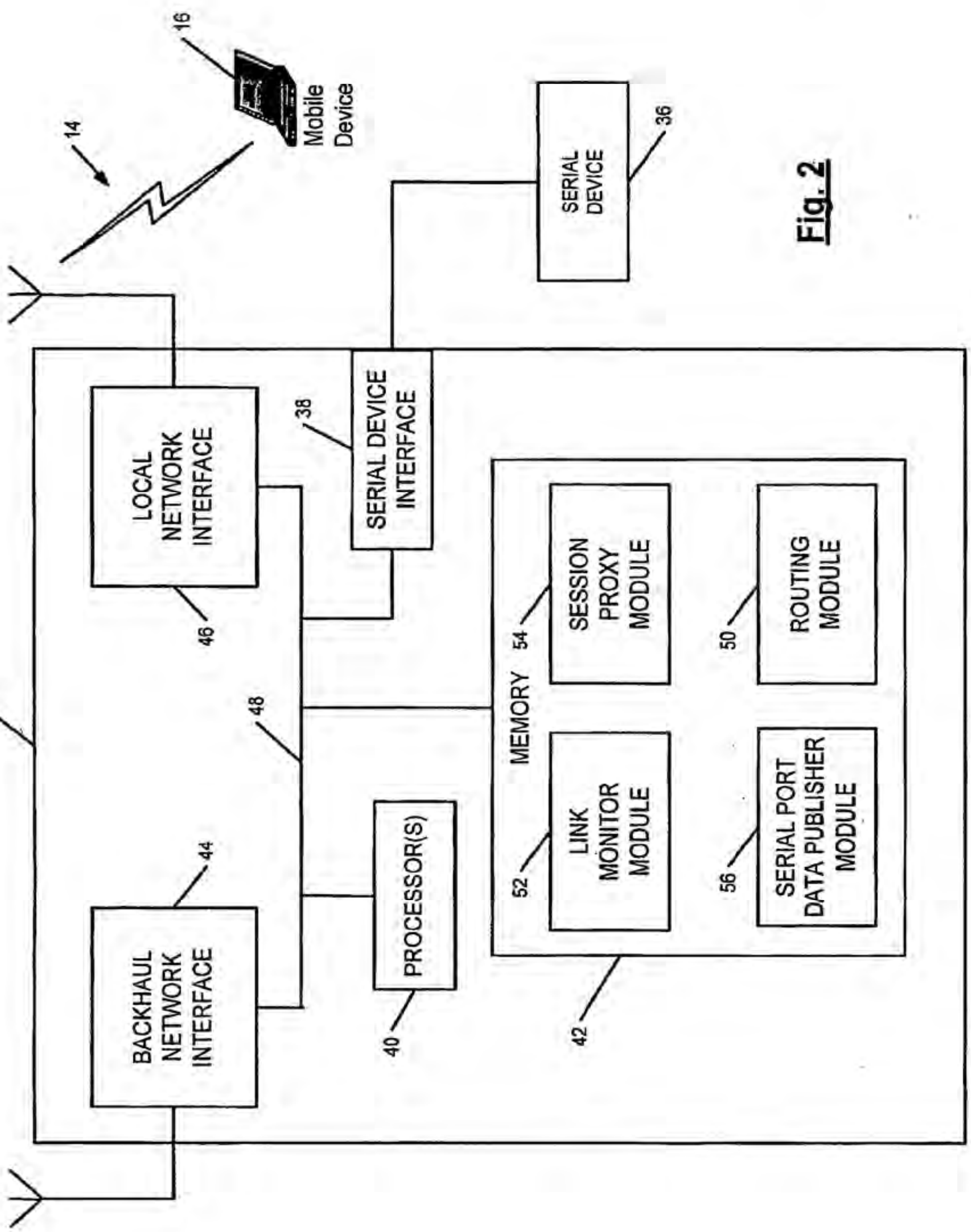
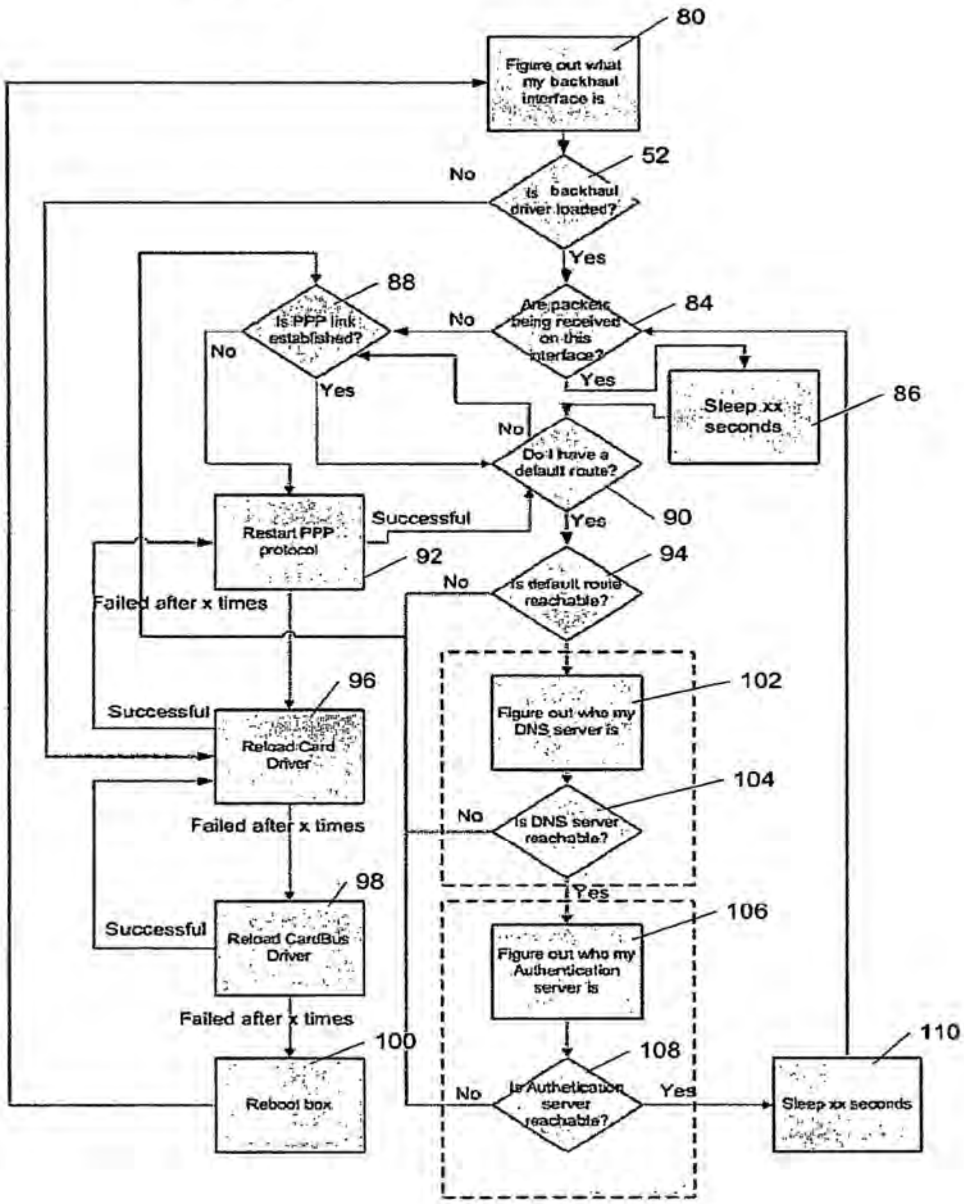

16
14
Mobile Device
SERIAL DEVICE
36
12
LOCAL NETWORK INTERFACE
38
SERIAL DEVICE INTERFACE
46
48
MEMORY
54
SESSION PROXY MODULE
50
ROUTING MODULE
52
LINK MONITOR MODULE
56
SERIAL PORT DATA PUBLISHER MODULE
44
BACKHAUL NETWORK INTERFACE
PROCESSOR(S)
40
42

Fig. 2

FIG. 3



80
Figure out what my backhaul interface is
52
No
Is backhaul driver loaded?
Yes
88
Is PPP link established?
No
Yes
No
Are packets being received on this interface?
84
Yes
Sleep xx seconds
86
No
Do I have a default route?
90
Yes
Restart PPP protocol
Successful
92
Failed after x times
No
Is default route reachable?
94
96
Successful
Reload Card Driver
Failed after x times
Figure out who my DNS server is
102
No
Is DNS server reachable?
104
Yes
98
Successful
Reload CardBus Driver
Failed after x times
Figure out who my Authentication server is
106
100
Reboot box
No
Is Authetication server reachable?
108
Yes
Sleep xx seconds
110

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 May 2008 (08.05.2008)

PCT

(10) International Publication Number
WO 2008/054985 A2

(51) International Patent Classification: Not classified

(21) International Application Number: PCT/US2007/081414

(22) International Filing Date: 15 October 2007 (15.10.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/863,588 31 October 2006 (31.10.2006) US
11/842,259 21 August 2007 (21.08.2007) US

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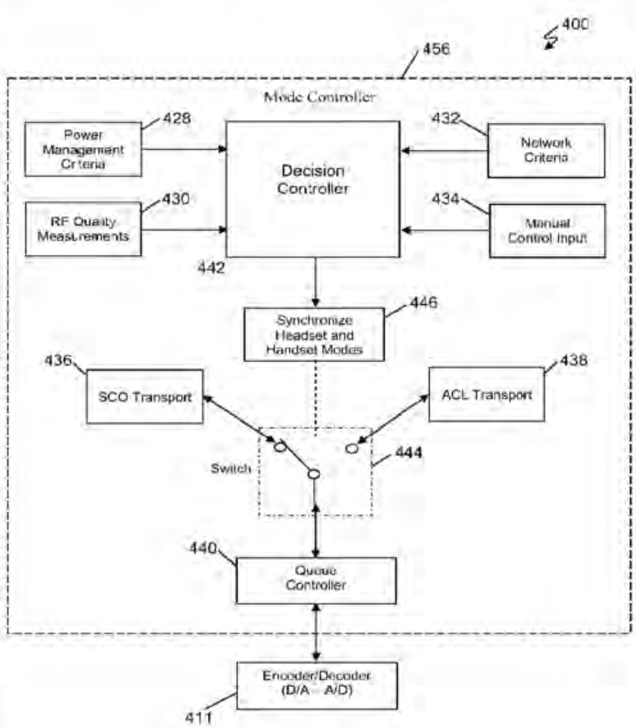
(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL,

[Continued on next page]

(54) Title: METHODS AND DEVICES FOR DUAL MODE BIDIRECTIONAL AUDIO COMMUNICATION



(57) Abstract: Disclosed are dual mode I/O devices and methods for transmission of a short range radio link such as a Bluetooth link that is a bi-directional real-time audio communication signal that can be over a synchronous circuit-switched transport and an asynchronous packet-switched transport either sequentially or simultaneously. Also disclosed are dual mode wireless headset systems and methods of at least two dual mode I/O devices and more particularly including a wireless audio terminal and an audio gateway for transmission of a bi-directional real-time audio communication signal that can be over a synchronous circuit-switched (SCO) transport and an asynchronous packet-switched (ACL) transport either sequentially or simultaneously. Having both SCO and ACL modes available may allow the user to optimize voice quality or data throughput under different operating conditions. The user may benefit from better Bluetooth voice quality and may have the flexibility of using either mode depending upon the situation.

WO 2008/054985 A2

PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

METHODS AND DEVICES FOR DUAL MODE BIDIRECTIONAL AUDIO COMMUNICATION

FIELD

[0001] Disclosed are wireless headsets and methods of wireless headsets, and more particularly dual mode wireless headsets and methods for use with an audio gateway device.

BACKGROUND

[0002] Bluetooth wireless technology provides a manner in which many wireless devices may communicate with one another, without connectors, wires or cables. Bluetooth technology uses the free and globally available unlicensed 2.4 GHz ISM spectrum, for low-power use, allowing two Bluetooth devices within a range of up to 10 to 100 meters to share data with throughput up to 2.1 Mbps. Each Bluetooth device can simultaneously communicate with multiple other devices.

[0003] Current common uses for Bluetooth technology include those for headsets, cellular car kits and adapters. Moreover, Bluetooth technology is currently used for connecting a printer, keyboard, or mouse to a personal computer without cables. Since Bluetooth technology can facilitate delivery of large amounts of data, computers may use Bluetooth for connection to the Internet through a mobile phone. Bluetooth devices can connect to form a piconet, which consists of a master and up to seven slave devices. Two types of connections can be established in a piconet: a Synchronous Connection Oriented (SCO) link, and an Asynchronous Connectionless

(ACL) link. SCO links provide a circuit-oriented service with constant bandwidth based on a fixed and periodic allocation of time slots that is used for voice transmission. There are also extended synchronous connection-oriented packets (eSCO) that have the same functionality as SCO packets but allow for more packet types, data types, and limited retransmissions. ACL connections, on the other hand, provide a packet-oriented service that is used for transmission of data and control signals. Traditionally, voice communication on SCO is bi-directionally processed by a voice codec or encoder/decoder while stereo communication on ACL is uni-directionally processed by a stereo codec. In a communication device, there are two separate codecs, one for communicating audio on SCO and the other for communicating audio on ACL.

[0004] Wireless Local Area Networks (WLANs) are becoming compatible with many different types of products. While businesses originally installed WLANs so that desktop computers could be used on networks without expensive wiring, the functionality of the WLANs has evolved to allow mobile communication devices, such as wireless telephones, laptop computers, personal digital assistants (PDAs) and digital cameras to connect to WLANs for Internet access and wireless Voice over Internet Protocol (VoIP) telephone service. Short for wireless fidelity, WiFi is a trademark for sets of product compatibility standards for WLANs. Manufacturers of mobile communication devices such as cellular telephones are WiFi enabling the devices so that when a user roams into a WiFi hot spot, a telephone can switch its communication protocol from the cellular band that uses licensed, limited spectrum to WiFi communication protocol that uses available unlicensed spectrum. In indoor situations, a switch to a WiFi protocol from a cellular network such as one based on the Global System for Mobile Communication standard (GSM) may be additionally beneficial since a cellular network can lose its signal strength indoors while a WLAN may have a strong signal within a hotspot.

[0005] The Bluetooth 2.4 GHz radio band is close to that of particular transceivers that operate at 2.3 GHz or 2.5 GHz, such as the Worldwide Interoperability for Microwave Access (WiMAX) Worldwide Interoperability for Microwave Access (WiMAX) transceiver based on IEEE 802.16e. Communication of audio signals between Bluetooth devices may collide in time with other signals such as WiFi and other standards-based wireless technologies such as Worldwide Interoperability for Microwave Access (WiMAX), thus desensitizing the receivers due to insufficient blocking performance and overlapping spectrum allocations. There can be adjacent channel interference with WiFi for example and with WiMAX, as the Bluetooth guard band is only 20 MHz. Synchronous connections, in particular SCO, such as those used in headsets are inflexible in scheduling of transmission and reception and result in simultaneous use of both radios, especially in an "802.16e" transceiver on a mobile device having packets scheduled by the WiMAX basestation, causing interference problems. While synchronous connections using eSCO have a limited ability to schedule packet transmissions, due to the limited retransmission window, they will still have periodic collisions with other wireless technologies and use more bandwidth and system resources than SCO links. The Bluetooth Core Specification describes a solution for co-existence with WiFi that mitigates interference. Advanced Frequency Hopping (AFH) is one technique that shrinks the available bandwidth to prevent using the same portion of the ISM band as another technology. Though this does not solve the problem of adjacent channel interference from other technologies such as WiMAX with high transmit powers and poor adjacent channel rejection. When Bluetooth and WiFi or WiMAX are collocated, AFH can be insufficient and a collaborative method of co-existence such as Packet Traffic Arbitration (PTA) may be used. However, PTA can significantly impact the WiFi data rate when Bluetooth SCO or eSCO is active.

[0006] Bluetooth devices, and particularly headsets, enjoy popularity because they can offer users the ability to communicate while seamlessly operating in different environments. Accordingly, providing improved voice quality over Bluetooth has become important for mobile device manufacturers. It would be beneficial were improvements made to voice quality over Bluetooth.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views and which together with the detailed description below are incorporated in and form part of the specification, serve to further illustrate various embodiments and to explain various principles and advantages all in accordance with the present invention.

[0008] FIG. 1 illustrates a system of two Input/Output (I/O) devices configured to transmit and/or receive via a short range radio link;

[0009] FIG. 2 is a flowchart illustrating input to a decision controller and output to switch between one and another transport;

[0010] FIG. 3 is a signal flow diagram for two devices, in this example a headset and a handset when the handset is the initiator;

[0011] FIG. 4 is an architecture diagram including a mode controller;

[0012] FIG. 5 illustrates some processes of a queue controller;

[0013] FIG. 6 is a flowchart of a method of a dual mode wireless headset according to an embodiment; and

[0014] FIG. 7 depicts some architecture components of a Bluetooth enabled I/O device such as the headset of FIG. 1.

[0015] Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of embodiments of the present invention.

DETAILED DESCPRIPTION

[0016] Disclosed are dual mode I/O devices and methods for transmission of a short range radio link such as a Bluetooth link that is a bi-directional real-time audio communication signal that can be over a synchronous circuit-switched transport and an asynchronous packet-switched transport either sequentially or simultaneously. Also disclosed are dual mode wireless headset systems and methods of at least two dual mode I/O devices and more particularly including a wireless audio terminal and an audio gateway for transmission of a bi-directional real-time audio communication signal that can be over a synchronous circuit-switched (SCO) transport and an asynchronous packet-switched (ACL) transport either sequentially or simultaneously. As mentioned above, a synchronous circuit switched transport can be used for voice data transmission. As will be described in detail below, an asynchronous packet-switched transport that is according to the Bluetooth specification used for data and control signal transmission can be used for audio and in particular voice communication transmission. Dual mode refers to use of both an SCO mode and an ACL mode for voice communication. Either one or both of the wireless audio terminal and the audio gateway can process signals of both an SCO transport and an ACL transport. To process both transports, SCO and ACL, a single encoder/decoder in either or both devices can provide bi-directional audio communication from a single source.

[0017] Transport selection can be based on both transports' advantages and disadvantages when transferring audio, and in particular voice data. Transport selection for audio, and in particular voice transmission is characterized differently than for example, changing applications such as voice audio on SCO and streaming stereo on ACL where a choice is made between mutually exclusive telephony and single-directional media playing. Transport selection for voice transmission is further characterized differently from traditional methods of mitigating Bluetooth interference. It is understood that voice communication is an example of a bi-directional audio communication.

[0018] In contrast to the limited scheduling ability of SCO and limited retransmissions of eSCO packets and their implementation in headsets and handsfree devices, a voice over ACL system with a scheduling process may avoid simultaneous transmissions and receptions with other time division multiplexing (TDM) technologies by varying when packets are sent versus the fixed frequency transmissions of SCO and eSCO links. Having both SCO/eSCO and ACL modes available may allow the user to optimize voice quality or data throughput under different operating conditions. From this point on the term SCO or SCO mode will include the functionalities of eSCO. In some noisy RF environments, voice over ACL may result in better audio quality than SCO. In either case, the user may benefit from better Bluetooth voice quality and may have the flexibility of using either mode (SCO or ACL) depending upon the situation. In particular, switching between SCO and ACL can be based on certain criteria such as quality of signal indicators or network infrastructure, for example, when handing over from a GSM cell to a WiFi access point or WiMAX basestation.

[0019] In the above-mentioned devices, systems and methods, transport selection of one of the SCO and ACL transports for real-time audio signal communication may be based upon operating conditions or manual activation. Transport selection according to operating conditions may be based on, for example, radio frequency quality measurements and network criteria as mentioned above and power management criteria. A Bluetooth audio I/O device can be, for example, a headset, a carkit, a handset of a cordless telephone, and a handset of a mobile communication device. An audio gateway may be, for example, a mobile telephone, a computer, a Bluetooth headset, and a Bluetooth handsfree carkit.

[0020] During transmission and receipt of audio signals, and in particular voice signals, a Bluetooth device can switch between a synchronous circuit-switched transport and an asynchronous packet-switched transport. Each transport has particular characteristics and benefits, and the two transports are mutually exclusive, except for example during the switching process where they may be simultaneously transmitted as discussed in detail below. The ability to use two transports for bi-directional audio signals, and in particular voice signals can improve voice quality over Bluetooth, enhancing the user's experience of seamless mobility. In a system such as a Bluetooth headset and a Bluetooth enabled handset, one or the other device can make a transport selection of one of the transports for real-time audio signal communication based upon operating conditions and/or manual activation.

[0021] The instant disclosure is provided to explain in an enabling fashion the best modes of making and using various embodiments in accordance with the present invention. The disclosure is further offered to enhance an understanding and appreciation for the invention principles and advantages thereof, rather than to limit in any manner the invention. While the preferred embodiments of the invention are illustrated and described here, it is clear that the invention is not so limited. Numerous modifications, changes, variations, substitutions, and equivalents will occur to those skilled in the art having the benefit of this disclosure without departing from the spirit and scope of the present invention as defined by the following claims. It is understood that the use of relational terms, if any, such as first and second, up and down, and the like are used solely to distinguish one from another entity or action without necessarily requiring or implying any actual such relationship or order between such entities or actions.

[0022] At least some inventive functionality and inventive principles may be implemented with or in software programs or instructions and integrated circuits (ICs) such as application specific ICs. In the interest of brevity and minimization of any risk of obscuring the principles and concepts according to the present invention, discussion of such software and ICs, if any, is limited to the essentials with respect to the principles and concepts within the preferred embodiments.

[0023] FIG. 1 illustrates a system 100 of two I/O devices 102 and 104 configured to transmit and/or receive via a short range radio link. The short range radio link can be a Bluetooth link that is a bi-directional real-time audio communication signal, and can be sent over a synchronous circuit-switched transport and an asynchronous packet-switched transport either sequentially or simultaneously. The system 100 can include more than two devices. The first device 102 is depicted as a wireless audio terminal, such as a Bluetooth headset, Bluetooth handsfree carkit, a mobile phone or a Bluetooth adapter with attached stereo speakers. The second device 104 is depicted as an audio gateway such as a mobile communication device, a computer, a Bluetooth headset or a Bluetooth handsfree carkit. A second device 104 may be complimentary to the first device 102 so far as the functions and some, most or all of the Bluetooth architecture. However, the functions and/or architecture may be unique to each device as well.

[0024] The mobile communication device 104 may be implemented as a cellular telephone (also called a mobile phone). The mobile communication device 104 represents a wide variety of devices that have been developed for use within various networks. Such handheld communication devices include, for example, cellular telephones, messaging devices, personal digital assistants (PDAs), notebook or laptop computers incorporating communication modems, mobile data terminals, application specific gaming devices, video gaming devices incorporating wireless modems, and the like. Any of these portable devices may be referred to as a mobile station or user equipment. Herein, wireless communication technologies may include, for example, voice communication, the capability of transferring digital data, SMS messaging, Internet access, multi-media content access and/or voice over internet protocol (VoIP).

[0025] The devices 102 and 104 are depicted as each having a controller 106 and 108 respectively. They also can include one or more transceivers 110 and 112. Each device 102 and 104 may further include a voice codec that can also be referred to as an encoder/decoder 111 and 113 respectively. The terms encoder, encoder/decoder, analog-to-digital (A/D) and digital-to-analog (D/A) converter, and codec may be used interchangeably. Moreover, they can include memory 114 and 116 which may store instruction modules 118 and 119.

[0026] The modules 118 of device 102 and 119 of device 104 can carry out certain processes of the methods as described herein. Steps of methods may involve modules and modules may be inferred and/or implied by the methods discussed herein. The modules can be implemented in software, such as in the form of one or more sets of prestored instructions, and/or hardware, which can facilitate the operation of the mobile station or electronic device as discussed below. The modules may be installed at the factory or can be installed after distribution by, for example, a downloading operation. The operations in accordance with the modules will be discussed in more detail below.

[0027] Establishing modules 120 and 121 are for receiving real-time audio signals from a single source. SCO communication modules 122 and 123 are for bi-directionally communicating with another I/O device, via a short range radio link, real-time audio signals over a synchronous circuit-switched transport. ACL communication modules 124 and 125 are for bi-directionally communicating with another I/O device, via a short range radio link, real-time audio signals over an asynchronous packet-switched transport. Selecting modules 126 and 127 are for selecting one of the transports for real-time audio signal communication based upon operating conditions. Power management criteria modules 128 and 129 are for transport selection. Radio frequency quality measurement modules 130 and 131 are for transport selection. Network criteria modules 132 and 133 are for transport selection. Manual selection modules 134 and 135 are for manually activating one or the other of the above described transports. Queue controller modules 140 and 141 are for managing packets in an encoder or decoder queue.

[0028] Referring to device 102 FIG. 1 further illustrates that the transceiver 110 is coupled to the controller 106 and that the transceiver 110 can be configured to establish a short range radio link and bi-directionally communicate real-time audio signals 101 over a synchronous circuit-switched (SCO) transport 136 and an asynchronous packet-switched transport (ACL) 138 over the short range radio link in accordance with establishing module 120 for receiving real-time audio signals from a single source. That is, for example, in bi-directional communication between the headset 102 having a single source voice codec 111 and the handset 104 having a single source voice codec 113, the transmission of the SCO transport 136 and the ACL transport 138 can be both processed from a single source, codec 111 and codec 113 of each device 102 and 104, respectively. Either or both devices 102 and/or 104 may include a bi-directional voice codec 111 and/or 113, respectively.

[0029] For the purpose of illustration, devices 102 and 104 are equipped with stereo codecs 115a and 115b respectively to further describe a single source and distinguish between the bi-directional ACL voice communication 138 and uni-directional ACL stereo communication 117. A traditional mono voice system with stereo music capability use both a bi-directional SCO communication mode 136 utilizing voice codecs 111 and 113 and an uni-directional ACL communication mode

117 utilizing stereo codecs 115a and 115b. In this example the source of audio from device 104 is seen to be from two sources, 113 and 115b, and in contrast to the disclosed methods and systems are mutually exclusive and the audio communication over the ACL transport is not bi-directional. While FIG. 1 shows two ACL paths 117 and 138 for illustrative purposes, there is only one ACL transport between devices 102 and 104. Accordingly, a described headset 102, for example, can be backwards compatible with an existing handset 104 using the SCO transport if the handset 104 is not capable of using the ACL transport 138 for voice communication and vice-versa. A handset 104 with a single source voice codec 113 as described may operate better with a headset 102 with a single source voice codec 111 according to this disclosure.

[0030] A hardware and/or software switch for transport selection of one of the transports for real-time audio signal communication based upon operating conditions is discussed in detail below. The system 100 of two devices 102 and 104 can communicate bi-directionally over the short range radio link 101 over a synchronous circuit-switched transport 136 and an asynchronous packet-switched transport 138 either sequentially or simultaneously.

[0031] FIG. 2 is a flowchart 200 illustrating input to a decision controller 242 and output to switch between one and the other above-described transports. A selection module 126 of device 102 (see FIG. 1) may provide instructions to the decision controller 242 that can receive automatic or manual activation. Automatic transport selection can be based, for example, on at least one of power management criteria 228, radio frequency quality measurements 230 and network criteria 232. Manual transport selection 234 may be provided by a user during regular operation, either through a button press or through a user interface on, for example, a mobile communication device 104 (see FIG. 1) or another Bluetooth enabled wireless device to which a dual mode Bluetooth headset 102 is paired. A manual transport selection user interface may be coupled to the headset 102 as well. For example, if a user were to notice degradation over the voice link, the user could change modes using the headset man-machine interface to try to take advantage of the performance of the other link mode. Accordingly, a hardware and/or software switch 244 for transport selection of one of the transports for real-time audio signal communication may be manually activated and/or automatically activated and based upon operating conditions.

[0032] Automatic transport selection can be based on one or more of different criteria including power management criteria 228, radio frequency quality measurements 230 and network criteria 232. It is understood that any automatic transport selection criteria is within the scope of this discussion. If more than one criterion is considered, weighting of criteria or other criteria characterization may provide a determination of which criterion or criteria is controlling. Moreover, additional criteria or fewer criteria than those mentioned may be considered as well.

[0033] The automatic transport selection according to power management criteria 228 can include that the components of the device reach or exceed threshold values for a battery meter indicator or current drain measurement. The automatic transport selection according to radio frequency quality measurements 230 can include that the radio frequency quality is based on a Signal-to-Noise measurement, a channel map classification based upon number of channels with measured interference, a link quality measurement, a lost packets threshold, a missed packets threshold, a header errors threshold or a packet error rate threshold. The automatic transport selection according to network criteria 232 can include that the network criteria is based on a wide area network indicator, a packet scheduling requirement for co-existence between wide area network and short range radio network, a system latency requirement, a system jitter requirement or a system bandwidth requirement for data rate. The decision controller 242 may then operate according to instructions of the selecting module 126 and one or more of the power management criteria module 128, the radio frequency management module 130, the network criteria module 132 and/or the manual selection module 134 to activate the SCO mode 236 and/or the ACL mode 238, sequentially or simultaneously.

[0034] FIG. 3 is a signal flow diagram 300 for two devices, in this example a handset 302 and a headset 304 when the handset 302 is the initiator. When the headset 304 is the initiator, the signaling diagram can be illustrated in the similar manner by exchanging the role of handset 302 and headset 304. The signal flow diagram illustrates messages that may be exchanged between the handset 302 and the headset 304 to enable the switching synchronization between the handset 302 and the headset 304.

[0035] The handset 302 may transmit a request switching signal 346 to the headset 304. The headset 304 may transmit an acknowledgement (ACK) signal 348 in response. The handset 302 may transmit a ready to switch with timing information query 350. The timing information may be exchanged to enable the synchronization between the handset 302 and the headset 304. The headset 304 may transmit an ACK signal 352 with any timing information in response. The switching may then occur 354 between the two devices so that the devices 302 and 304 may bi-directionally communicate real-time audio signals over a synchronous circuit-switched transport and an asynchronous packet-switched transport over the short range radio link either sequentially or simultaneously.

[0036] FIG. 4 is an architecture diagram 400 including a mode controller 456. Mode controller may include a decision making level indicated by the decision controller 442 as illustrated in FIG. 2 as 242, a preparation level indicated by the synchronization controller 446 and an executing level indicated by the switch 444 in combination with the queue controller 440. As discussed above, the decision controller 442 may receive signals from one or more of the power management criteria input 428, the RF quality measurements input 430, the network criteria input 432, and the manual control input 434. The decision controller 442 can decide when to switch from SCO to ACL or vice-versa based on the inputs that can include the described four inputs.

[0037] The preparation level can contain a synchronization controller 446. A signal flow diagram of the synchronization controller 446 is illustrated in FIG. 3 previously discussed. The executing level can provide the switch 444 between the SCO and ACL after the time/signaling messages are exchanged between the headset 102 (see FIG. 1) and the handset 104 to synchronize the switching. The hardware and/or software switch 244 (see FIG. 2) for transport selection of one of the transports for real-time audio signal communication may be manually activated and/or automatically activated and based upon operating conditions to choose between the SCO transport 436 which may be the default transport, and the ACL transport 438. While the decision to switch is made by the decision controller 442, the operation to switch may be performed by a software and/or hardware switch 444 and a queue controller 440 at the executing level. The queue controller 440 operation may be performed between the switch 444 and the encoder / decoder 411 such as a codec (D/A-A/D).

[0038] A description of a queue controller 440 is **hereby incorporated by reference to substantially simultaneously filed** METHODS AND DEVICES OF A QUEUE CONTROLLER FOR DUAL MODE BIDIRECTIONAL AUDIO COMMUNICATION, **on the date of 31 October 2006, having received a serial number ____________, and patent number ________________.** The output of the switch 444 is processed by a queue controller 440 that can be configured to deliver at least one packet between transmission of the synchronous transport 436 and the asynchronous transport 438. That is, upon transport selection according to the selection module 126 (see FIG. 1), the switch between the synchronous circuit-switched transport and an asynchronous packet-switched transport can be processed by the queue controller 440 that can be configured to deliver at least one packet to the encoder/decoder when at least one of a wireless audio terminal and an audio gateway is in audio communication.

[0039] The described dual mode headset 102 (see FIG. 1) can have a single D/A and A/D encoder/decoder that may be a codec that can support both types of encoded packets, SCO and ACL carrying voice payload. The encoder/decoder can have two queues including a first queue 562 (see FIG. 5) for incoming packets, for example from a microphone, and including a second queue 564 for outgoing packets, for example to a speaker. The packets from SCO and ACL links can have different encoder parameters such as different packet sizes, packet types, or sampling rates. Accordingly, the mode controller 456 (see FIG. 4) can monitor the buffers when switching between the SCO and the ACL modes.

[0040] FIG. 5 illustrates some processes of the above-mentioned queue controller. To prevent the encoder 511 processing the outgoing queue 564 from not receiving required data and thus being rendered inoperable, the queue contents can be flushed and/or cleared when switching between modes and the packet generator 566 can pad the queue during the mode switch. That is, heterogeneity of the queue can render the encoder inoperable. For example, measures can be taken to determine, based on a first encoder parameter and a second encoder parameter, whether the queue 564 anticipates to contain heterogeneous audio packet types, that is a group of audio packets with differing encoder parameters. Heterogeneous packet types can arise from different encodings for the SCO and ACL modes such as different sampling rates and quantization. If the queue contains packets with different encoding, then the queue 564 is changed from having heterogeneous packet types to a queue having homogeneous packet types, that is a group of audio packets with identical encoder parameters. In one embodiment, the packets generator 566 can supply empty packets in case of stream interruption. In another embodiment the packets generator 566 may use a packet concealment or interpolation method to enhance the user's perceivable quality of experience. Empty packets from the empty packet generator 566 can be processed in queue 562 or queue 564.

[0041] As mentioned above, the SCO and the ACL may be processed sequentially or simultaneously. In a sequential processing the switch may be characterized as a hard handoff. In simultaneously processing, the switch may be characterized as a soft handoff. Different conditions are considered for a soft handoff or a hard handoff as is described below. Since a payload of a single input stream may be processed by the encoder/decoder 511, there may be processing overhead in terms of time taken to establish a new link when there is a change in transport. In a soft handoff, there can be a period of time where two transports are processed simultaneously. As the first transport continues through the queue controller input queue, a second transport can be buffered. Once the second is buffered, the first transport can be flushed and the second transport can populate the queue. In this way, there may be simultaneous processing of two transports. As discussed in more detail below, a "make before break" soft handoff process may involve packet concealment. On the other hand, in a hard handoff the first transport can be flushed and the second transport can be populated sequentially, but at the cost of the time taken to establish a new link when there is a change in transport. As will be discussed in more detail below, a "break before make" hard handoff process may involve empty packets and/or packet concealment.

[0042] It is understood that the queue controller 558 and handoff process are slightly different but may be considered inter-related. The queue controller 558 can prevent buffer under or over-runs for the pulse code modulated (PCM) data to and from the D/A and A/D in the cases when the encoder parameters are changed. For example, parameters can be changed when going from a case where the sampling rate is 8 KHz to one where the sampling rate is 16 KHz or even 44.1 KHz, thus changing from SCO audio to wideband ACL packetized audio or even stereo audio. The queue controller 540 may be needed in any instance where the encoder parameters changed because in that instance the 8 KHz audio packets in the buffer could not be consumed by the codec when it was operating at another sampling rate, 16 KHz, and would cause the encoder to become inoperable.

[0043] In the above-discussed case, the 8 KHz samples may be flushed and filled with packets to prevent the D/A from starving. Empty packets or some form of packet concealment may fill the packets when the encoder parameters change, for example sampling rate and packet size.

[0044] A hard handoff, or a "Break before Make" connection, can be utilized where the device 102 (see FIG. 1) terminates a SCO connection for audio and then brings up an ACL connection for audio, or vice-versa. Similarly a soft handoff or "Make before Break" connection can be utilized where the device 102 brings up an ACL channel for audio before terminating the SCO channel for audio so for a brief period of time both connections may be broadcasted simultaneously.

[0045] A soft handoff may take place without loss of information and therefore the switch can appear seamless to the user. However, a soft handoff may require more processing power and memory to maintain. Therefore the limitations on handoffs may be implementation and hardware specific, though power/battery life can be a control, specifically utilizing hard handoffs when battery power is low. Soft handoffs may not require empty packet transmissions and the hard handoff may be discernable to the user since the connection may be broken and enough information may be lost.

[0046] As mentioned, the handoffs may be related to the queue controller. Described are four scenarios in particular since the operation of the queue controller 540 and handover mechanisms may not be necessarily dependent. The queue controller 540 may be utilized when either the soft or hard handoffs change the encoder parameters. For instance when going from SCO to ACL the sampling rate could change from 8 to 16 KHz to improve speech quality or when switching from

ACL to SCO the sampling rate may change from 16 KHz to 8 KHz since SCO may only support the lower audio quality.

[0047] As mentioned there are four scenarios discussed below. Hard handovers may include two scenarios, specifically, the same encoder parameters, and a change in encoder parameters. The hard handover case may require the queue controller 540 to send empty packets or conceal packet losses since the connection may be broken, information will be lost, and then a new connection will be re-established. The steps for each may be:

1. Receive signal to change transports;
2. Break SCO or ACL connection;
3. Make ACL or SCO connection; and
4. Prevent queue from starving regardless of change in codec parameters.

[0048] In the case of a soft handoff with the same codec parameters, the transmission of empty packets or concealment of packet losses may not be required since no data should be lost in such a scenario. The steps may be:

1. Receive signal to change transports;
2. Make additional ACL or SCO connection;
3. Break current SCO or ACL connection; and
4. Change inputs to D/A queue controller (Queue OUT) and similarly for A/D queue controller (Queue IN).

[0049] The case of a soft handover where the encoder parameters are changed may require the use of the Queue Controller 540 to insert new packets, not because data is lost but because of the change in sampling rates as illustrated in the previously mentioned figure. In this scenario the steps may be:

1. Receive signal to change transports;

2. Make additional ACL or SCO connection;

3. Break current SCO or ACL connection; and

4. Change inputs to D/A queue controller (Queue OUT) and add packets for transitioning of codec parameters and similarly for A/D (Queue IN) queue controller.

[0050] Still referring to FIG. 5, the timer 567 can implement synchronization between two devices as illustrated in the signal flow diagram of FIG. 3. The state machine 568 can be an event driver to control signals corresponding to a change in state or conditions as illustrated in FIGs. 2 and 4. The ACL path 569 can be the same respective paths of FIG. 7 to block 783, 785, and 786 to then be processed over the air link. The SCO path 570 can be the same respective paths of FIG. 7 to block 782 to then be processed over the air link.

[0051] Fig. 6 is a flowchart of a method 600 of a dual mode wireless device and/or a plurality of devices of a system according to an embodiment. The steps of the flowchart are described above with respect to the FIGS. As shown in FIG. 1, a short range radio link can be established for real-time audio signals received from a single source 620 according to establishing module 120 and/or 121 (see FIG. 1). As also shown in FIG. 1, real-time audio signals can be communicated bi-directionally over a radio link using a synchronous circuit-switched transport mode (e.g., SCO) 636 and/or using an asynchronous packet-switched transport mode (e.g., ACL) 638 in accordance with synchronous connection oriented communication module 122 and/or 123 and asynchronous connectionless communication module 124 and/or 125. FIGS. 2 and 4 illustrate one of the transports is selected for real-time audio signal communication based upon operating conditions 626, as described above and according to selecting module 126 and/or 127, power management criteria module 128 and/or 129, radio frequency quality measurement module 130 and/or 131, network criteria module 132 and/or 133 and/or manual selection module 134 and/or 135. FIGS. 4 and 5 show switching between one transport and the other is processed by the queue controller 640 according to queue controller module 140 and/or 141. It is understood that fewer or more steps may be included in the above-described method.

[0052] FIG. 7 depicts some architecture components 700 of a Bluetooth enabled I/O device such as a headset 102 (see FIG. 1). The mode controller 756, the switch 744, queue controller 740 and encoder 711 were discussed above. A microphone 780 may provide input to the encoder 711, and a speaker 781 may receive output from the decoder 711. When SCO audio transport is used, continuously variable slope delta (CVSD) encoding takes place within the hardware of the baseband processor 782.

[0053] When ACL audio transport is used, audio compression and decompression 783 takes place within an application layer 784. The ACL audio packets conform to data protocols such as a real-time transport protocol (RTP), a user datagram protocol (UDP), and an Internet Protocol (IP) 785. Packets may undergo header compression/decompression 786. A user interface 787 may be accessed using for example, a multifunction button, for manual control of switching between one transport and another.

[0054] Bluetooth profiles 788 may use the ACL transport. Such profiles can include signaling for a handsfree profile (HFP) and data for a serial port profile (SPP), a personal area networking profile (PAN), a service discovery application profile

(SDAP), and a generic access profile (GAP). Moreover, the ACL packets may further conform to protocols such as a logical link control and adaptation protocol (L2CAP), a link manager protocol (LMP), a service discovery protocol (SDP), and a Bluetooth network encapsulation protocol (BNEP) 789. Radio frequency communication protocol (RFCOMM) provides emulation of serial ports within L2CAP.

[0055] As described in detail above, during transmission and receipt of audio signals, and in particular voice signals, a Bluetooth device can switch between a synchronous circuit-switched transport and an asynchronous packet-switched transport, each having particular characteristics and benefits and are mutually exclusive for voice, except, for example during the switching process where they may be simultaneously transmitted. The ability to use two transports for bi-directional audio signals with the ability to seamlessly handoff between the two can significantly improve the voice quality over Bluetooth and the user's handsfree experience. In a system such as a Bluetooth headset and a Bluetooth enabled handset, one or the other device can make a transport selection of one of the transports for real-time audio signal communication based upon operating conditions and/or manual activation. Bluetooth devices and particularly, headsets enjoy popularity because they provide users the ability to communicate while seamlessly operating in different environments. Accordingly, providing improved voice quality over Bluetooth has become important for mobile device manufacturers. A headset as described above can be backwards compatible with an existing handset using the SCO transport. While a handset as described may operate better with a headset according to this disclosure. As described above, improvements made to bi-directional audio communication, and in particular voice quality over Bluetooth may be beneficial.

[0056] This disclosure is intended to explain how to fashion and use various embodiments in accordance with the technology rather than to limit the true, intended, and fair scope and spirit thereof. The foregoing description is not intended to be exhaustive or to be limited to the precise forms disclosed. Modifications or variations are possible in light of the above teachings. The embodiment(s) was chosen and described to provide the best illustration of the principle of the described technology and its practical application, and to enable one of ordinary skill in the art to utilize the technology in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims, as may be amended during the pendency of this application for patent, and all equivalents thereof, when interpreted in accordance with the breadth to which they are fairly, legally and equitably entitled.

CLAIMS:

1. An I/O device, comprising:

a controller;

a transceiver coupled to the controller, the transceiver configured to establish a short range radio link and bi-directionally communicate real-time audio signals over a synchronous circuit-switched transport and an asynchronous packet-switched transport over the short range radio link from a single source of real-time audio signals; and

a switch for transport selection of one of the transports for real-time audio signal communication based upon operating conditions.

2. The device of claim 1 wherein the I/O device is a wireless audio terminal.

3. The device of claim 1 wherein the I/O device is an audio gateway.

4. The device of claim 1 wherein the synchronous circuit-switched transport is a Bluetooth synchronous connection-oriented or extended synchronous connection-oriented transport.

5. The device of claim 1 wherein the asynchronous packet-switched transport is a Bluetooth asynchronous connection-oriented transport.

6. The device of claim 1 wherein transport selection is automatically activated.

7. The device of claim 6 wherein transport selection is based on at least one of power management criteria, radio frequency quality measurements and network criteria.

8. The device of claim 1 wherein transport selection is manually activated.

9. The device of claim 1, bi-directionally communicating real-time audio signals between the wireless audio terminal and the audio gateway over a synchronous circuit-switched transport and simultaneously an asynchronous packet-switched transport of the short range radio link.

10. The device of claim 1 wherein a switch is processed by a queue controller configured to deliver at least one packet between transmission of the synchronous transport and the asynchronous transport.

11. The device of claim 1 wherein audio signals are voice signals.

12. A method of an I/O device, comprising:

bi-directionally communicating with another I/O device over a short range radio link of real-time audio signals over a synchronous circuit-switched transport and an asynchronous packet-switched transport over the short range radio link from a single source of real-time audio signals; and

selecting one of the transports for real-time audio signal communication based upon operating conditions.

13. The method of claim 12, bi-directionally communicating real-time audio signals between the wireless audio terminal and the audio gateway over a synchronous circuit-switched transport and simultaneously an asynchronous packet-switched transport of the short range radio link.

14. The method of claim 12 wherein the synchronous circuit-switched transport is a Bluetooth synchronous connection-oriented or extended synchronous connection-oriented transport.

15. The method of claim 12 wherein the asynchronous packet-switched transport is a Bluetooth asynchronous connection-oriented transport.

16. The method of claim 12 wherein transport selection is automatically activated.

17. The method of claim 16 wherein the transport selection is based on at least one of power management criteria, radio frequency quality measurements and network criteria.

18. The method of claim 12 wherein transport selection is manually activated.

19. The method of claim 12, further comprising:

switching processed by a queue controller configured to deliver at least one packet when the wireless audio terminal is switching audio communication between the synchronous transport and the asynchronous transport.

20. The method of claim 12 wherein audio signals are voice signals.

21. A method of a dual mode wireless headset system, including a wireless audio terminal and an audio gateway, the method comprising:

establishing a short range radio link between the wireless audio terminal and the audio gateway;

bi-directionally communicating real-time audio signals between the wireless audio terminal and the audio gateway over a synchronous circuit-switched transport and an asynchronous packet-switched transport of the short range radio link from at least one single source; and

selecting one of the transports for real-time audio signal communication based operating conditions of at least one of the wireless audio terminal and the audio gateway.

22. The method of claim 21 wherein the synchronous circuit-switched transport is a Bluetooth synchronous connection-oriented or extended synchronous connection-oriented transport.

23. The method of claim 21 wherein the asynchronous packet-switched transport is a Bluetooth asynchronous connection-oriented transport.

24. The method of claim 21 wherein transport selection is automatically activated.

25. The method of claim 25 wherein transport selection is based on at least one of radio frequency quality measurements, network criteria and power management criteria

26. The method of claim 21 wherein transport selection is manually activated.

27. The method of claim 21, further comprising:

switching processed by a queue controller configured to deliver at least one packet when the wireless audio terminal is switching audio communication between the synchronous transport and the asynchronous transport.

28. The method of claim 21, upon transport selection, further comprising:

switching between the synchronous circuit-switched transport and an asynchronous packet-switched transport that is processed by a queue controller configured to deliver at least one packet when at least one of the wireless audio terminal and the audio gateway is in audio communication.

29. The method of claim 21 wherein switching is processed by a queue controller configured to deliver at least one packet when the wireless audio terminal is switching audio communication between the synchronous transport and the asynchronous transport.

30. The method of claim 21 wherein audio signals are voice signals.

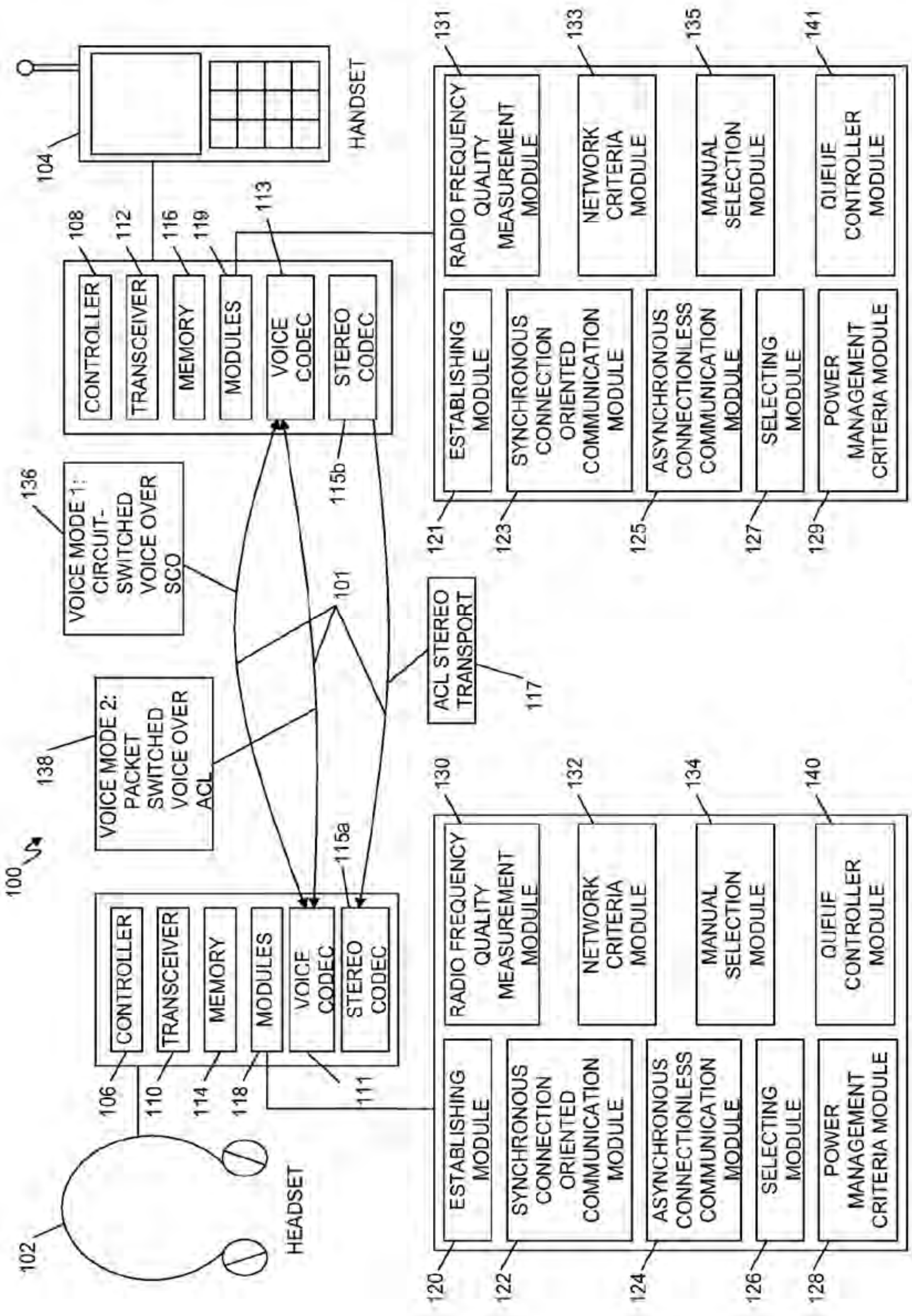

100
102
HEADSET
106
110
114
118
111
CONTROLLER
TRANSCEIVER
MEMORY
MODULES
VOICE CODEC
STEREO CODEC
115a
104
HANDSET
108
112
116
119
113
CONTROLLER
TRANSCEIVER
MEMORY
MODULES
VOICE CODEC
STEREO CODEC
115b
138
VOICE MODE 2: PACKET SWITCHED VOICE OVER ACL
136
VOICE MODE 1: CIRCUIT-SWITCHED VOICE OVER SCO
101
ACL STEREO TRANSPORT
117
120
ESTABLISHING MODULE
122
SYNCHRONOUS CONNECTION ORIENTED COMMUNICATION MODULE
124
ASYNCHRONOUS CONNECTIONLESS COMMUNICATION MODULE
126
SELECTING MODULE
128
POWER MANAGEMENT CRITERIA MODULE
130
RADIO FREQUENCY QUALITY MEASUREMENT MODULE
132
NETWORK CRITERIA MODULE
134
MANUAL SELECTION MODULE
140
QUEUE CONTROLLER MODULE
121
ESTABLISHING MODULE
123
SYNCHRONOUS CONNECTION ORIENTED COMMUNICATION MODULE
125
ASYNCHRONOUS CONNECTIONLESS COMMUNICATION MODULE
127
SELECTING MODULE
129
POWER MANAGEMENT CRITERIA MODULE
131
RADIO FREQUENCY QUALITY MEASUREMENT MODULE
133
NETWORK CRITERIA MODULE
135
MANUAL SELECTION MODULE
141
QUEUE CONTROLLER MODULE

FIG. 1

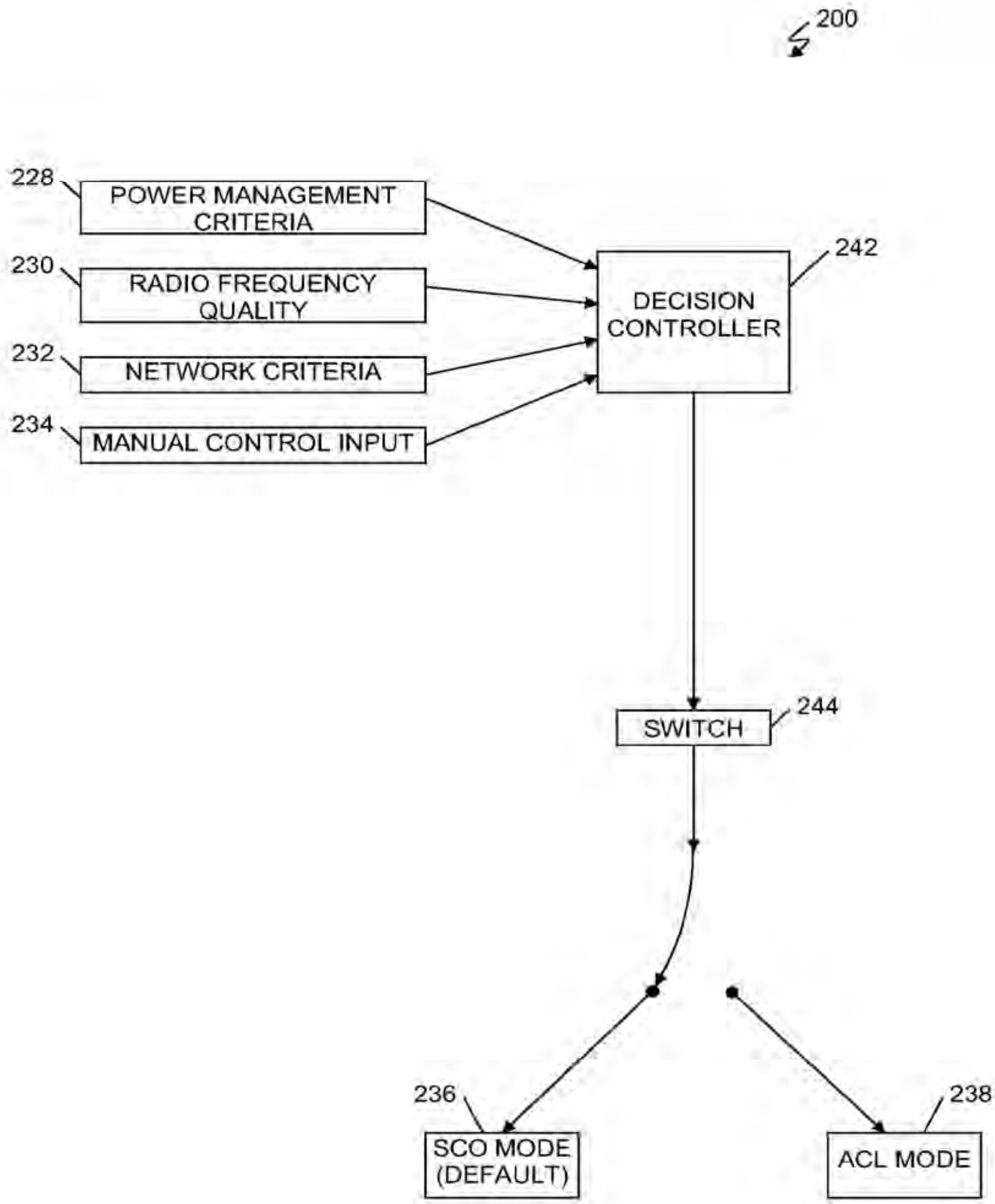

200
228
POWER MANAGEMENT CRITERIA
230
RADIO FREQUENCY QUALITY
232
NETWORK CRITERIA
234
MANUAL CONTROL INPUT
242
DECISION CONTROLLER
SWITCH
244
236
SCO MODE (DEFAULT)
238
ACL MODE

FIG. 2

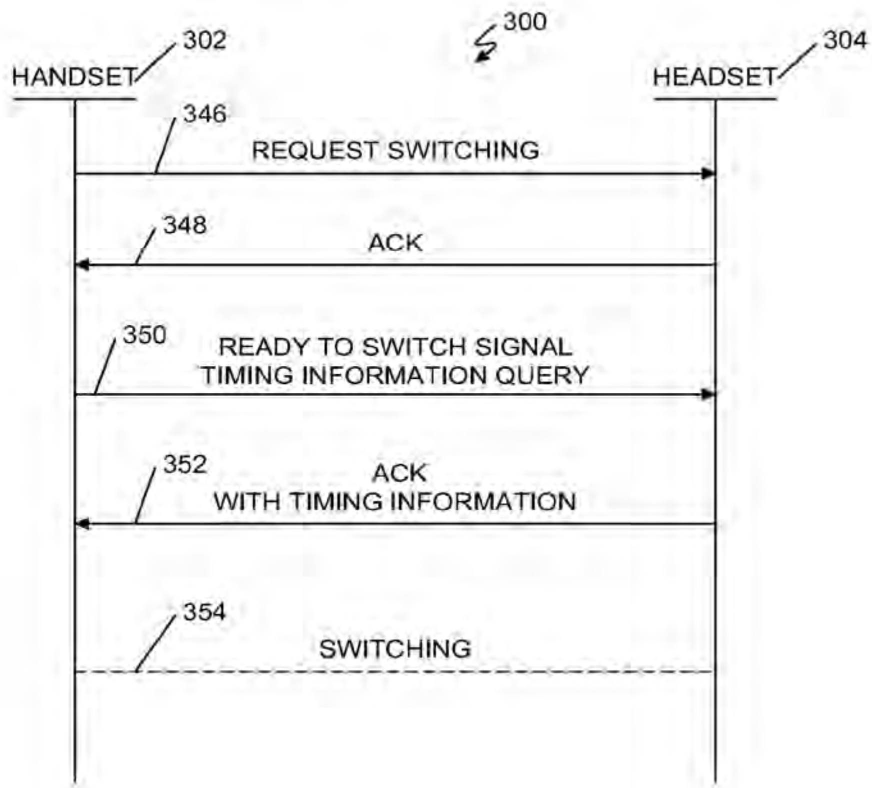

300
302
HANDSET
304
HEADSET
346
REQUEST SWITCHING
348
ACK
350
READY TO SWITCH SIGNAL
TIMING INFORMATION QUERY
352
ACK
WITH TIMING INFORMATION
354
SWITCHING

FIG. 3

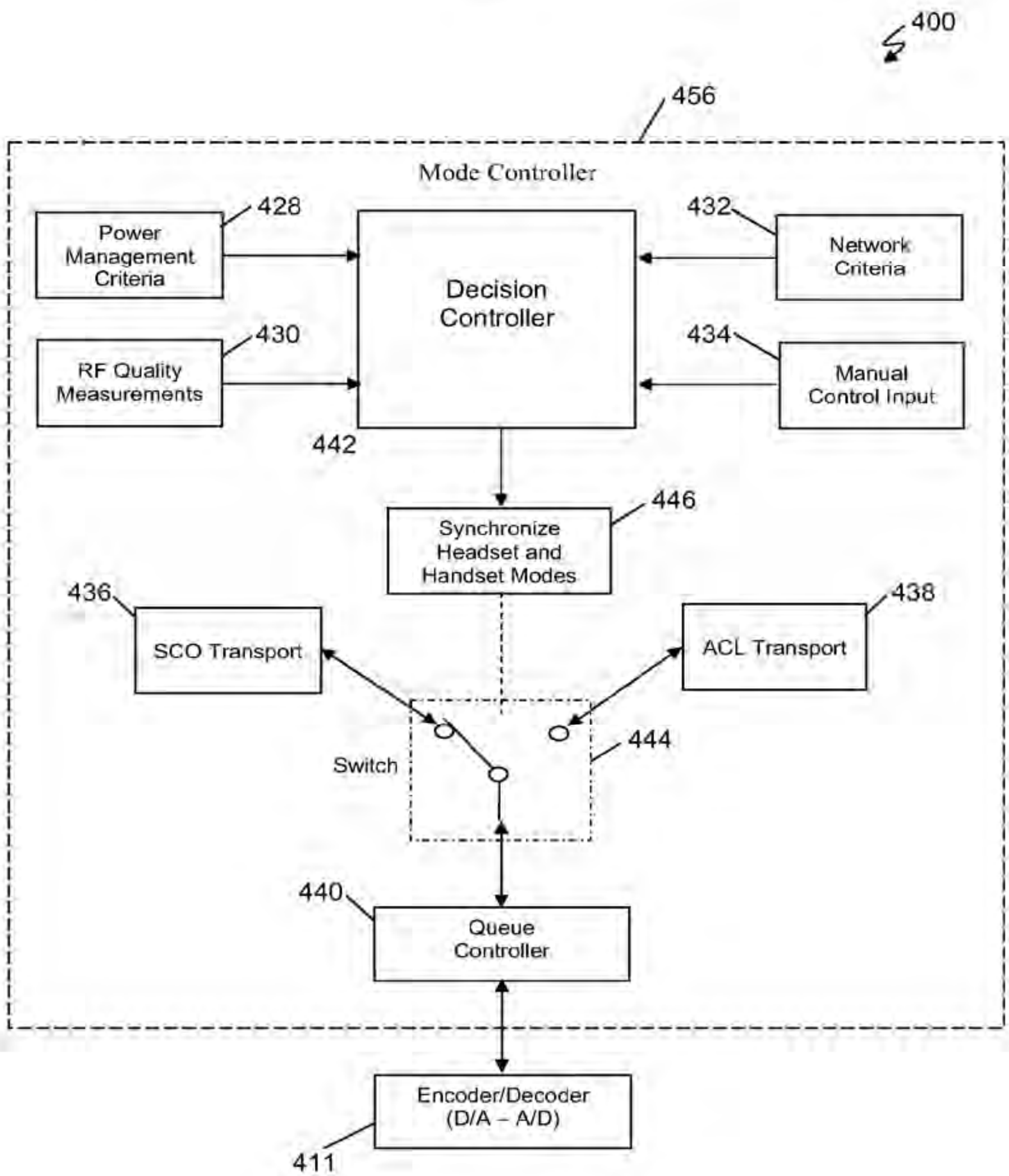

400
456
Mode Controller
Power Management Criteria
428
Decision Controller
432
Network Criteria
RF Quality Measurements
430
434
Manual Control Input
442
446
Synchronize Headset and Handset Modes
436
SCO Transport
438
ACL Transport
Switch
444
440
Queue Controller
Encoder/Decoder (D/A – A/D)
411

FIG. 4

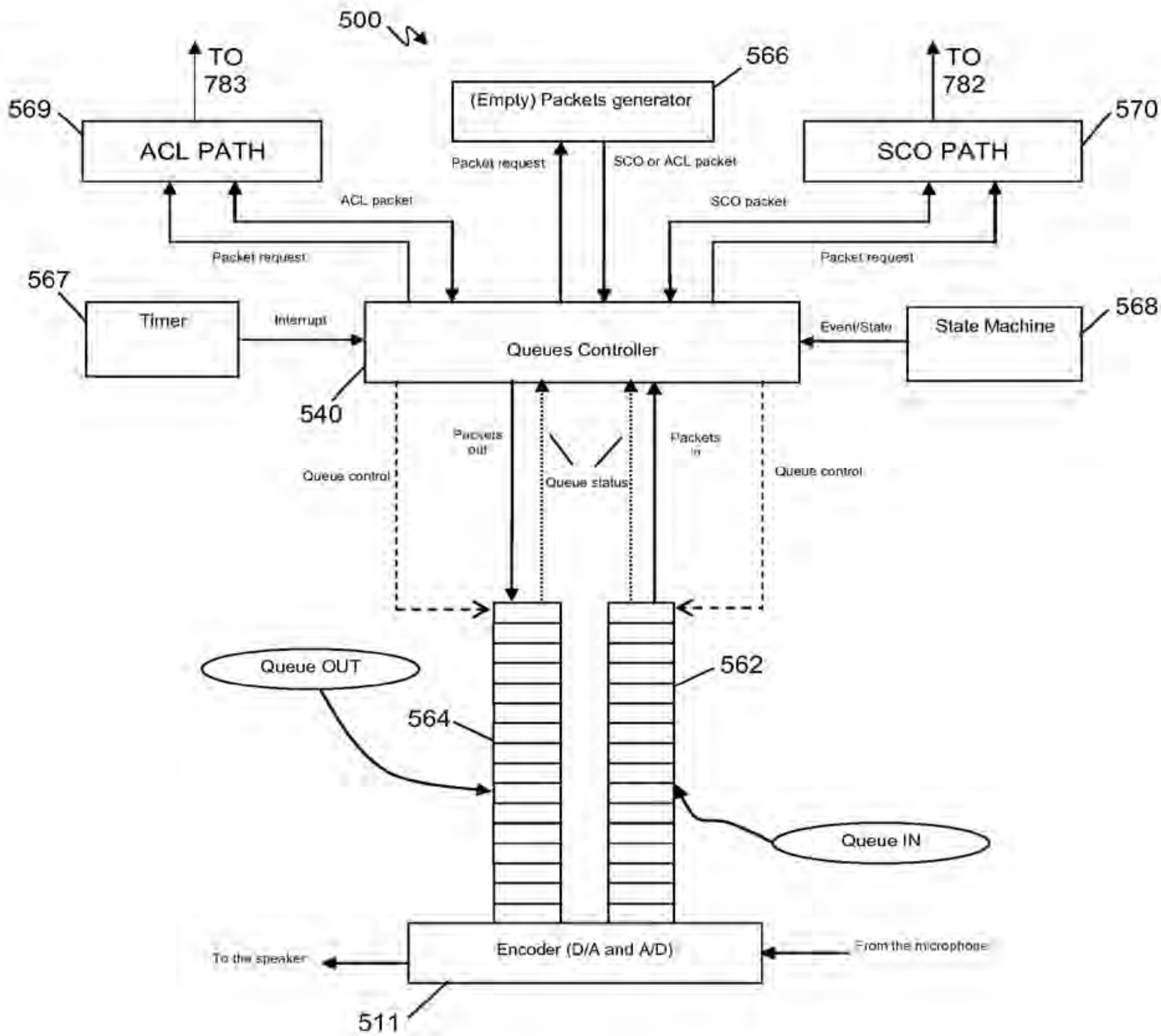

500
TO
783
569
ACL PATH
566
(Empty) Packets generator
TO
782
570
SCO PATH
Packet request
SCO or ACL packet
ACL packet
SCO packet
Packet request
Packet request
567
Timer
Interrupt
Queues Controller
Event/State
State Machine
568
540
Packets
out
Packets
in
Queue control
Queue status
Queue control
Queue OUT
564
562
Queue IN
To the speaker
Encoder (D/A and A/D)
From the microphone
511

FIG. 5

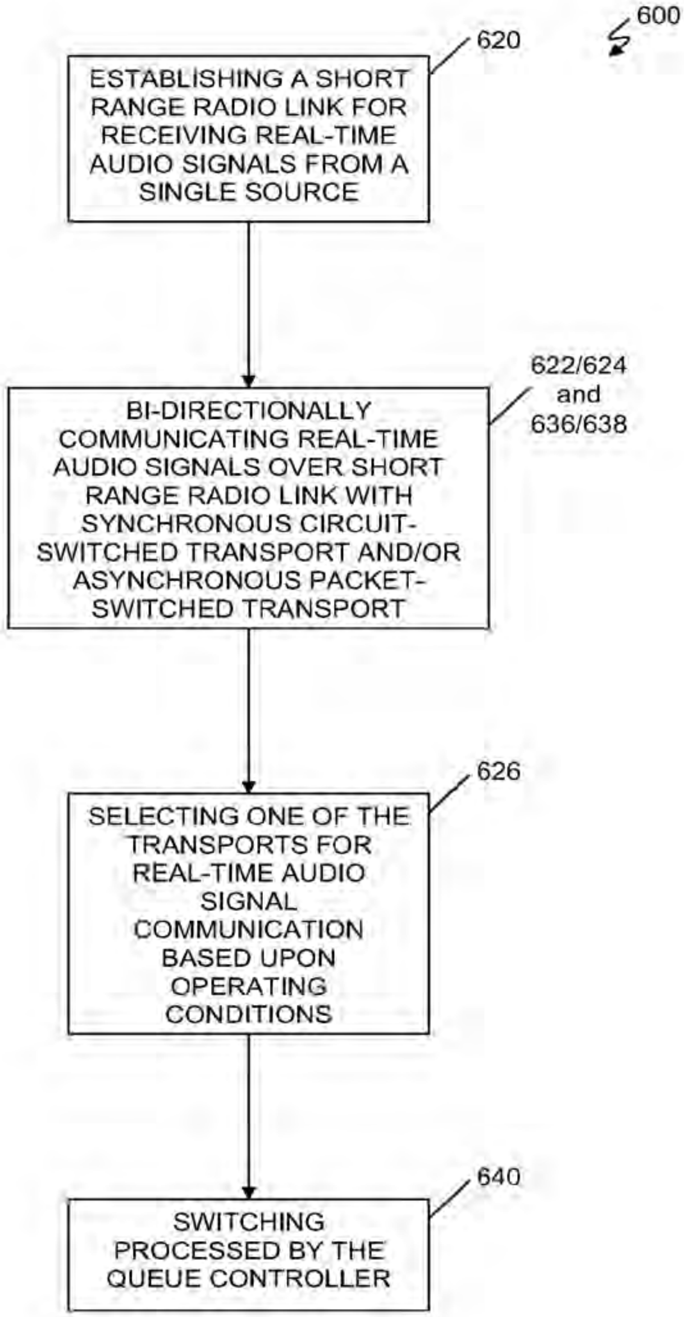

600
620
ESTABLISHING A SHORT RANGE RADIO LINK FOR RECEIVING REAL-TIME AUDIO SIGNALS FROM A SINGLE SOURCE
622/624 and 636/638
BI-DIRECTIONALLY COMMUNICATING REAL-TIME AUDIO SIGNALS OVER SHORT RANGE RADIO LINK WITH SYNCHRONOUS CIRCUIT-SWITCHED TRANSPORT AND/OR ASYNCHRONOUS PACKET-SWITCHED TRANSPORT
626
SELECTING ONE OF THE TRANSPORTS FOR REAL-TIME AUDIO SIGNAL COMMUNICATION BASED UPON OPERATING CONDITIONS
640
SWITCHING PROCESSED BY THE QUEUE CONTROLLER

FIG. 6

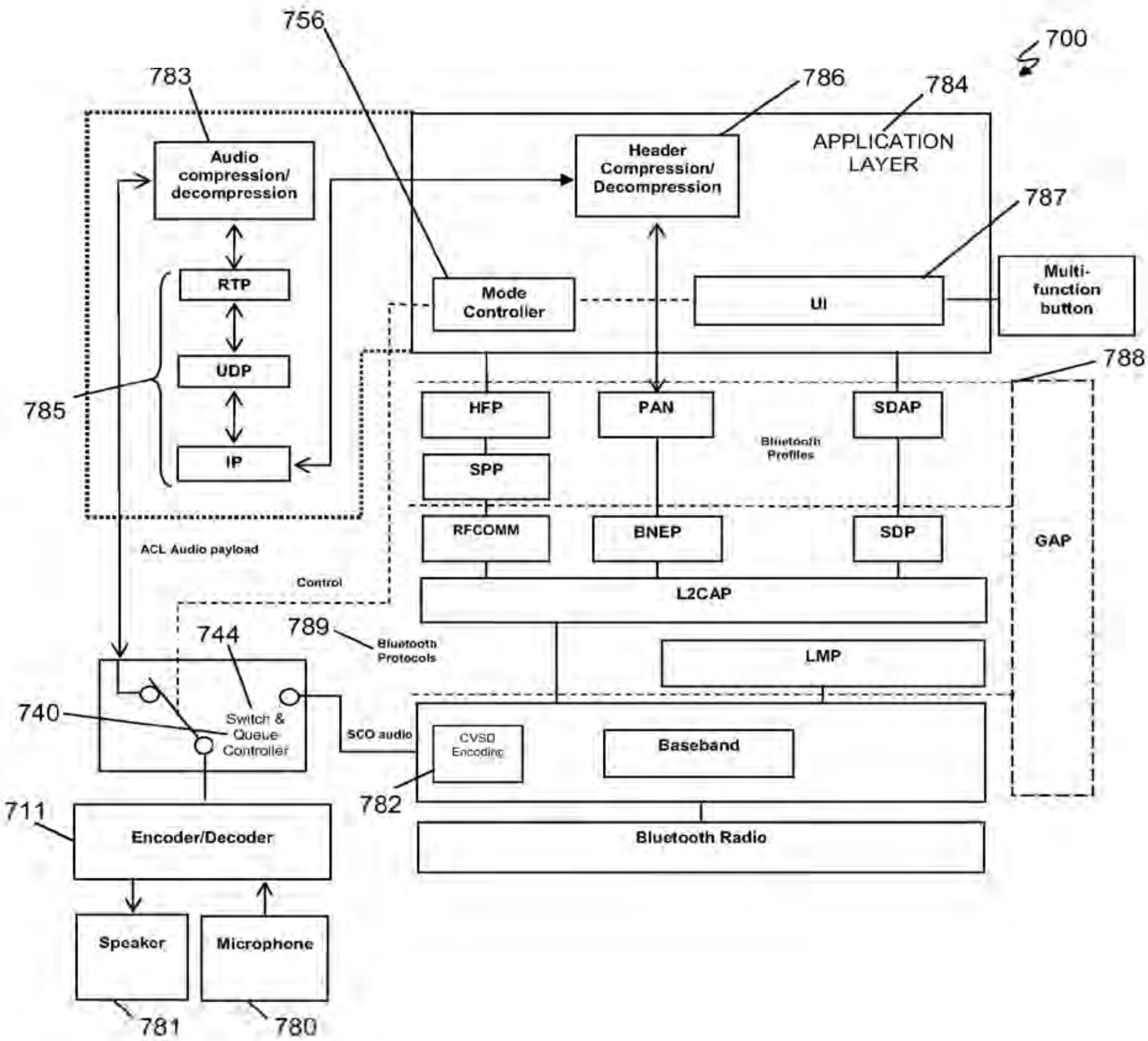

756
700
783
786
784
APPLICATION LAYER
Audio compression/ decompression
Header Compression/ Decompression
787
RTP
Mode Controller
UI
Multi-function button
UDP
788
785
HFP
PAN
SDAP
Bluetooth Profiles
IP
SPP
RFCOMM
BNEP
SDP
GAP
ACL Audio payload
Control
L2CAP
789
Bluetooth Protocols
744
LMP
740
Switch & Queue Controller
SCO audio
CVSD Encoding
Baseband
782
711
Encoder/Decoder
Bluetooth Radio
Speaker
Microphone
781
780

FIG. 7

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
9 July 2009 (09.07.2009)

PCT

(10) International Publication Number
WO 2009/086555 A1

(51) International Patent Classification: *H04R 25/00* (2006.01)

(21) International Application Number: PCT/US2008/088656

(22) International Filing Date: 31 December 2008 (31.12.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/009,690 31 December 2007 (31.12.2007) US

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH,

[Continued on next page]

(54) **Title:** ADJUSTABLE SHAPE EARPHONE

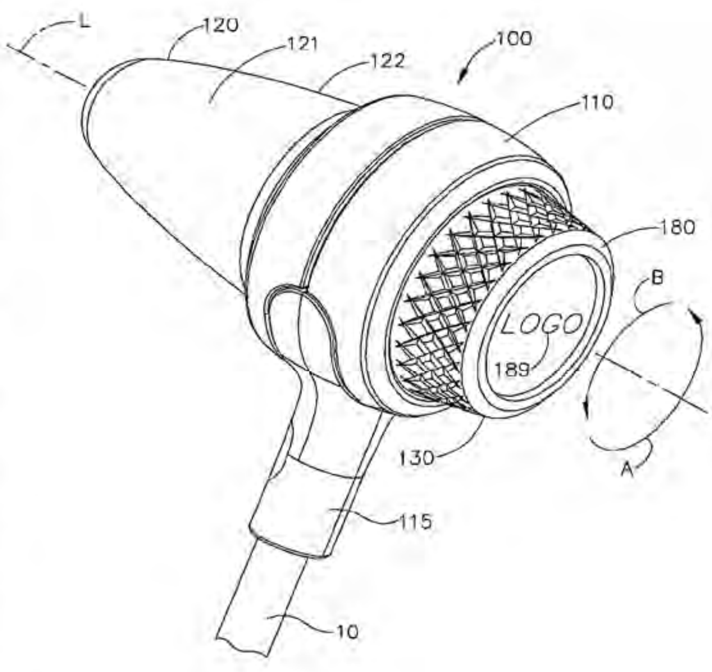

FIG. 1A

(57) Abstract: This disclosure relates to an adjustable ear insert, such as an earbud style earphone, that may be inserted in a user's ear canal in a compact configuration and adjusted by a user to expand and fit snugly against the ear canal.

WO 2009/086555 A1

GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *with international search report*

— *with amended claims*

TITLE

ADJUSTABLE SHAPE EARPHONE

PRIORITY CLAIM

The present application claims priority to U.S. provisional application Serial No. 61/009,690, titled "ADJUSTABLE FIT EARBUD, CLOTH COVERED CORD AND CORD CLIP ZIPPER," filed December 31, 2007, which is incorporated herein by reference in its entirety.

BACKGROUND

The present disclosure generally relates to adjustable ear inserts and more particularly to earphones for listening to audio media, such as that which may be played from portable audio devices.

Earphones are usually a pair of small loudspeakers that are provided with a mechanism to hold them close to a user's ears and a means of connecting them to a signal source such as an audio amplifier, radio, or portable audio device, such as a CD or MP3 player.

Earbuds are earphones of a small size that are placed directly outside or in the ear canal. Some earbuds, called external-canal earbuds, are designed to sit outside the ear canal. These are generally inexpensive and are favored for their portability and convenience. However, due to their inability to provide sound isolation, they are incapable of delivering the same dynamic range offered by many full-sized headphones and ear-canal earbuds (described below) for a given volume level. As a result, they are often used at higher volumes in order to drown out noise from the user's surroundings. Over time, earbuds became a common type of earphone bundled with portable audio devices.

Internal-canal earbuds are earbuds that are inserted directly into the ear canal. These offer portability similar to external-canal earbuds, and also act like earplugs to block out environmental noise. There are two main types of internal-canal earbuds: universal and custom. Universal internal-canal earphones provide one or more stock sleeve size(s) to fit various ear canals, which are commonly made out of silicone rubber, elastomer, or foam, for noise isolation. Universal internal-canal earbuds are marketed typically to casual listeners and are relatively inexpensive, though some offer very high audio quality.

Custom internal-canal earbuds are fitted to individuals. Castings of the ear canals are made, usually by an audiologist. The manufacturer uses the castings to create custom-molded silicone rubber or elastomer plugs that provide added comfort and noise isolation. Because of the individualized labor involved, custom internal-canal earbuds are more expensive than universal internal-canal earbuds.

Consequently, there is a need for improved internal-canal earbuds. The foregoing discussion is intended only to illustrate some of the shortcomings present in the field of the invention at the time, and should not be taken as a disavowal of claim scope.

SUMMARY

The present invention includes, in various embodiments, an adjustable shape earphone. In at least one embodiment, the earphone includes: (i) a housing having a first side and a second side; (ii) a resilient cushion attached to the first side of the housing, the resilient cushion having a compact shape and an opening; (iii) at least one cantilever arm protruding from the first side of the housing, where at least part of the cantilever arm is located within the opening of the resilient cushion; (iv) a dial rotatably mounted in the housing, where at least part of the dial extends from the second side of the housing and where the dial includes threads; and (v) an actuator comprising a first portion and a second portion, where the second portion has threads. The actuator is mounted slidably in the housing, and the actuator threads operably engage the dial threads such that rotation of the dial in a first direction translates the first portion of the rigid actuator into contact with the cantilever arm. Further, the first portion of the actuator is configured to bend the cantilever arm into the resilient cushion as the actuator contacts the arm, and the cantilever arm is subsequently configured to force the resilient cushion to have an expanded shape as the cantilever arm bends into the cushion.

In another embodiment, the adjustable earphone includes: (i) a housing having a first side and a second side, where the first side of the housing is configured to attach to a cushion; (ii) at least one cantilever arm protruding from the first side of the housing, where at least part of the cantilever arm is configured to be located within an opening of the cushion when the cushion is attached to the housing; (iii) a dial rotatably mounted in the housing, where at least part of the dial extends from the second side of the housing, and where the dial includes threads; and (iv) an actuator comprising a first portion and a second portion, the second portion having threads. The actuator is slidably mounted in the housing, with the actuator threads operably engaging the dial threads such that rotation of the dial in a first direction translates the first portion of the rigid actuator into contact with the cantilever arm. In addition, the first portion of the actuator is configured to bend the cantilever arm as the actuator contacts the arm.

In yet another embodiment, the adjustable earphone includes: (i) a housing; (ii) an ear canal portion adjacent to the housing, the ear canal portion having a first shape; (iii) and an adjustment assembly operably coupled to the housing. The adjustment assembly includes: (i) a movable member movable with respect to the housing between a first position and at least a second position; (ii) an expansion assembly configured to receive the movable member; and (iii) a control member configured to move the movable member such that actuation of the control member causes the movable member to move from a first position to at least a second position. Further, the movable member is configured to cause the expansion assembly to expand in at least one direction when the movable member is moved to the second position. Subsequently, the expansion assembly is configured to force the ear canal portion to have at least a second shape when the expansion assembly is expanded.

In yet other embodiments, the adjustable earphone includes: (i) an ear canal portion having a shape, where the ear canal portion is operable for placement in a user's ear canal; and (ii) means for adjusting the shape of the ear canal portion by a user when the ear canal portion is positioned in the user's ear.

In yet other embodiments, the present invention provides an adjustable ear insert including: (i) an ear canal portion configured for insertion in a user's ear canal, the ear canal portion having a first shape; and (ii) an adjustment assembly at least partially located within the ear canal portion, where the adjustment assembly is operable to cause the ear canal portion to have at least a second shape.

In yet other embodiments, the adjustable ear insert includes: (i) an inner end having an eartip, where the inner end is configured to be placed within an ear canal of a user; (ii) and an outer end having a control feature, where the outer end is configured to remain outside the ear canal, and where the control feature is accessible by the user to expand or compact the eartip.

In these and other various embodiments, an adjustable ear insert is capable of insertion into a user's ear canal and then may be adjusted by the user to create a snug fit between the ear canal and an ear canal portion of the adjustable ear insert. In other words, the ear canal portion is capable of being adjusted to substantially seal the ear canal portion against the user's ear canal. Where the adjustable ear insert is an earphone, such a snug fit or seal provides, among other things, enhanced noise isolation from external noises other than those produced by the earphone, and sound enhancement for sound produced by the earphone. Where the adjustable ear insert is an earplug, such a snug fit or seal provides, among other things, enhanced noise isolation from external noises. Further, the in-ear adjustability of the ear canal portion provides an ear insert that should not require different sized ear canal portions for different users.

BRIEF DESCRIPTION OF THE FIGURES

The features of the various embodiments are set forth with particularity in the appended claims. The various embodiments, however, both as to organization and methods of operation, may best be understood by way of example with reference to the following description, taken in conjunction with the accompanying drawings as follows.

FIG. 1A is a perspective view of a wired adjustable earphone according to one non-limiting embodiment.

FIG. 1B is a is a perspective view of a wireless adjustable earphone according to one non-limiting embodiment

FIGS. 2A-2B are diagrams showing compact and expanded shapes of various ear canal portions of adjustable earphones according to various embodiments.

FIGS. 3A-3D are several top views of adjustable earphones using a variety of user controls and actuator mechanisms to provide an adjustable earphone according to various embodiments.

FIG. 4 is a side cross-sectional view of one non-limiting embodiment of an adjustable earphone.

FIGS. 5A-5G are several illustrations of some of the various ear canal portion shapes made possible by the adjustable earphone of FIG. 4.

FIG. 6 is an exploded view of the adjustable earphone of FIG. 4.

FIG. 7 is a side cross-sectional view of one non-limiting embodiment of an adjustable earphone.

FIGS. 8A-8G are several illustrations of some of the various ear canal portion shapes made possible by the adjustable earphone of FIG. 7.

FIG. 9 is an exploded view of the adjustable earphone of FIG. 7.

FIG. 10 is a top cross-sectional view of one non-limiting embodiment of an adjustable earphone.

FIGS. 11A-11H are several illustrations of some of the various ear canal portion shapes made possible by the adjustable earphone of FIG. 10.

FIG. 12 is an exploded view of the adjustable earphone of FIG. 10.

FIG. 13 is a top cross-sectional view of one non-limiting embodiment of an adjustable earphone.

FIGS. 14A-14C are several illustrations of some of the various ear canal portion shapes made possible by the adjustable earphone of FIG. 13.

FIG. 15 is an exploded view of the adjustable earphone of FIG. 13.

FIG. 16 is a cross-sectional view of one non-limiting embodiment of an adjustable earphone inserted and expanded in a user's ear canal.

FIGS. 17A-17B are perspective views of a non-limiting embodiment of an eartip cushion and a base housing element of an adjustable earphone.

FIG. 18A is a perspective view of an earphone assembly including a cord wrapped around an audio device.

FIG. 18B is a perspective view of a portion of an earphone assembly including a cord only partially wrapped around an audio device.

FIG. 19A is a perspective view of an adjustable earphone from the earphone assembly of FIG. 18A and 18B.

FIG. 19B is an illustration of a spring clip from the earphone assembly of FIGS. 18A and 18B.

FIG. 19C is an illustration of the spring clip of FIG. 19B being used to hold in place the wrapped cord of the earphone assembly of FIG. 18A.

FIG. 20 is a perspective view of one non-limiting embodiment of an adjustable earphone having a rotatable dial.

FIG. 21A is an exploded view of the adjustable earphone of FIG. 21A.

FIG. 21B is an exploded view of an ear canal cushion and part of a housing of the adjustable earphone of FIG. 21A.

FIG. 22 is a front view of the adjustable earphone of FIG. 21A.

FIG. 23 is a side view of the adjustable earphone of FIG. 21A.

FIG. 24 is a perspective cross-sectional view, taken along line 24-24 in FIG. 22, of the adjustable earphone of FIG. 21A.

FIG. 25 is a top cross-sectional view, taken along line 25-25 in FIG. 22, of the adjustable earphone of FIG. 21A, with an ear canal portion shown having a compact, first shape.

FIG. 26 is a top cross-sectional view, taken along line 26-26 in FIG. 22, of the adjustable earphone of FIG. 21A, with the ear canal portion shown having an expanded, second shape.

FIG. 27 is a side cross-sectional view of the adjustable earphone of FIG. 21A inserted and expanded in a user's ear canal.

FIG. 28 is a top cross-sectional view of one non-limiting embodiment of an adjustable earphone having a push button.

DETAILED DESCRIPTION

Certain exemplary embodiments will now be described to provide an overall understanding of the principles of the structure, function, manufacture, and use of the devices and methods disclosed herein. One or more examples of these embodiments are illustrated in the accompanying drawings. Those of ordinary skill in the art will understand that the devices and methods specifically described herein and illustrated in the accompanying drawings are non-limiting exemplary embodiments and that the scope of the various embodiments of the present invention is defined solely by the claims. The features illustrated or described in connection with one exemplary embodiment may be combined with the features of other embodiments. Such modifications and variations are intended to be included within the scope of the present invention.

In the following description, like reference characters designate like or corresponding parts throughout the several views. In addition, in the following description, it is to be understood that such terms as "forward," "rearward," "front," "back," "right," "left," "upwardly," "downwardly," and the like are words of convenience and are not to be construed as limiting terms. The description below is for the purpose of describing various embodiments of the invention and is not intended to limit the invention thereto.

The various embodiments described herein are directed to devices intended to be placed in an ear canal, such as an earphone assembly usable with an audio device. Referring to FIGS. 18A and 18B, an earphone assembly 5 includes a cord 10 and a pair of earphones 100. The cord 10 has a first end 11, a second end 12, and an electrical connector 13 located at the first end 11. The electrical connector 13 connects the earphone assembly 5 to an audio device 1 such that electrical signals may be conveyed through the cord 10, to each earphone 100, where the electrical signal may be converted to audible sounds by a transducer (see, e.g., FIGS. 24 and 27). As is known in the field, a transducer is a device, usually electrical, electronic, electro-mechanical, electromagnetic, photonic, or photovoltaic, that converts one type of energy or physical attribute to another for various purposes, including producing audible sounds. The term transducer may be used to refer to an audio loudspeaker, which converts electrical voltage variations representing music or speech, to mechanical cone vibration, and hence vibrates air molecules creating sound.

Each earphone 100 is located at the second end 12 of the cord. The cord 10 further includes a first portion 16 adjacent to the first end 11 of the cord 10 and a second portion 17 adjacent to the second end 12 of the cord 10. The first portion 16 includes a single strand and the second portion 17 includes two strands such that the two earphones 100 may be placed in the ears of a user, with one strand of the second portion 17 on each side of the users head.

As shown in FIGS. 1A and 1B, a wired (FIG. 1A) or wireless (FIG. 1B) earbud style earphone (100, 50 respectively) according to an aspect of the present disclosure includes an eartip cushion 121 that may be inserted in a user's ear canal in a compact configuration, or first shape 122, and, once in the ear canal, expanded to an expanded configuration, or second shape 123 (see FIG. 26), to fit snugly against all sides of the ear canal (see, e.g., FIG. 27). The resulting customized fit provides improved audio isolation by blocking external sounds from reaching the user's eardrum, as well as improved comfort by allowing the user to determine the amount of pressure exerted by the eartip, or ear canal portion 120, on the interior of the ear canal. Further, forming a near airtight seal between the ear canal portion 120 and the user's ear canal should not only reduce the outside ambient noise that reaches the user's eardrum, but should also provide a sound transducer (see FIGS. 24 and 27) of the earphone 120 with a 1:1 acoustic coupling with the user's eardrum, thus enhancing the audible sound perceived by the user. The eartip cushion 121 may be fabricated from a foam material. While the earphone of FIGS. 1A or 1B will typically be returned to its compact configuration, or first shape 122, prior to removal from the user's ears, the compressible material of the eartip, or ear canal portion 120, may allow the earbud to be removed while still in its expanded configuration.

Still referring to FIGS. 1A and 1B, expansion of the eartip may be achieved by twisting or pressing on a control 180 on an exterior surface of the earbud. Where expansion is achieved by twisting a control 180 about longitudinal axis L in the direction of arrow A and/or B, a manufacturer's logo

189 displayed on the control 180 may be attached to the control by a mechanism (described below) that allows the logo 189 to remain substantially upright and readable regardless of the rotation of the control 180.

In various embodiments, referring now to FIGS. 20-27, an adjustable earphone, such as adjustable earphone 100, for example, can comprise a housing 110, an ear canal portion 120, and an adjustment assembly 130. The housing may have a first side 111 and a second side 112 (see FIG. 21A and 24). Adjacent to and attached to the first side 111 of the housing is the ear canal portion 120. Ear canal portion 120 generally defines longitudinal axis L (see FIG. 20) and is operable for placement in a user's ear canal (see, e.g., FIG. 27). Ear canal portion 120 is shown in FIG. 20 having a shape that includes a compact, first shape 122 to facilitate initial placement of the ear canal portion 120 in the user's ear canal and may include a cushion 121 (see FIGS. 21A and 21B). Cushion 121 generally has an opening 125 that, as is described in more detail below, may receive part of an expansion assembly 160. Further, cushion 121 includes a housing groove 127 (FIG. 24) designed to receive or snap on a protruding ring 118 of the housing 110 such that cushion 121 may attach releasably to the housing 110. Cushion 121 may be stretchable and made of a resilient, compressible material. The resilient material may include a foam, a memory foam, a closed-cell foam, an open-cell foam, an elastomer, an elastomeric foam, silicone, and/or rubber. The ear canal portion 120, including cushion 121, may be capable of being adjusted to have an expanded, second shape 123 (see FIG. 26). Further, ear canal portion 120, including cushion 121, may also be capable of being adjusted to have intermediate shapes, or at least a third shape (not shown). In other words, the shape of the ear canal portion 120 may be changed to have any number of shapes, including a continuum of shapes between the first shape 122 and the second shape 123. The purpose of adjusting the shape of the ear canal portion 120 is to allow a user to change the shape of the ear canal portion 120, after insertion in the user's ear canal, to have a snug fit between the ear canal and a substantial part of the ear canal portion 120. Such a snug fit provides noise isolation (from external noises other than those produced by the earphone 100) and sound enhancement (for sound produced by the earphone 100), among other things. Further, the in-ear adjustability of the ear canal portion 120 provides an earphone 100 that should not require different sized ear canal portions 120 or cushions 121 for different users; in other words, the adjustable earphone 100 may provide a one-size-fits-all device owing to the customized fit offered by the adjustability of the ear canal portion.

In various embodiments, referring again to FIGS. 20-27, the adjustable earphone 100 may include means for adjusting the shape of the ear canal portion 120 by a user when the ear canal portion 120 is positioned in the user's ear canal. Means for adjusting the shape of the ear canal portion 120 may be provided in at least one embodiment by adjustment assembly 130. Adjustment assembly 130 may be operably coupled to the housing 110 and/or to the ear canal portion 120 such that actuation of the adjustment assembly 130 causes the ear canal portion 120 to have at least a second shape 123.

Generally, according to various non-limiting embodiments, the adjustment assembly 130 may include a movable member 140, an expansion assembly 160, and a control member 180. The movable member 140 may be movable with respect to the housing 110 between a first position (see FIG. 25) and at least a second position (see FIG. 26). The expansion assembly 160 may be configured to receive the movable member 140, and the control member 180 may be configured to move the movable member 140 with respect to the housing 110. Actuation of the control member 180 may cause the movable member 140 to move from the first position (see FIG. 25) to the second position (see FIG. 26). The movable member may be configured to cause the expansion assembly 160 to expand in at least one direction when the movable member is moved to the second position (FIG. 26). Relatedly, the expansion assembly may be configured to force the ear canal portion 120 to have at least a second shape 123 when the expansion assembly 160 is expanded. Conversely, the expansion assembly 160 may be configured to retract in at least one direction when the movable member is moved to the first position (FIG. 25), thus resulting in the ear canal portion returning to the first shape 122 when the expansion assembly 160 is retracted.

In more detail, according to at least one non-limiting embodiment, the movable member 140 may include a first portion 150 and a second portion 142 that together serve as an actuator (see FIGS. 21A and 24), as explained in more detail below. Generally, the movable member moves along longitudinal axis L (see FIG. 20) and is designed to move relative to the housing such that the first portion 150 of the movable member 140 may engage the expandable member 160 when moved accordingly. Such relative movement is caused by force exerted on the movable member by a user adjusting control member 180, as described below. This force may be provided by any number of mechanical mechanisms; here the movable member 140 receives a moving force from a threaded engagement between the control member 180 and the second portion 142 of the movable member 140 at threads 143 (see FIGS. 21A and 25). Threads 143 of the movable member 140 are designed to remain rotationally stationary relative to the housing 110 such that rotation of the control member 180 forces the movable member to translate with respect to the housing 110. This rotational stability is provided by guide protrusions 146 (FIG. 21A) on the second portion 142 of the movable member 140. Guide protrusions 146 are received slideably in guide recesses 114 (FIG. 21B) of the first side 111 of the housing 110 such that the second portion 142 of the movable member 140 may translate but will not substantially rotate with respect to the housing 110 owing to the interface between the protrusions 146 and the recesses 114.

Further, referring to FIGS. 21A, 24, 25 and 27, the second portion 142 may include a cavity 141 that is configured to support a transducer 190, part of the cord 10 electrically coupled to the transducer 190 (see FIG. 27), and the first portion 150 of the movable member 140. The second portion 142 may also include a slot 149 for passing the cord 10 into the cavity 141. Additionally, the second portion 142 may include locking grooves 147 and transducer supports 148. The first portion 150 of the movable member 140 may include locking protrusions 152 that are designed to be inserted and twisted into the locking grooves 147 of the second portion 142 such that transducer 190 is held in place, or sandwiched, between the first portion 150 and the second portion 142 of the movable member. Friction between the first portion 150, the transducer

190, and the supports 148 of the second portion 142 may provide sufficient force to prevent the protrusions 152 of the first portion 150 from freely decoupling from the locking grooves 147 of the second portion 142. Accordingly, the movably member 140, including the first and second portions 150, 142, is designed to move as a single rigid body relative to housing 110. Thus, while shown in at least one embodiment as two separable components, first and second portions 150, 142 could also be one unitary and integral component.

The first portion 150 of the movable member 140 is designed, in at least one non-limiting embodiment, to actuate expansion assembly 160 as the first portion 150 is moved from a first position (FIG. 25) to at least a second position (FIG. 26). The first portion 150 thus includes an actuating surface 155 (see, e.g. FIG. 24) that may be shaped and positioned such that the actuating surface 155 engages operably the expansion assembly 160, as explained in more detail below. The first portion 150 of the movable member 140 also may include a sound passageway 151 (FIG. 21A) oriented along longitudinal axis L. Sound passageway 151 provides a channel along which sound produced by the transducer 190 may travel freely toward an inner end 101 (FIG. 20) of the earphone 100 and into opening 125 (FIGS. 21A-26) of the cushion 121. Also, the first portion 150 includes an O-ring groove 153 (FIG. 21A) configured to hold an elastic O-ring 154. O-ring 154 seals the movable member against the first side 111 of the housing 110 and/or against the expansion assembly 160 (see FIGS. 25-26). Accordingly, audible sound waves produced by the transducer 190 only are allowed to travel toward the inner end 101 of the earphone 100, and, subsequently, a user's ear drum, via sound passageway 151 of the movable member 140.

According at least one non-limiting embodiment, referring now to FIGS. 21A-21B and 25-26, the expansion assembly 160 is designed to expand in at least one direction when actuated by the movable member 140. The expansion assembly 160 may be designed to expand in a direction substantially transverse to the longitudinal axis L (see FIG. 20). Here, this is accomplished by using a set of cantilever arms 161. The cantilever arms 161 protrude from the first side

111 of the housing and, when the resilient cushion 121 is attached to the housing, are at least partially located within the opening 125 of the cushion 121. Arm recesses 126 (FIG. 21B) formed in the cushion 121 receive the cantilever arms 161 such that the cushion 121 does not rotate freely thereon. The cantilever arms 161 are uniformly spaced around longitudinal axis L to form an opening 164 configured to receive the first portion 150 of the movable member. Cantilever arms 161 each include an inner surface 163 and an outer surface 162. Inner surface 163 is curved at least partially toward longitudinal axis L so that at least part of the inner surface 163 will make contact with the movable member's actuating surface 155 when the movable member 140 is advanced toward the inner end 101 of the earphone 100. The actuating surface 155 of the movable member 140 is curved correspondingly to meet the inner surface 163 of each cantilever arm 161. As the movable member 140 is moved toward the inner end 101 of the earphone 100, the actuating surface 155 of the first portion 150 of the movable member 140 makes contact with one or more of the cantilever arms 161 at inner surface 163. Further movement of the movable member 140 in the same direction pushes on the inner surface 163, thus forcing the cantilever arm 161 to bend away from longitudinal axis L (see FIG. 26). Because the cantilever arms 161 are received insertably in the opening 125 of the resilient cushion 121, the cantilever arm is bent into the cushion 121 as the movable member 140 contacts and pushes the cantilever arm 161. Consequently, as the cantilever arm is continually bent away from longitudinal axis L, the cushion 121 is forced to have an expanded, second shape 123 (see FIG. 26). Thus, the ear canal portion 120 may be expanded after insertion in a user's ear canal, substantially sealing the cushion 121 against the user's ear canal to form a snug fit.

Note that, while a plurality of cantilever arms 161 are described above as providing the expansion assembly 160 with the ability to expand, it is contemplated that any number of cantilever arms, including one, could perform the same or similar function.

According at least one non-limiting embodiment, the control member 180 is designed to actuate the movable member 140 such that the movable member

140 moves to cause expansion assembly 160 to expand in at least one direction. Control member 180 accomplishes this in any number of forms. For instance, but without limitation, control member 180 could be in the form of a push button, rotatable dial, or squeezable member. In FIGS. 20-27, for example, control member 180 is a dial 182 rotatably mounted in the housing 110. Dial 182 rotates, but does not translate with respect to housing 110. Dial 182 moves in such a fashion because it includes a protruding ring 184 (FIGS. 21A and 25) along its perimeter that slideably engages a groove 117 of the housing 110. Groove 117 is formed between a lip 113 of the second side 112, the first side 111, and cord guide 115 of housing 110 (see FIG. 25). Thus, dial 182 is rotatable about longitudinal axis L. Further, at least part of the dial may extend from the second side 112 of the housing 110 such that it is accessible to a user while ear canal portion 120 is inserted in the user's ear canal (see. FIG 27). Grips 185 (FIG. 21A) or another textured surface of the dial 182 may provide an enhanced user interface as the user rotates the dial with his or her fingers.

Referring to FIGS. 21A and 25, dial 182 may include a cavity 181 for insertably receiving the second portion 142 of the movable member. Further, the dial may have threads 183 formed in the inside of the dial, facing cavity 181. The threads 183 are configured to operably engage the threads 143 formed on the surface of the second portion 142 of the movable member 140. Thus, rotation of the dial 182 rotates dial threads 183, resulting in a translational force being applied to the movable member 140 via movable member threads 143. The translational force causes the movable member to move either forward, toward the inner end 101 of the earphone 100, or backward, toward an outer end 102, depending on the direction dial 182 is being rotated. Thus, the actuator or movable member threads 143 operably engage the dial threads 183 such that rotation of the dial 182 in a first direction translates the rigid actuator into contact or additional contact with each cantilever arm 161 (see FIGS. 25-26).

Focusing now on the other elements of earphone 100, the housing 110 may be adapted to receive a number of components, including a transducer

190. Also, cord 10 (FIGS. 18B and 27) is received in the housing 110 through cord passageway 116 of cord guide 115 (see FIG. 24). Cord guide 115 may also include a marking 119 to indicate in which ear, for example right ("R," as seen in FIG. 21A) or left ("L," not shown), a user should place the earphone 100. Cord 10 provides an electrical conduit between the electrical connector 13 and the transducer 190; part of the cord 10 may be electrically coupled to the transducer 190, for instance, an interior wire of cord 10 may be soldered to the transducer 190 (see FIG. 27). Transducer 190 is capable of producing audible signals, or sound, in response to electrical signals received by the transducer 190 from the electrical connector 13 via cord 10. To prevent undesired stress from being transferred to the transducer, the cord 10 may be tied to form a knot (FIG. 27) at the cord's second end 12 (FIG. 18B). This knot is received within the cavity 141 of the second portion 142 of the movable member 140 and is sized such that it is larger than the width of slot 149 (FIG. 24). Therefore, if a user pulls on cord 10, the knot is forced against the second portion 142 at slot 149 and the knot absorbs the stress created by such pulling, thereby shielding the transducer from unnecessary stress and/or strain.

Further, the second portion 142 of the movable member 140 may have a manufacturer's logo piece189 positioned near the outer end 102 of the earphone 100 (see FIGS. 1A, 20, 21A and 25). Logo piece 189 is press fit to the second portion 142 such that it is visible through dial 182 at the outer end 102. The logo piece182 is kept in a desired position, for example, approximately horizontal, when the cord 10 is hanging in a downward direction from a user's ear, for example similar to the orientation shown in FIG. 27. The logo piece 189 is kept in such a position because the logo piece 189 is secured to the non-rotating movable member 140 at second portion 142. While the logo 189 may translate with the movable member 140, it will not rotate with dial 182; therefore, it is prevented from rotating such that an observer easily may read the manufacturer's logo regardless of the rotation of dial 182.

The foregoing has focused on at least one embodiment for adjusting the shape of an eartip, or an ear canal portion, of an earphone while inserted in a user's ear canal. However, various embodiments are possible to accomplish the same or similar goal. As illustrated in FIGS. 2A-2E, expansion of the eartip 220 may be achieved in several ways. In a first embodiment (see FIG. 2A), where the eartip 220 is in a compact configuration 222 when unmodified, inner and outer sides 227, 228 of the eartip may be brought together to compress the material of the eartip 220, causing it to expand into an expanded configuration 223. In a second embodiment (see FIG. 2B), where the eartip 320 is in an expanded configuration 323 while unmodified, inner and outer sides 327, 328 of the eartip 320 may be pulled apart from each other to stretch the material of the eartip, causing it to change into a compact configuration 322. In a third embodiment (see FIG. 2C), where the eartip 420 is in a compact configuration 422 when unmodified, an outer portion 428 of the eartip may be squeezed, displacing eartip material into remaining portions of the eartip 420, causing the remaining portions to expand into an expanded configuration 423. In a fourth embodiment (see FIG. 2D), where the eartip is in a compact configuration 522 when unmodified, one or more elements of the earbud that are located inside the eartip (for example, a cantilever arm or arms 161, as described above and seen in FIGS. 21A-21B and 24-27) may push outwards on the eartip, causing it to expand into an expanded configuration 523. In a fifth embodiment (see FIG. 2E), where the eartip 620 is in an expanded configuration 623 when unmodified, one or more elements of the earbud that are located inside the eartip 620 may pull inwards on the eartip 620, causing it to change into a compact configuration 622.

As illustrated in FIGS. 3A-3D, a variety of user controls and actuator mechanisms may be utilized to provide an earbud, or earphone, according to various non-limiting aspects of the present disclosure. For example, referring to FIG. 3A, an earphone 1400 may include an adjustment assembly 1430 that may include a control member 1480 in the form of a pressable button. The control member 1480 may also be operable with finger grips 1417 protruding from a housing 1410 of the earphone 1400 such that a user may grip the finger grips 1417 and press the button, or control member 1480, without forcing the earphone 1400 excessively into an ear canal of the user. Depressing the button, or control member 1480, may cause an ear canal portion 1420 extending from a housing 1410 to transition from a first shape 1422 to a second shape 1423. Alternatively, referring now to FIG. 3D, an earphone 1600 may include an adjustment assembly 1630 that may include a control member 1680 also in the form of a pressable button. However, in the earphone 1600 of FIG. 3D, the finger grips shown in FIG. 3A are omitted. Depressing the button, or control member 1680, may cause an ear canal portion 1620 extending from a housing 1610 to transition from a first shape 1622 to a second shape 1623.

In more detail, an earphone 1700 with a pressable button as control member 1780 is shown in FIG. 28. The control member 1780 is part of an adjustment assembly 1730 that includes a movable member 1740 and an expansion assembly 1760. Earphone 1700 is similar to earphone 1400 described above in that it also has finger grips 1717 protruding from a housing 1710 such that a user may grip the ginger grips and press the button, or control member 1780, without forcing the earphone 1700 and ear canal portion 1720 excessively into an ear canal of the user. Depressing the button, or control member 1780 causes a movable member 1740 to move and actuate expansion assembly 1760. Thus, depressing the button, or control member 1780, may cause an ear canal portion 1720 extending from a housing 1710 to transition from a first shape 1722 to a second shape 1723. Movable member 1740, expansion assembly 1760, and ear canal portion 1720 are similar to movable member 140 and expansion assembly 160 described above and seen in FIGS. 25-26, for example. The control member 1780 includes a protract-retract assembly 1783 operable to hold the movable member 1740 in the first position shown in FIG. 28 before the button, or control member 1780, is initially pressed and, after pressing the button, operable to hold the movable member in a second position (not shown) correlating with expansion of the expansion assembly 1760 and transition of the first shape 1722 to a second shape 1723. Protract-retract assembly 1783 may be similar to that used with a traditional retractable ballpoint pen including a spring and cam arrangement and is described, for example, in U.S. Patent No. 3,819,282 to Schultz titled RETRACTABLE PEN, hereby incorporated by reference in its entirety.

Further, referring now to FIG. 3B, and as discussed above, an earphone 100 may include an adjustment assembly 130 including a control member 180 in the form of a rotatable dial. Rotating the dial, or control member 180, may cause an ear canal portion 120 extending from a housing 110 to transition from a first shape 122 to a second shape 123.

Another non-limiting example of a user control and actuator mechanism is provided by reference to FIG. 3C. An earphone 1500 may include an adjustment assembly 1530 including a squeezeable control member 1580 operable to rotate a movable member 1540 such that an expansion assembly 1560 presses outward on an ear canal portion 1520 extending from a housing. Squeezing the control member 1580 causes the ear canal portion 1520 to transition from a first shape 1522 to a second shape 1523.

In any event, according to various non-limiting embodiments of an adjustable earphone, a user control, or control member, is capable of being manipulated by a user while an eartip, or ear canal portion, of the earphone is positioned in the user's ear canal. In response to such manipulation of the control member, the ear canal portion is designed to change shape such that the ear canal portion fits snugly against the ear canal.

Unless otherwise indicated herein, an earbud, or earphone, according to an aspect of the present disclosure has an inner end with an eartip, or ear canal portion, that is placed within the ear canal of a user and an outer end with a control feature, or control member, that remains outside the ear canal and may be accessed by the user to expand or compact the eartip, or ear canal portion.

In various embodiments, referring to FIGS. 4-6, an adjustable earphone 800 may include another means for adjusting the shape of an ear canal portion 820 having a first shape 822 (FIGS. 4, 5C, and 5E) by a user when the ear canal portion 820 is positioned in the user's ear canal. Means for adjusting the shape of the ear canal portion 820 may be provided in at least one embodiment by adjustment assembly 830. Adjustment assembly 830 may be operably coupled to housing 810 and/or to the ear canal portion 820 such that actuation of the adjustment assembly 830 causes the ear canal portion 820 to have a second shape 823 (FIGS. 5D and 5G) and may also cause ear canal portion 820 to have at least an intermediate, third shape 824 (FIG. 5F).

As seen at least in FIGS. 4 and/or 6, adjustment assembly 830 may include a movable member 840, an expansion assembly 860, and a control member 880. The control member 880 may include a rotatable adjustment dial 882. Further, the ear canal portion 820 may include a cushion 821. Positioned at least partially within the housing 810 are a transducer 890 and a manufacturer logo piece 889. A cord is coupled to the transducer 890 (see FIG. 4) such that electrical signals can be passed to the transducer 890 to create audible sound therefrom.

Thus, FIGS. 4-6 depict an earphone or earbud 800, according to an aspect of the present disclosure, where rotation of an adjustment dial 882 having an internal thread 883 and located at an outer end 802 of the earbud 800 pulls a movable member, or actuator 840, coupled to an ear canal portion, or eartip 820, at an inner end 801 of the earbud 800, with the result that the eartip 820 is compressed along an axis L running from the outer end 802 to the inner end 801 of the earbud 800, causing it to expand radially away from the axis L.

In various embodiments, referring to FIGS. 7-9, an adjustable earphone 900 may include another means for adjusting the shape of an ear canal portion 920 having a first shape 922 (FIGS. 7 and 8A), 922a (FIG. 8D), or 922b (FIG. 8F) by a user when the ear canal portion 920 is positioned in the user's ear canal. Means for adjusting the shape of the ear canal portion 920 may be provided in at least one embodiment by adjustment assembly 930. Adjustment assembly 930 may be operably coupled to housing 910 and/or to the ear canal portion 920 such that actuation of the adjustment assembly 930 causes the ear canal portion 920 to have a second shape 923, (FIG. 8A), 923a (FIG. 8E), or 923b (FIG. 8G). The first and second shapes shown in FIGS. 7-8G (922, 922a, and 922b, and 923, 923a, and 923b) are dependent on the relative size, shape, and placement of the various components of the earphone 900 including, but not limited to, the expansion assembly 960, the movable member 940, and the ear canal portion 920.

As seen at least in FIGS. 7 and/or 9, adjustment assembly 930 may include a movable member 940, a expansion assembly 960, and a control member 980. The control member 980 may include a rotatable adjustment dial 982. Further, the ear canal portion 920 may include a cushion 921. Positioned at least partially within the housing 910 are a transducer 990 and a manufacturer logo piece 989. A cord is coupled to the transducer 990 (see FIG. 7) such that electrical signals can be passed to the transducer 990 to create audible sound therefrom.

Thus, FIGS. 7-9 illustrate another earbud 900, according to an aspect of the present disclosure, where rotation of an adjustment dial 982 having an internal thread 983 and located at an outer end 901 of the earbud 900 pulls a movable member, or first element 940, of an adjustment assembly, or actuator assembly 930, toward the outer end 902 of the earbud 900. The first element 940 is tapered along its length, having a narrower portion 956 and a wider portion 955. An expansion assembly, or second element 960, of the actuator assembly 930 is positioned between the first element 940 and the eartip 920. The second element 960 is similar to the expansion assembly 160 including cantilever arms 161 described above (see, e.g., FIGS. 21A-21B and 24-26). The second element 960 has a plurality of portions 961 extending from an outer end to an inner end of the second element 960. In a compact configuration, inner surfaces 963 of the plurality of portions 961 of the second element 960 are in contact with the narrower portion 956 of the first element 940. As the first element 940 moves toward the outer end 902 of the earbud 900, the wider portion 955 of the first element 940 is pulled into contact with the inner surfaces 963 of the plurality of portions 961 of the second element 960, causing the plurality of portions 961 of the second element 960 to push outward and expand the eartip 920.

In various embodiments, referring to FIGS. 10-12, an adjustable earphone 1000 may include another means for adjusting the shape of the ear canal portion 1020 having a first shape 1022 (FIGS. 10, 11A-11B, and 11E) by a user when the ear canal portion is positioned in the user's ear canal. Means for adjusting the shape of the ear canal portion may be provided in at least one embodiment by adjustment assembly 1030. Adjustment assembly 1030 may be operably coupled to housing 1010 and/or to the ear canal portion 1020 such that actuation of the adjustment assembly 1030 causes the ear canal portion 1020 to have at least a second shape 1023 (FIGS. 11A-11B and 11F).

As seen at least in FIGS. 10 and/or 12, adjustment assembly 1030 may include a movable member 1040, a expansion assembly 1060, and a control member 1080 that are formed as one unitary and integral component. Further, the ear canal portion 1020 may include a cushion 1021. Positioned at least partially within the housing 1010 are a transducer 1090 and a manufacturer logo piece 1089. A cord (not shown) is coupled to the transducer 1090 such that electrical signals can be passed to the transducer 1090 to create audible sound therefrom.

Thus, FIGS. 10-12 show yet another earbud 1000 according to an aspect of the present disclosure, having an ear canal portion, or eartip 1020, with an interior having a plurality of radially inward-extending lobes 1026 and a moveable member, or actuator 1040, with corresponding radially outward-extending lobes 1055 that form at least part of expansion assembly 1060. An outer end of the actuator 1040 forms a control member 1080 that may be rotated by a user. In a compact configuration, the lobes 1055 of the actuator 1040 are located in gaps 1028 between the lobes 1026 of the eartip 1020. When the user rotates the actuator 1040 via control member 1080, the outward-extending lobes 1055 of the actuator 1040 press against the inward-extending lobes 1026 of the eartip, pushing outward on the inner surface of the eartip 1020 and causing the eartip 1020 to expand. The number of outward extending lobes of the actuator and/or expansion assembly may vary, for example, four lobes 1055 of expansion assembly 1060 are shown at least in FIG. 11C, whereas two lobes 1055a or an expansion assembly 1060a are shown at least in FIG. 11D. The cushion of eartip 1020 is correspondingly formed for the number of respective expansion assembly lobes, for instance cushion 1021 (FIG. 11C) and cushion 1021a (FIG. 11D) may be formed for expansion assembly 1060 and expansion assembly 1060a, respectively. The first and second shapes of the eartip 1020 shown in FIGS. 10 and 11A-11H are dependent on the size, shape, and placement of the various components of the earphone 1000. Adjusting the number of lobes, as explained above, can also provide different first and second shapes (1022 and 1022a, and 1023 and 1023a, respectively) of the ear canal portion 1020.

In various embodiments, referring to FIGS. 13-15, an adjustable earphone 1100 may include another means for adjusting the shape of an ear canal portion 1120 having a first shape 1122 (FIG. 14A) by a user when the ear canal portion 1120 is positioned in the user's ear canal. Means for adjusting the shape of the ear canal portion 1120 may be provided in at least one embodiment by adjustment assembly 1130. Adjustment assembly 1130 may be coupled operably to the housing 1110 and/or to the ear canal portion 1120 such that actuation of the adjustment assembly 1130 causes the ear canal portion 1120 to have a second shape 1123 (FIG. 14A).

As seen at least in FIGS. 13 and/or 15, adjustment assembly 1130 may include fixed element 1140, expansion assembly 1160, and control member 1180. Further, the ear canal portion 1120 may include a cushion 1121. Positioned at least partially within the housing 1110 are a transducer 1190 and a manufacturer logo piece 1189. A cord (not shown) is coupled to the transducer 1190 such that electrical signals can be passed to the transducer 1190 to create audible sound therefrom.

Thus, FIGS. 13-15 depict another earbud 100 according to an aspect of the present disclosure. An adjustment assembly, or actuator assembly 1130, within an eartip 1120 includes an expansion assembly, coiled element 1160, wrapped around an external surface of a fixed element 1140 and attached to the fixed element 1140 at an inner end. A rotating control member 1180 is attached to an outer end of the coiled element 1160. In a compact configuration (see FIG 14B), the coiled element 1160 lies adjacent to the fixed element 1140 and rotation in a first direction is not possible, because it would cause the coiled element 1160 to wrap more tightly against the fixed element. Rotation in the opposite direction, however, results in an expansion of the diameter of the coiled element 1160, causing the eartip 1120 to expand (see FIG. 14C).

FIG. 16 shows an exemplary earbud 1200 according to an aspect of the present disclosure that is adjusted by pressing, rather than rotating, a control 1280. An adjustment, or actuator assembly 1230, has a plurality of stiff fingers 1261 extending from an outer end 1202 to an inner end 1201 within an eartip 1220 and coupled to a button 1282 at an outer end 1202 of the earbud. The fingers 1261 form a profile 1262 with a portion having a narrower radius tapering to a portion having a wider radius. The earbud 1200 also includes a ring 1240 around the fingers 1261, the ring 1240 positioned at a fixed distance inward from the outer end 1202 of the earbud 1200. As the button 1282 is pushed inward or pulled outward, the tapered profile 1262 of the fingers 1261 slides within the ring 1240, the outer end of the fingers 1261 expand or contract radially, and the eartip 1220 expands or contracts.

The earbud 1200 of FIG. 16 and other earbuds or earphones according to aspects of the present disclosure not only cause the outer surface of an eartip to expand, but also cause the inner cavity of the eartip to expand. The expanded cavity provides a larger volume for sound from the earphone to resonate and generates better low frequency response from the earphone.

In FIG. 17 a snap ring 1327 is shown that operates to attach an eartip element 1321 to a base element 1311 of an earbud 1300. The snap ring 1327 is located in a first end of the eartip element 1321. The base element 1311 of the earbud 1300 includes a tapering portion with a groove 1318 around the tapering portion that corresponds in size to the snap ring 1327. As the first end of the eartip 1320 is pressed onto the base element, the snap ring 1327 expands elastically around the tapering portion of the base element 1311 until reaching the groove 1318, whereupon it contracts back toward its original diameter. The elastic force of the snap ring 1327 attempting to return to its original diameter holds the snap ring 1327 in the groove 1318 and acts to prevent the eartip 1320 from slipping off the earbud 1300 and sealing the eartip 1320 to the base element 1311. Eartip element 1321 and base element 1311 may form part of a housing of an earphone, such as first side 111 of housing 110 of adjustable earphone 100 described above and seen in FIG. 21A.

FIGS. 18A and 18B also depict a cord 11 according to another aspect of the present disclosure that may be used with earphones, such as the earbuds described above or with other types of earphones. The cord is covered with cloth, foam, or another soft material. The cord has an electrical connector 13 at a first end 11 and one or more earphones 100 at a second end 12. The connector 13 at the first end 11 may be coupled to an audio device 1. When the audio device 1 is not in use, the cord may be wrapped around the audio device 1 and form a cushion (FIG. 18A), protecting the audio device 1 from damage when placed loose in a briefcase, backpack, or other carrier. The earphones 100 at the second end of the cord may be tucked under another section of the cord to prevent the cord from unwrapping from around the audio device 1.

FIGS. 18A, 18B, 19B, and 19C illustrate a cord clip 15 according to another aspect of the present disclosure. An earphone cord 11 may include a first portion 16 adjacent to a first end 11 of the cord 11 where the cord 11 is configured as a single strand. Between the first portion 16 of the cord 11 and a pair of earphones 100 at a second end 12 of the cord, is a second portion 17 of the cord 11, which is configured as two strands that lie along opposite sides of the head when the earphones are inserted into the ears. The two strands of the second portion 17 may pass through two corresponding apertures in a cord clip 15, as shown in FIGS. 18A, 18B, 19B and 19C. When the earphones 100 are in use, the cord clip 15 may be slid toward the first portion 16 of the cord 11, allowing the earphones to be separated and placed in the ears of the user. When the earphones 100 are not in use, the cord clip 15 may be slid toward the second end 12 of the cord 11, to hold the earphones 100 together and make the cord 11 easier to handle than it would be if the earphones 100 were left separated. The cord clip 15 further includes a spring clip 14 that may be used when the cord is wrapped around an audio device 1 to clip the second end 12 of the cord 11 to a portion of the cord closer to the first end 11 of the cord and help to prevent the cord 11 from unwrapping from around the audio device 1.

Although various embodiments have been described herein, many modifications and variations to those embodiments may be implemented. For example, the adjustable earphone may be converted to an adjustable earplug or other adjustable ear insert. Conversion of the above described earphone into an adjustable earplug may be accomplished, for example, by removing the electrical components and removing the passageways for sound to travel, thereby providing an earplug with an adjustable shape when placed in an ear canal of a user. Further, while the general components of the adjustable earphone described above may be made of plastic (except at least parts of the cord, the eartip cushion, and the transducer), metal or other materials may be used where desirable. The foregoing description and following claims are intended to convey and cover all such modification and variations.

Any patent, publication, or other disclosure material, in whole or in part, that is said to be incorporated by reference herein is incorporated herein only to the extent that the incorporated material does not conflict with existing definitions, statements, or other disclosure material set forth in this disclosure. As such, and to the extent necessary, the disclosure as explicitly set forth herein supersedes any conflicting material incorporated herein by reference. Any material, or portion thereof, that is said to be incorporated by reference herein, but which conflicts with existing definitions, statements, or other disclosure material set forth herein will only be incorporated to the extent that no conflict arises between that incorporated material and the existing disclosure material.

CLAIMS

What is claimed is:

1. An adjustable earphone, comprising:

a housing having a first side and a second side;

a resilient cushion attached to the first side of the housing, the resilient cushion having a compact shape and an opening;

at least one cantilever arm protruding from the first side of the housing, wherein at least part of the cantilever arm is located within the opening of the resilient cushion;

a dial rotatably mounted in the housing, wherein at least part of the dial extends from the second side of the housing, wherein the dial includes threads; and

an actuator comprising a first portion and a second portion, the second portion having threads, wherein the actuator is slidably mounted in the housing, wherein the actuator threads operably engage the dial threads such that rotation of the dial in a first direction translates the first portion of the rigid actuator into contact with the cantilever arm;

wherein the first portion of the actuator is configured to bend the cantilever arm into the resilient cushion as the actuator contacts the arm, wherein the cantilever arm is configured to force the resilient cushion to have an expanded shape as the cantilever arm bends into the cushion.

2. An adjustable earphone, comprising:

a housing having a first side and a second side, wherein the first side of the housing is configured to attach to a cushion;

at least one cantilever arm protruding from the first side of the housing, wherein at least part of the cantilever arm is configured to be located within an opening of the cushion when the cushion is attached to the housing;

a dial rotatably mounted in the housing, wherein at least part of the dial extends from the second side of the housing, wherein the dial includes threads; and an actuator comprising a first portion and a second portion, the second portion having threads, wherein the actuator is slidably mounted in the housing, wherein the actuator threads operably engage the dial threads such that rotation of the dial in a first direction translates the first portion of the rigid actuator into contact with the cantilever arm;

wherein the first portion of the actuator is configured to bend the cantilever arm as the actuator contacts the arm.

3. An adjustable earphone, comprising:

a housing;

an ear canal portion adjacent to the housing, the ear canal portion having a first shape; and

an adjustment assembly operably coupled to the housing, wherein the adjustment assembly comprises:

a movable member movable with respect to the housing between a first position and at least a second position;

an expansion assembly configured to receive the movable member; and

a control member configured to move the movable member such that actuation of the control member causes the movable member to move from a first position to at least a second position;

wherein the movable member is configured to cause the expansion assembly to expand in at least one direction when the movable member is moved to the second position, wherein the expansion assembly is configured to force the ear canal portion to have at least a second shape when the expansion assembly is expanded.

4. The adjustable earphone of claim 3, wherein the expansion assembly is configured to retract in at least one direction when the movable member is moved to the first position, wherein the ear canal portion is configured to have the first shape when the expansion assembly is retracted.

5. The adjustable earphone of claim 3, wherein the ear canal portion comprises a resilient material.

6. The adjustable earphone of claim 3, wherein the control member comprises a rotatable dial.

7. The adjustable earphone of claim 3, wherein the control member comprises a pressable button.

8. The adjustable earphone of claim 3, wherein the control member comprises a squeezable member.

9. An adjustable earphone, comprising:

a housing;

an ear canal portion adjacent to the housing, the ear canal portion having a first shape; and

an adjustment assembly operably coupled to the housing such that actuation of the adjustment assembly causes the ear canal portion to have at least a second shape.

10. The adjustable earphone of claim 9, wherein the adjustment assembly comprises a control member accessible to a user and an expansion assembly operably coupled to the control member, wherein the control member is configured to actuate the expansion assembly such that the ear canal portion has at least a second shape when the expansion assembly is actuated

11. The adjustable earphone of claim 10, further comprising an inner end and an outer end, wherein the ear canal portion is adjacent to the inner end and the control member is adjacent to the outer end, wherein the expansion assembly comprises an actuator coupled to the ear canal portion near the inner end.

12. The adjustable earphone of claim 10, wherein the expansion assembly comprises at least one bendable arm.

13. The adjustable earphone of claim 10, wherein the expansion assembly comprises a rotatable actuator having lobes.

14. The adjustable earphone of claim 10, wherein the expansion assembly comprises a coiled element.

15. The adjustable earphone of claim 9, wherein the adjustment assembly is operably coupled to the housing such that actuation of the adjustment assembly causes the ear canal portion to have at least a third shape.

16. The adjustable earphone of claim 9, further comprising a cord having a first end, a second end, and an electrical connector located at the first end, wherein the housing is located at the second end of the cord, wherein the cord is at least partially covered with a soft material.

17. The adjustable earphone of claim 16, wherein the soft material comprises a cloth.

18. The adjustable earphone of claim 16, further comprising a cord clip, wherein the cord further comprises a first portion adjacent to the first end of the cord and a second portion adjacent to the second end of the cord, wherein the first portion comprises a single strand and the second portion comprises two strands, wherein the cord clip is slidably coupled to the two strands of the second portion.

19. The adjustable earphone of claim 18, wherein the cord clip further comprises two apertures, wherein each aperture is configured to insertably receive one of the two strands of the second portion of the cord.

20. The adjustable earphone of claim 18, wherein the cord clip further comprises a spring clip that is configured to clip to the cord.

21. An adjustable earphone, comprising:

an ear canal portion, the ear canal portion having a shape, wherein the ear canal portion is operable for placement in a user's ear canal; and

means for adjusting the shape of the ear canal portion by a user when the ear canal portion is positioned in the user's ear.

22. An adjustable ear insert, comprising:

an ear canal portion configured for insertion in a user's ear canal, the ear canal portion having a first shape; and

an adjustment assembly at least partially located within the ear canal portion, wherein the adjustment assembly is operable to cause the ear canal portion to have at least a second shape.

23. The adjustable ear insert of claim 22, wherein the adjustment assembly comprises a control member accessible to a user and an expansion assembly operably coupled to the control member, wherein the control member is configured to actuate the expansion assembly such that the ear canal portion has at least a second shape when the expansion assembly is actuated.

24. The adjustable ear insert of claim 22, further comprising a first end and a second end, wherein a transducer is located between the first end and the second end.

25. The adjustable ear insert of claim 22, wherein the ear canal portion is configured to resist audible sound from reaching an ear drum of the user when the adjustable ear insert is inserted in the user's ear canal.

26. An adjustable ear insert, comprising:

an inner end having an eartip, wherein the inner end is configured to be placed within an ear canal of a user; and

an outer end having a control feature, wherein the outer end is configured to remain outside the ear canal, wherein the control feature is accessible by the user to expand or compact the eartip.

27. The adjustable ear insert of claim 26, further comprising a transducer located between the inner end and the outer end.

28. The adjustable ear insert of claim 26, wherein the ear canal portion is configured to resist audible sound from reaching an ear drum of the user when the adjustable ear insert is inserted in the user's ear canal.

AMENDED CLAIMS
received by the International Bureau on 07 April 2009 (07.04.2009)

1. An adjustable earphone, comprising:

a housing having a first side and a second side;

a resilient cushion attached to the first side of the housing, the resilient cushion having a compact shape and an opening;

at least one cantilever arm protruding from the first side of the housing, wherein at least part of the cantilever arm is located within the opening of the resilient cushion;

a dial rotatably mounted in the housing, wherein at least part of the dial extends from the second side of the housing, wherein the dial includes threads; and

an actuator comprising a first portion and a second portion, the second portion having threads, wherein the actuator is slidably mounted in the housing, wherein the actuator threads operably engage the dial threads such that rotation of the dial in a first direction translates the first portion of the rigid actuator into contact with the cantilever arm;

wherein the first portion of the actuator is configured to bend the cantilever arm into the resilient cushion as the actuator contacts the arm, wherein the cantilever arm is configured to force the resilient cushion to have an expanded shape as the cantilever arm bends into the cushion.

2. An adjustable earphone, comprising:

a housing having a first side and a second side, wherein the first side of the housing is configured to attach to a cushion;

at least one cantilever arm protruding from the first side of the housing, wherein at least part of the cantilever arm is configured to be located within an opening of the cushion when the cushion is attached to the housing;

a dial rotatably mounted in the housing, wherein at least part of the dial extends from the second side of the housing, wherein the dial includes threads; and an actuator comprising a first portion and a second portion, the second portion having threads, wherein the actuator is slidably mounted in the housing, wherein the actuator threads operably engage the dial threads such that rotation of the dial in a first direction translates the first portion of the rigid actuator into contact with the cantilever arm;

wherein the first portion of the actuator is configured to bend the cantilever arm as the actuator contacts the arm.

3. An adjustable earphone, comprising:

a housing;

an ear canal portion adjacent to the housing, the ear canal portion having a first shape; and

an adjustment assembly operably coupled to the housing, wherein the adjustment assembly comprises:

a movable member movable with respect to the housing between a first position and at least a second position;

an expansion assembly configured to receive the movable member; and

a control member configured to move the movable member such that actuation of the control member causes the movable member to move from a first position to at least a second position;

wherein the movable member is configured to cause the expansion assembly to expand in at least one direction when the movable member is moved to the second position, wherein the expansion assembly is configured to force the ear canal portion to have at least a second shape when the expansion assembly is expanded.

4. The adjustable earphone of claim 3, wherein the expansion assembly is configured to retract in at least one direction when the movable member is moved to the first position, wherein the ear canal portion is configured to have the first shape when the expansion assembly is retracted.

AMENDED SHEET (ARTICLE 19)

5. The adjustable earphone of claim 3, wherein the ear canal portion comprises a resilient material.

6. The adjustable earphone of claim 3, wherein the control member comprises a rotatable dial.

7. The adjustable earphone of claim 3, wherein the control member comprises a pressable button.

8. The adjustable earphone of claim 3, wherein the control member comprises a squeezable member.

9. An adjustable earphone, comprising:

a housing;

an ear canal portion adjacent to the housing, the ear canal portion having a first shape; and

an adjustment assembly operably coupled to the housing such that actuation of the adjustment assembly causes the ear canal portion to have at least a second shape.

10. The adjustable earphone of claim 9, wherein the adjustment assembly comprises a control member accessible to a user and an expansion assembly operably coupled to the control member, wherein the control member is configured to actuate the expansion assembly such that the ear canal portion has at least a second shape when the expansion assembly is actuated

11. The adjustable earphone of claim 10, further comprising an inner end and an outer end, wherein the ear canal portion is adjacent to the inner end and the control member is adjacent to the outer end, wherein the expansion assembly comprises an actuator coupled to the ear canal portion near the inner end.

AMENDED SHEET (ARTICLE 19)

12. The adjustable earphone of claim 10, wherein the expansion assembly comprises at least one bendable arm.

13. The adjustable earphone of claim 10, wherein the expansion assembly comprises a rotatable actuator having lobes.

14. The adjustable earphone of claim 10, wherein the expansion assembly comprises a coiled element.

15. The adjustable earphone of claim 9, wherein the adjustment assembly is operably coupled to the housing such that actuation of the adjustment assembly causes the ear canal portion to have at least a third shape.

16. The adjustable earphone of claim 9, further comprising a cord having a first end, a second end, and an electrical connector located at the first end, wherein the housing is located at the second end of the cord, wherein the cord is at least partially covered with a soft material.

17. The adjustable earphone of claim 16, wherein the soft material comprises a cloth.

18. The adjustable earphone of claim 16, further comprising a cord clip, wherein the cord further comprises a first portion adjacent to the first end of the cord and a second portion adjacent to the second end of the cord, wherein the first portion comprises a single strand and the second portion comprises two strands, wherein the cord clip is slidably coupled to the two strands of the second portion.

19. The adjustable earphone of claim 18, wherein the cord clip further comprises two apertures, wherein each aperture is configured to insertably receive one of the two strands of the second portion of the cord.

AMENDED SHEET (ARTICLE 19)

20. The adjustable earphone of claim 18, wherein the cord clip further comprises a spring clip that is configured to clip to the cord.

21. An adjustable earphone, comprising:

an ear canal portion, the ear canal portion having a shape, wherein the ear canal portion is operable for placement in a user's ear canal; and

means for adjusting the shape of the ear canal portion by a user when the ear canal portion is positioned in the user's ear.

22. An adjustable ear insert, comprising:

an ear canal portion configured for insertion in a user's ear canal, the ear canal portion having a first shape; and

an adjustment assembly at least partially located within the ear canal portion, wherein the adjustment assembly is operable to cause the ear canal portion to have at least a second shape.

23. The adjustable ear insert of claim 22, wherein the adjustment assembly comprises a control member accessible to a user and an expansion assembly operably coupled to the control member, wherein the control member is configured to actuate the expansion assembly such that the ear canal portion has at least a second shape when the expansion assembly is actuated.

24. The adjustable ear insert of claim 22, further comprising a first end and a second end, wherein a transducer is located between the first end and the second end.

25. The adjustable ear insert of claim 22, wherein the ear canal portion is configured to resist audible sound from reaching an ear drum of the user when the adjustable ear insert is inserted in the user's ear canal.

26. An adjustable ear insert, comprising:

AMENDED SHEET (ARTICLE 19)

an inner end having an eartip, wherein the inner end is configured to be placed within an ear canal of a user; and

an outer end having a control feature, wherein the outer end is configured to remain outside the ear canal, wherein the control feature is accessible by the user to expand or compact the eartip.

27. The adjustable ear insert of claim 26, further comprising a transducer located between the inner end and the outer end.

28. The adjustable ear insert of claim 26, wherein the ear canal portion is configured to resist audible sound from reaching an ear drum of the user when the adjustable ear insert is inserted in the user's ear canal.

29. An adjustable eaphone, comprising:

an ear canal portion configured for insertion in a user's ear canal, the ear canal portion having a compact shape;

a rotatable dial accessible to and rotatable by a user when the ear canal portion is inserted in the user's ear canal; and

an expansion assembly operably coupled to the rotatable dial, wherein the expansion assembly is at least partially located within the ear canal portion, and wherein the expansion assembly is operable to cause the ear canal portion to expand into at least an expanded shape without external force being applied to the ear canal portion;

wherein the rotatable dial is configured to actuate the expansion assembly such that the ear canal portion has one of a continuum of shapes between the compact shape and the expanded shape.

30. An adjustable eaphone, comprising:

an ear canal portion configured for insertion in a user's ear canal, the ear canal portion having an expanded shape;

a rotatable dial accessible to and rotatable by a user when the ear canal portion is inserted in the user's ear canal; and an expansion assembly operably coupled to the rotatable dial, wherein the expansion assembly is at least partially located within the ear canal portion, and wherein the expansion assembly is operable to cause the ear canal portion to retract into at least a compact shape without external force being applied to the ear canal portion;

wherein the rotatable dial is configured to actuate the expansion assembly such that the ear canal portion has one of a continuum of shapes between the expanded shape and the compact shape.

AMENDED SHEET (ARTICLE 19)

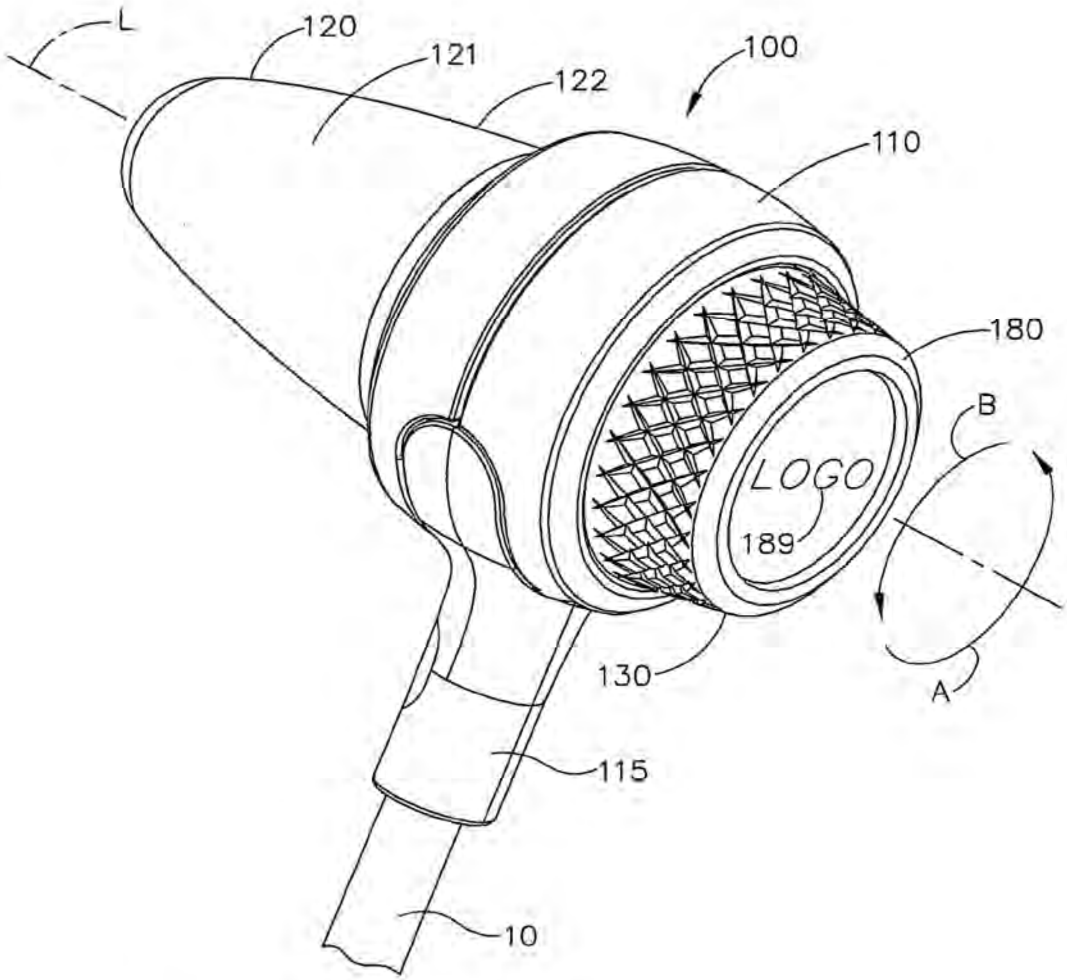

FIG. 1A

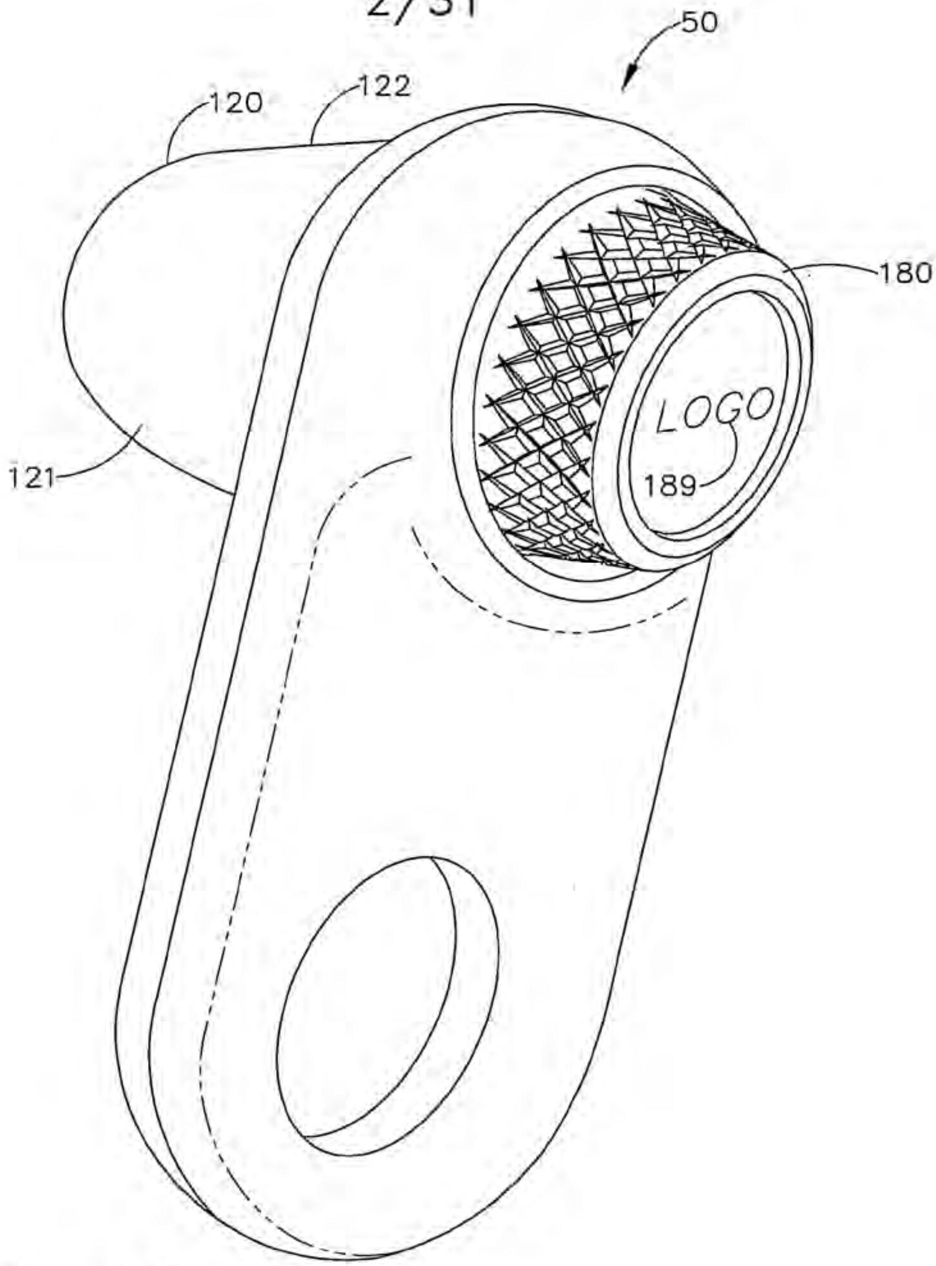

FIG. 1B

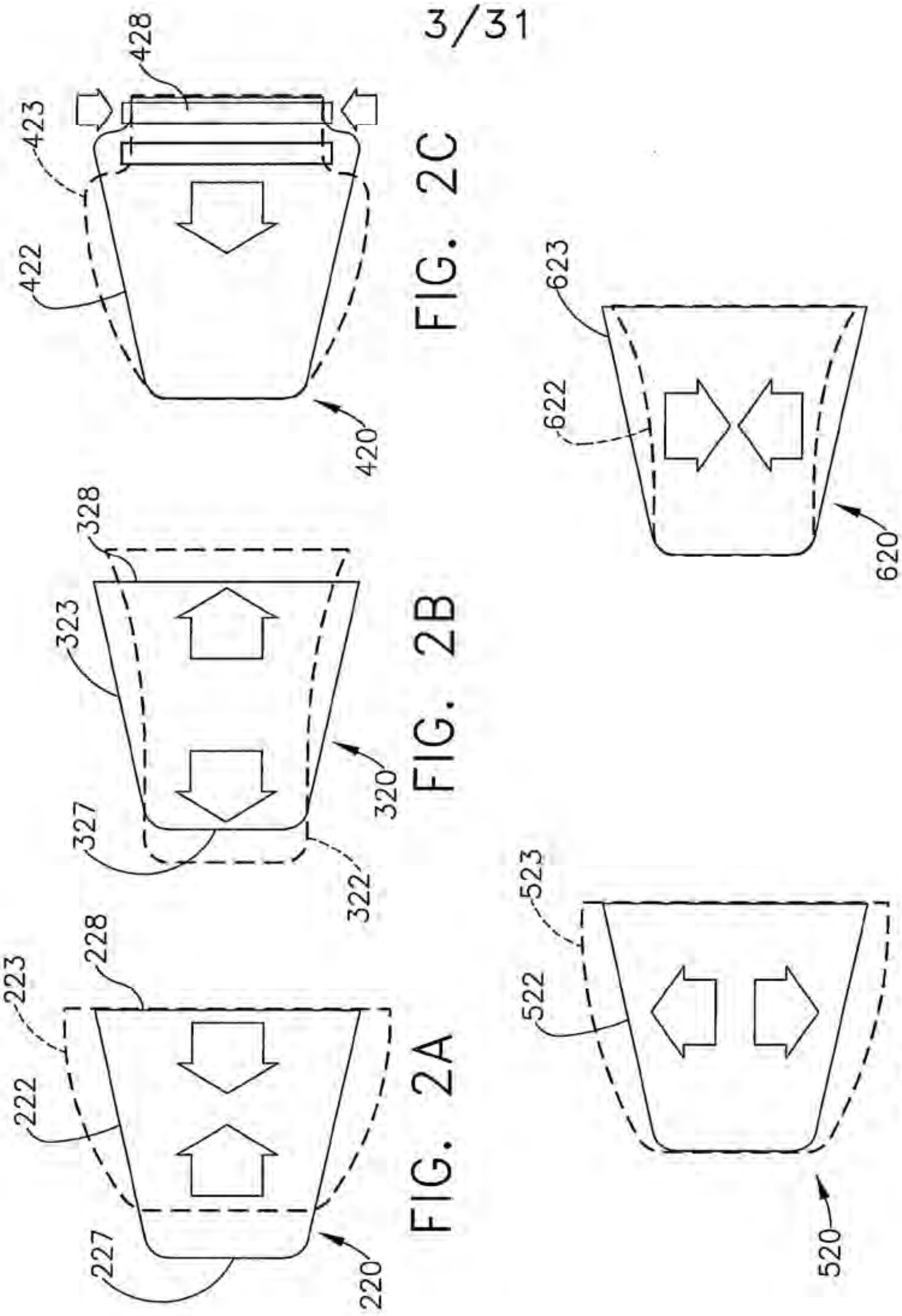

FIG. 2A

FIG. 2B

FIG. 2C

FIG. 2D

FIG. 2E

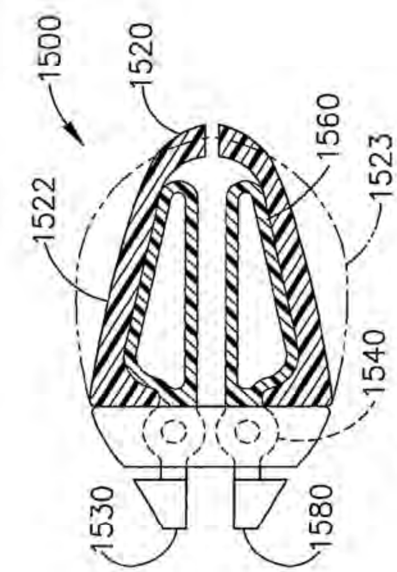

FIG. 3C

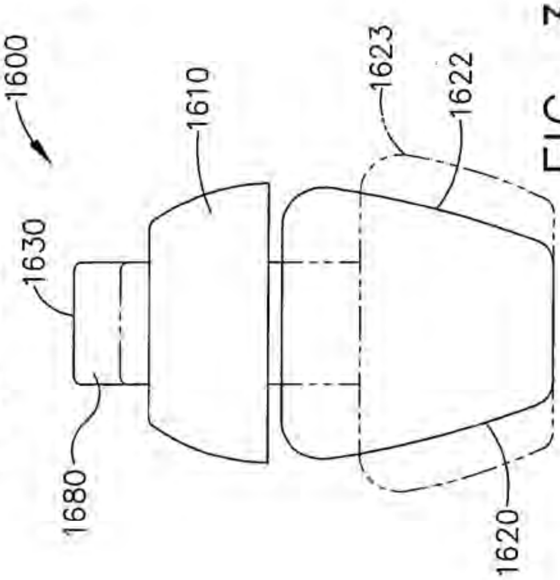

FIG. 3D

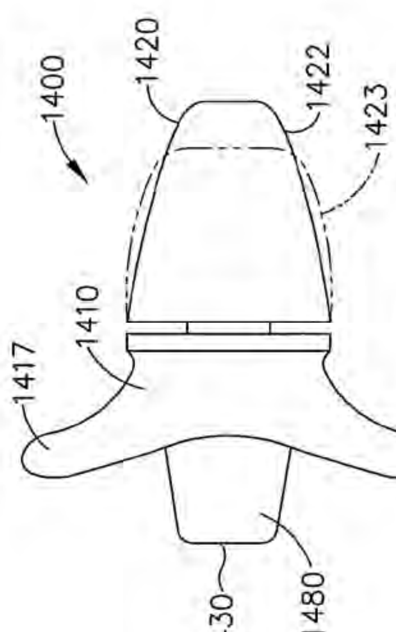

FIG. 3A

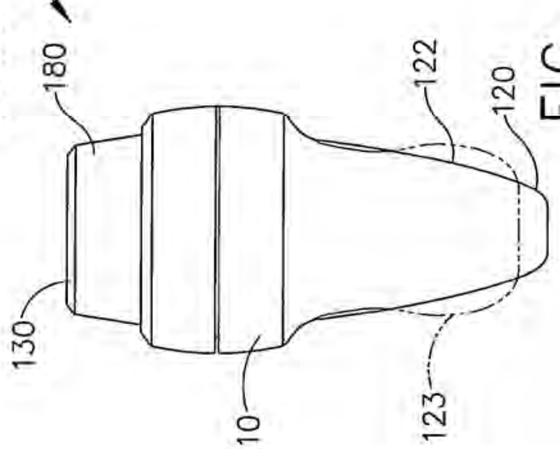

FIG. 3B

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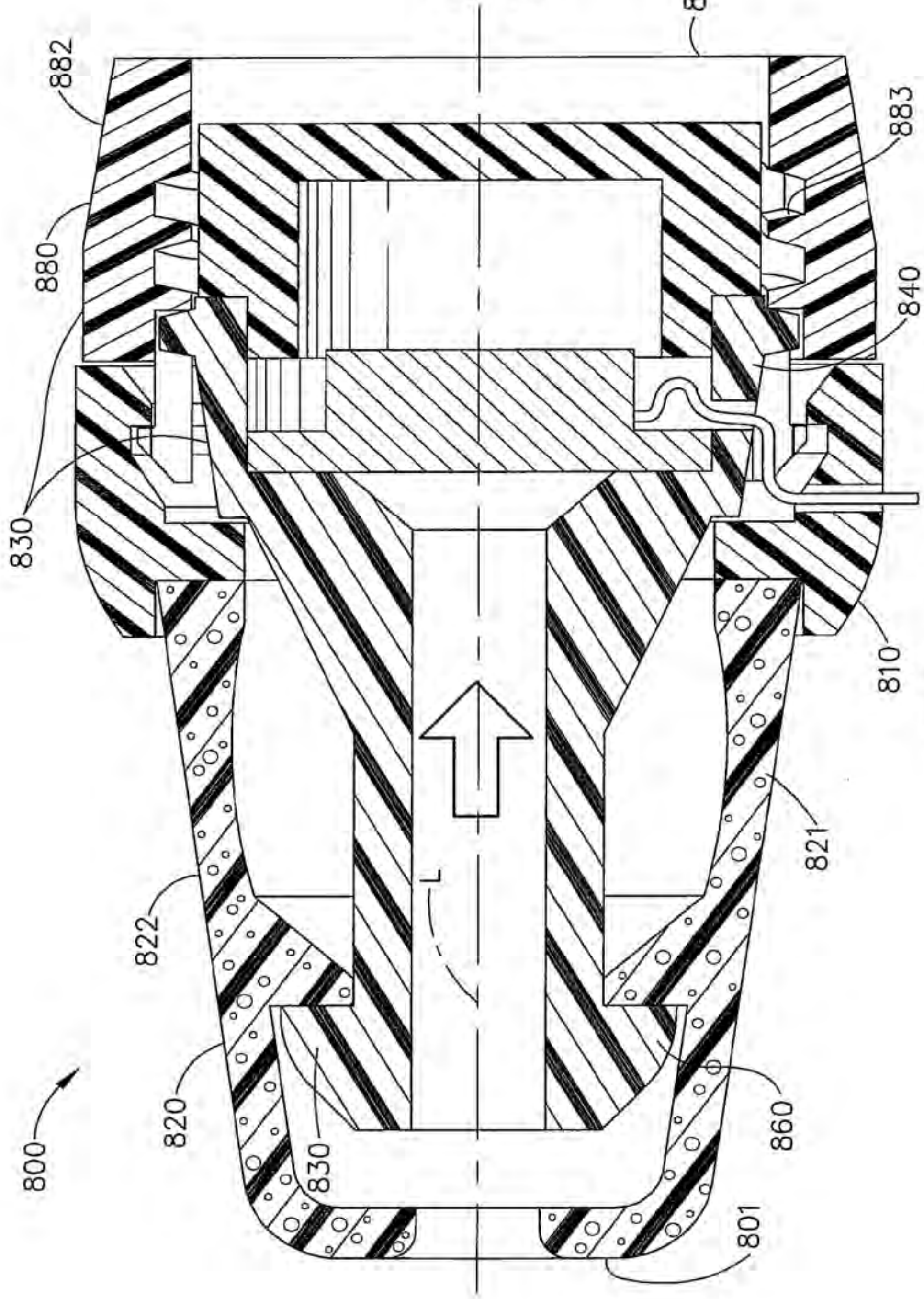

FIG. 4

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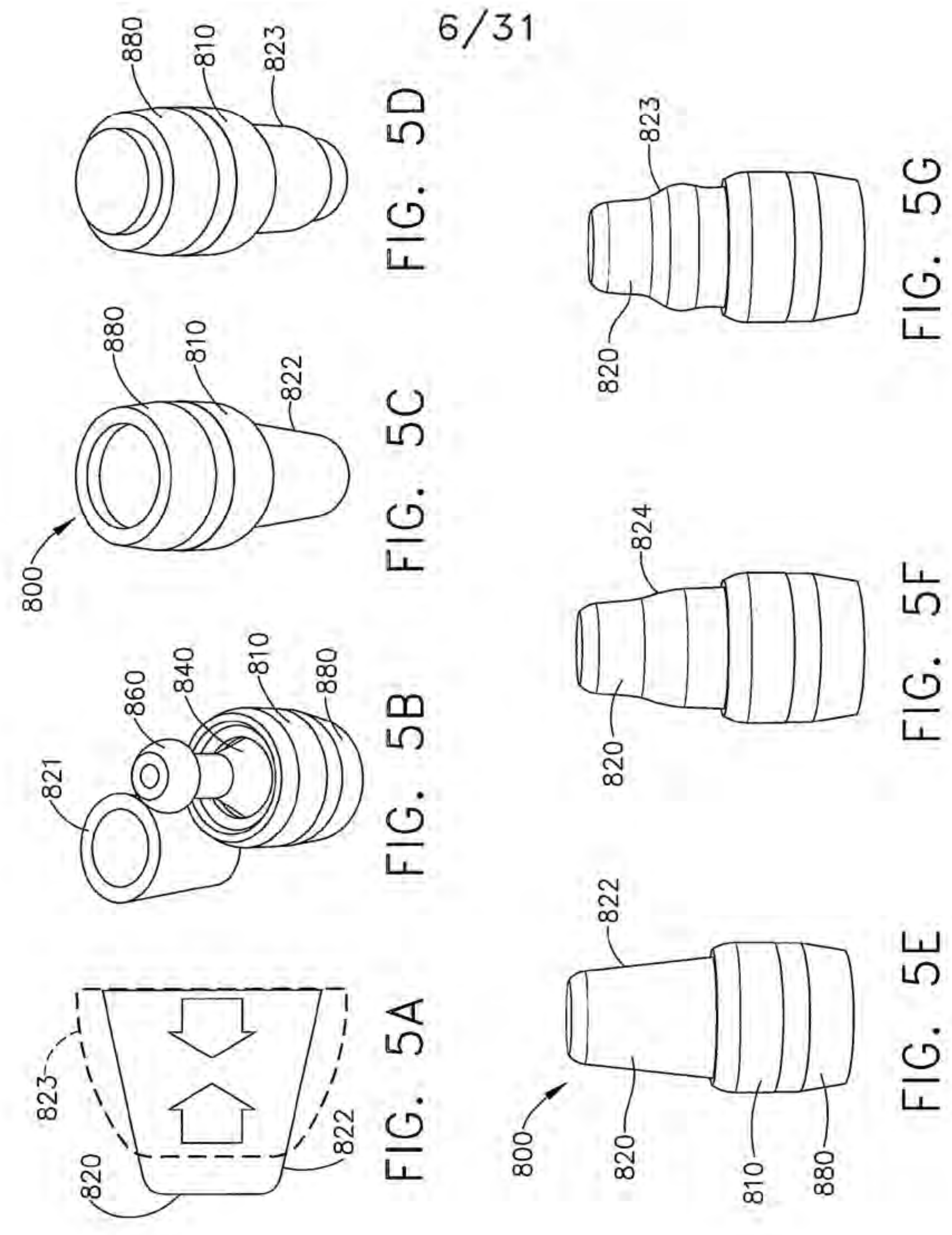

FIG. 5A FIG. 5B FIG. 5C FIG. 5D FIG. 5E FIG. 5F FIG. 5G

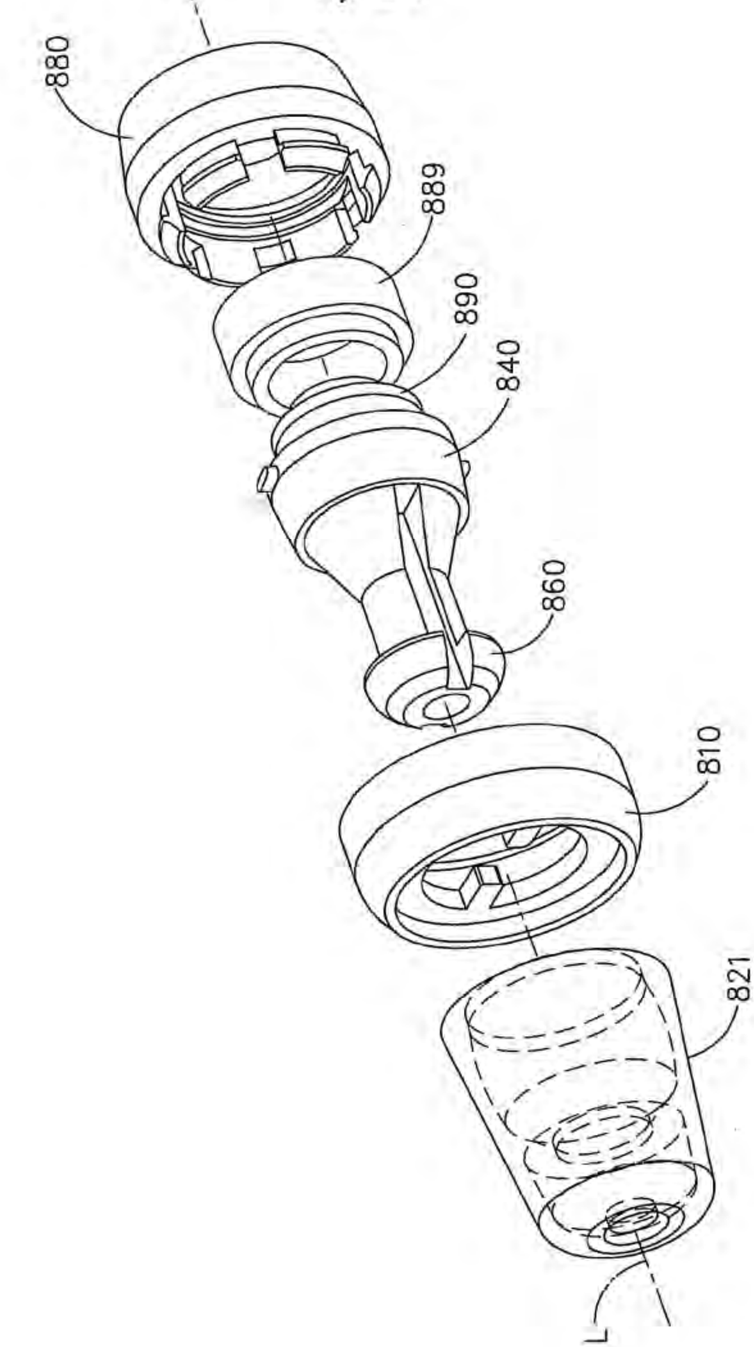

FIG. 6

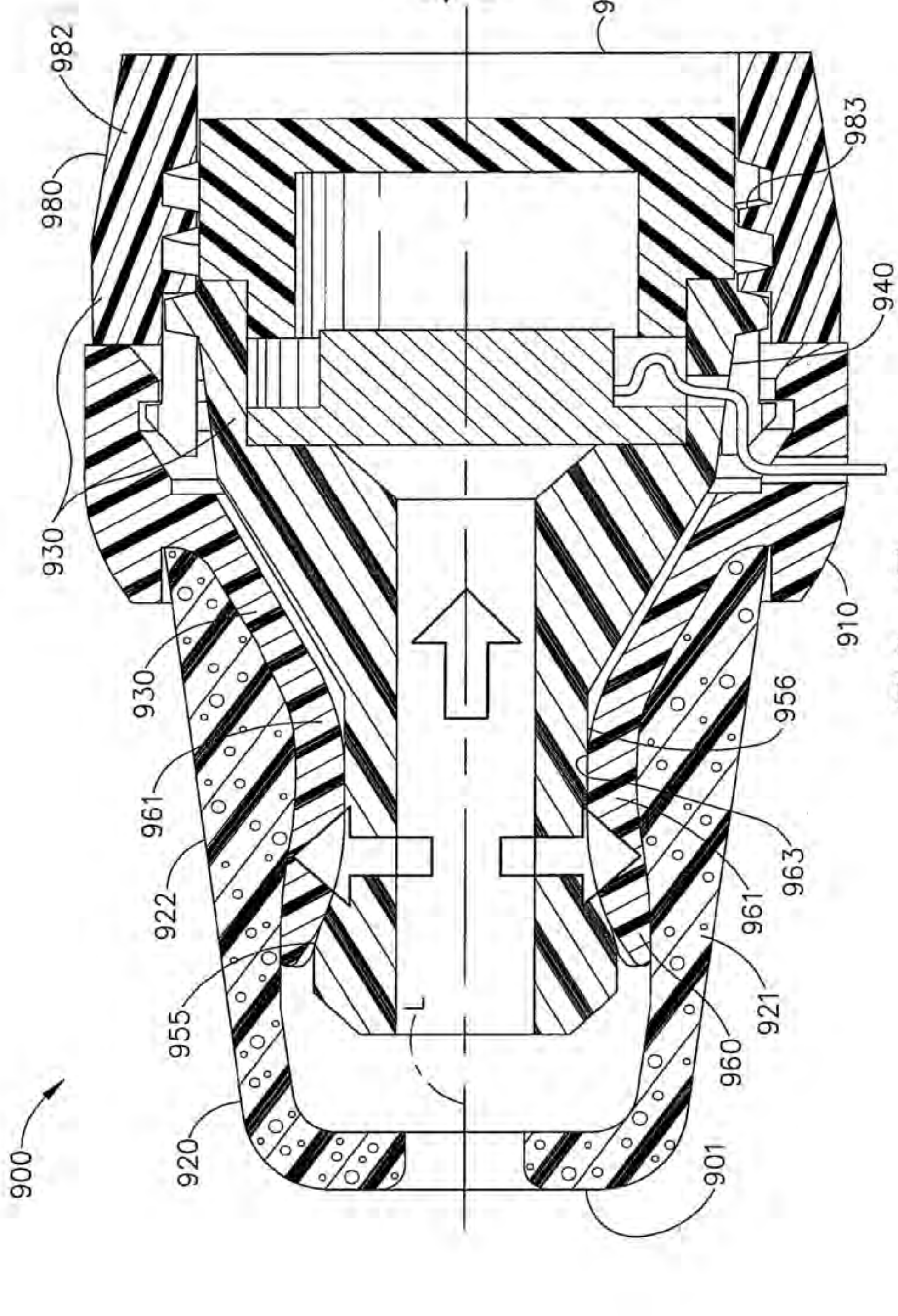
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FIG. 7

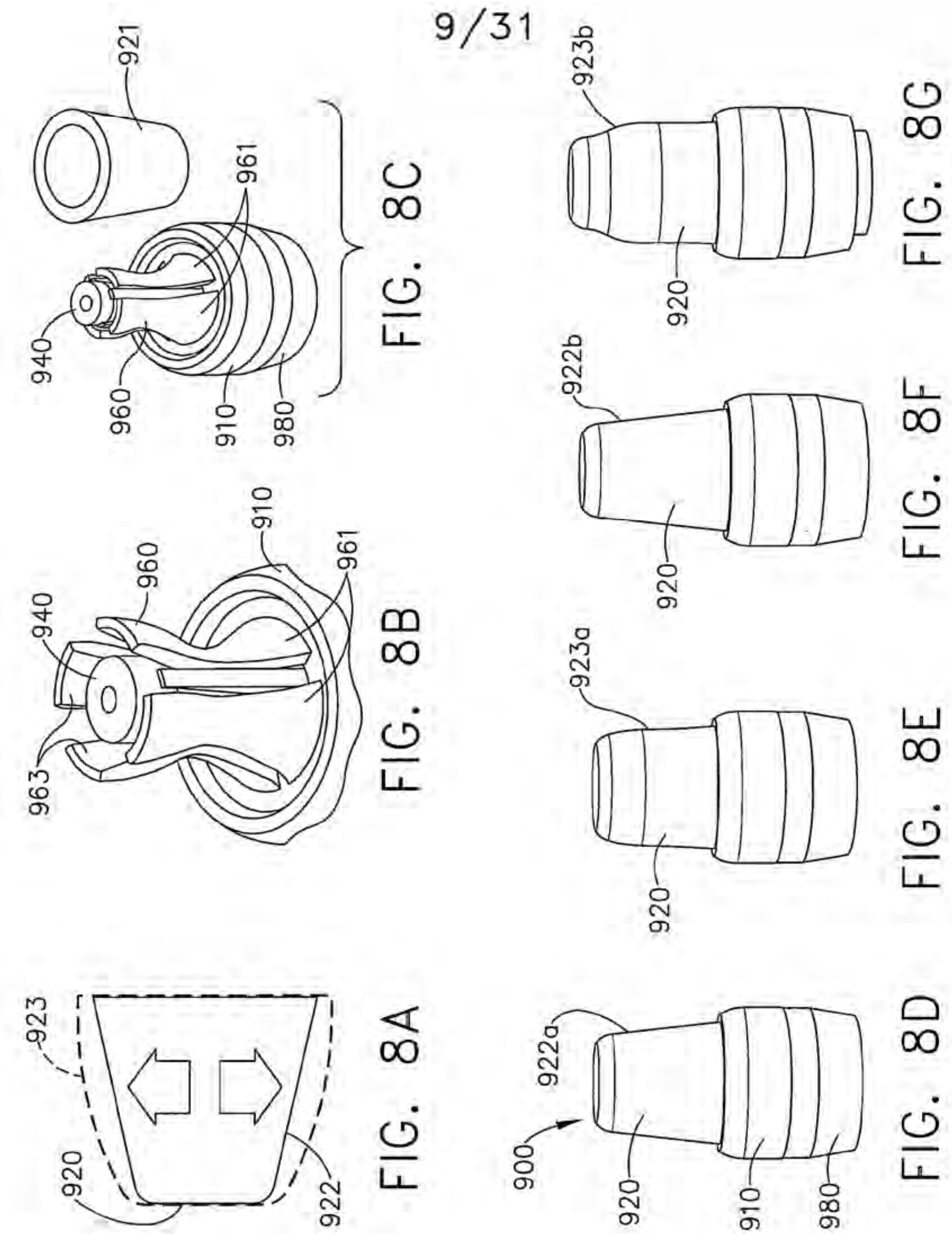

FIG. 8A
920
923
922
FIG. 8B
963
940
960
910
961
FIG. 8C
921
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960
910
980
961
FIG. 8D
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FIG. 8E
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923a
FIG. 8F
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922b
FIG. 8G
920
923b

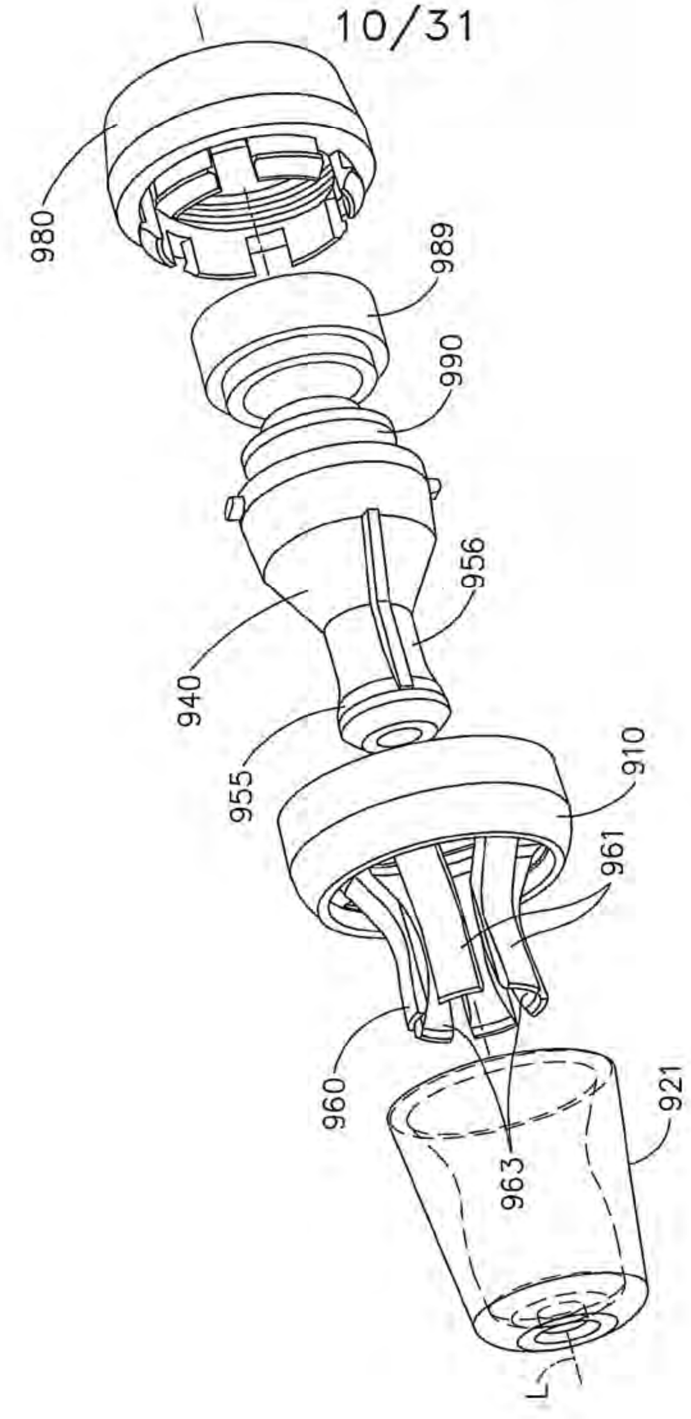
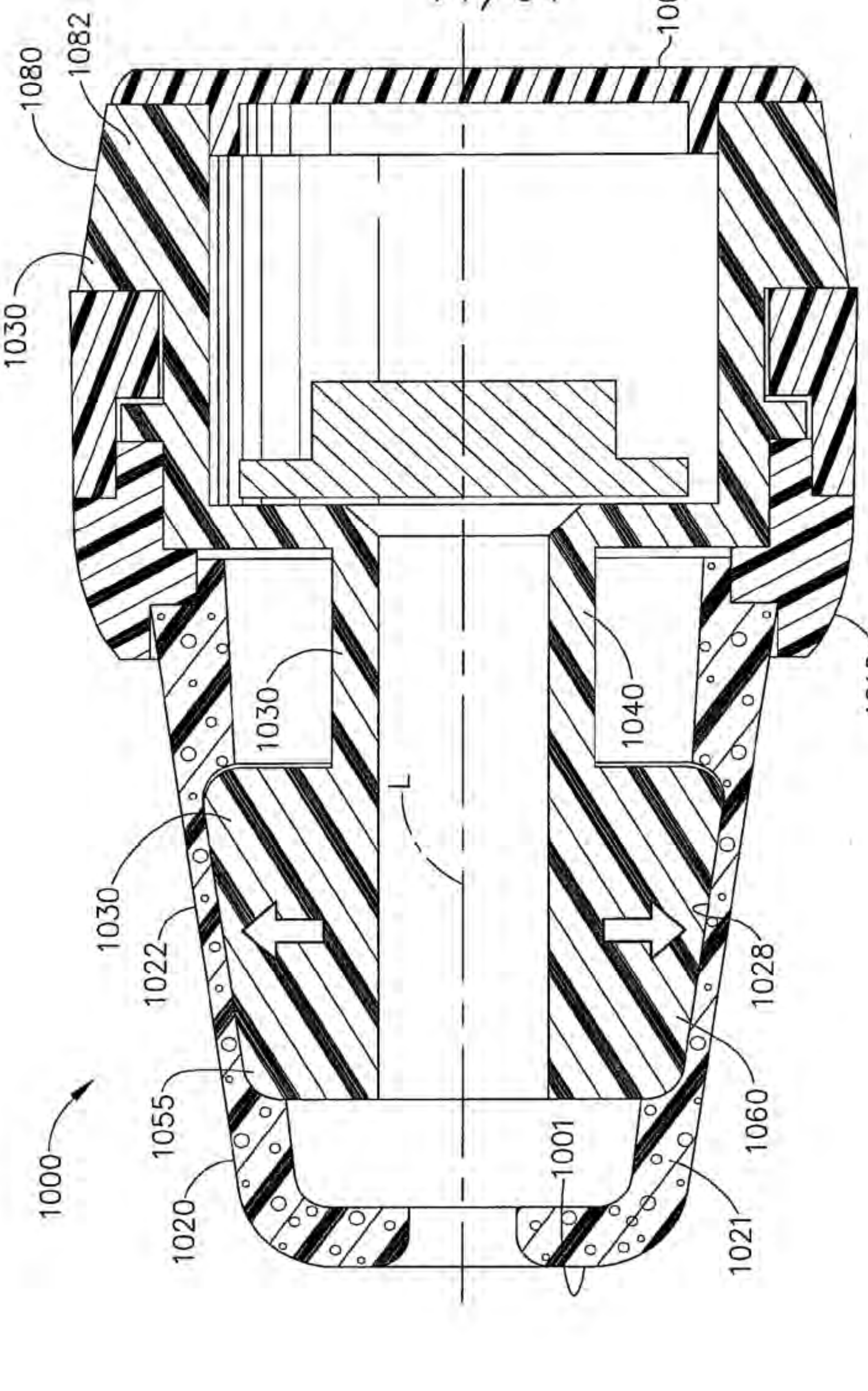


FIG. 9


1000
1002
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1028
1055
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1001
1020
1021

FIG. 10

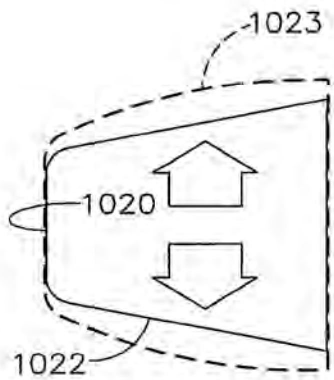

FIG. 11A

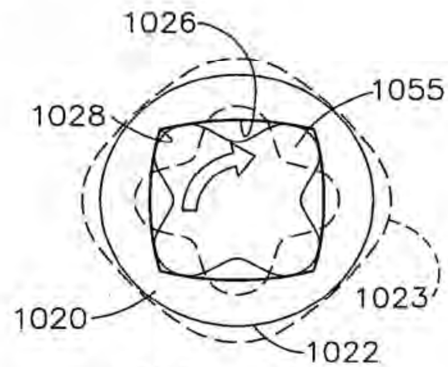

FIG. 11B

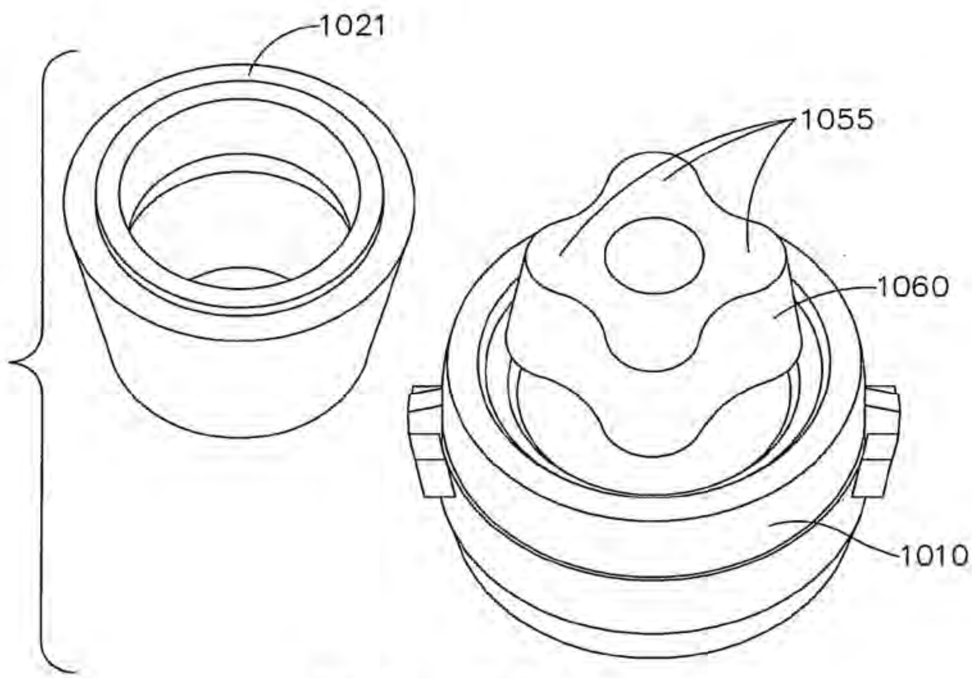

FIG. 11C

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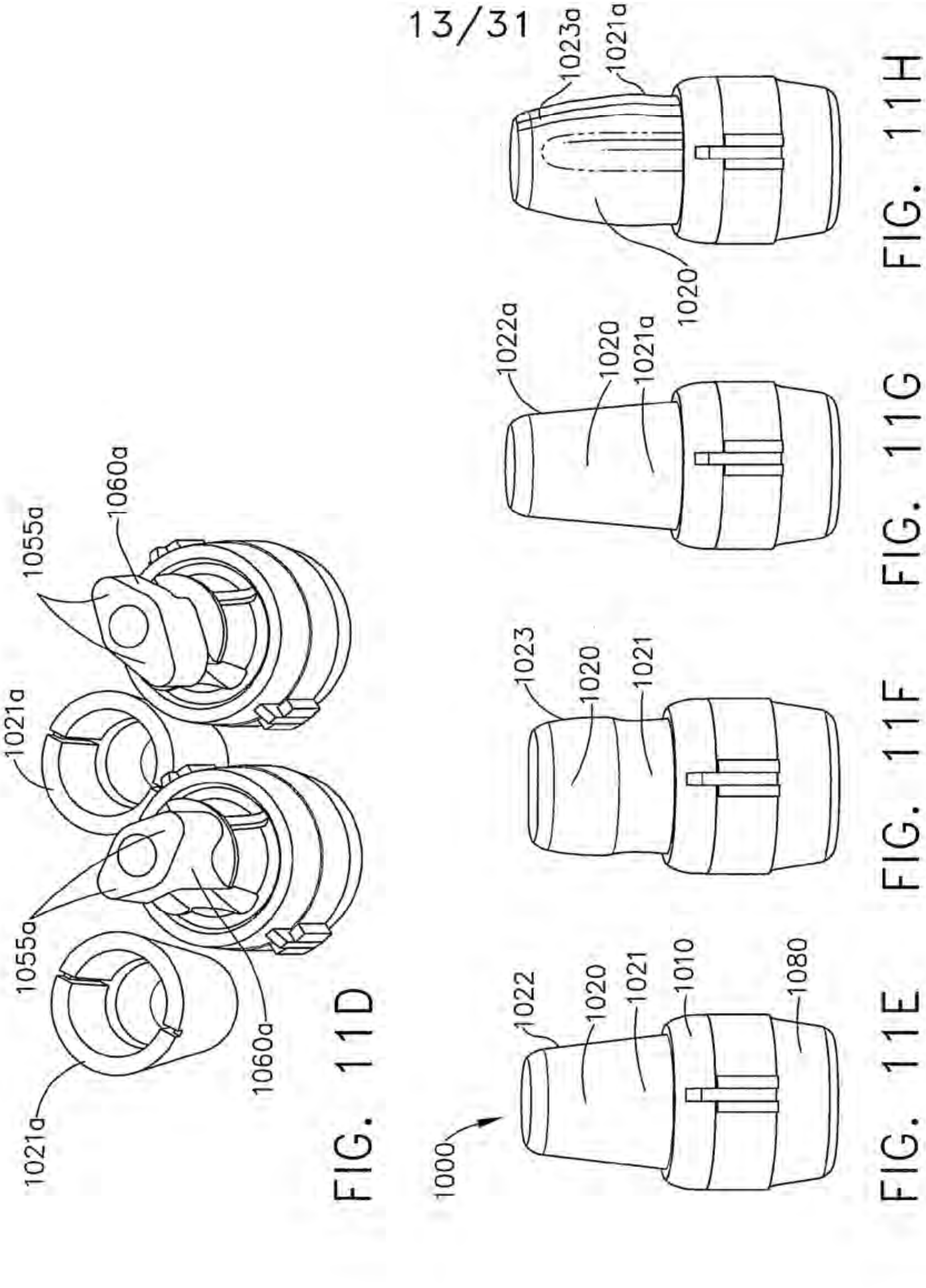

FIG. 11D

FIG. 11E

FIG. 11F

FIG. 11G

FIG. 11H

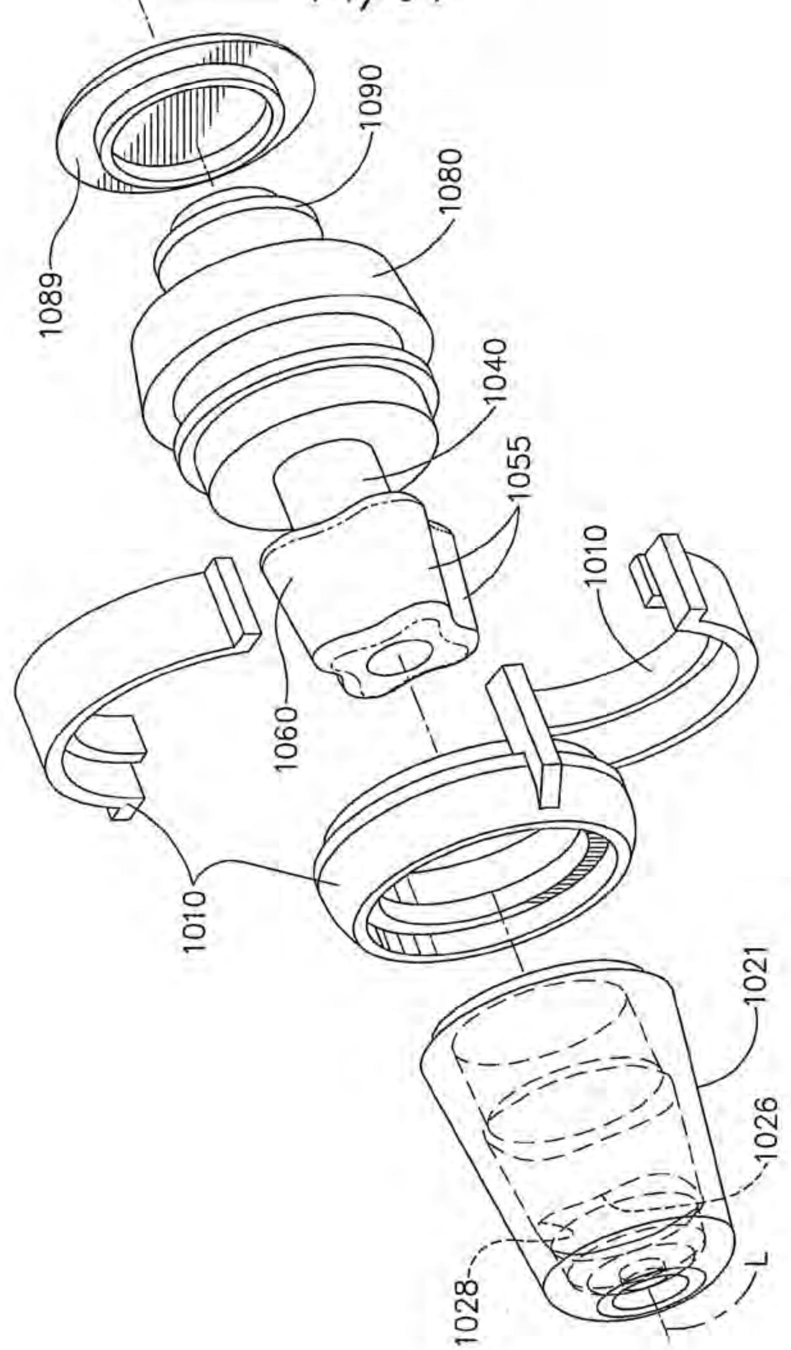

FIG. 12

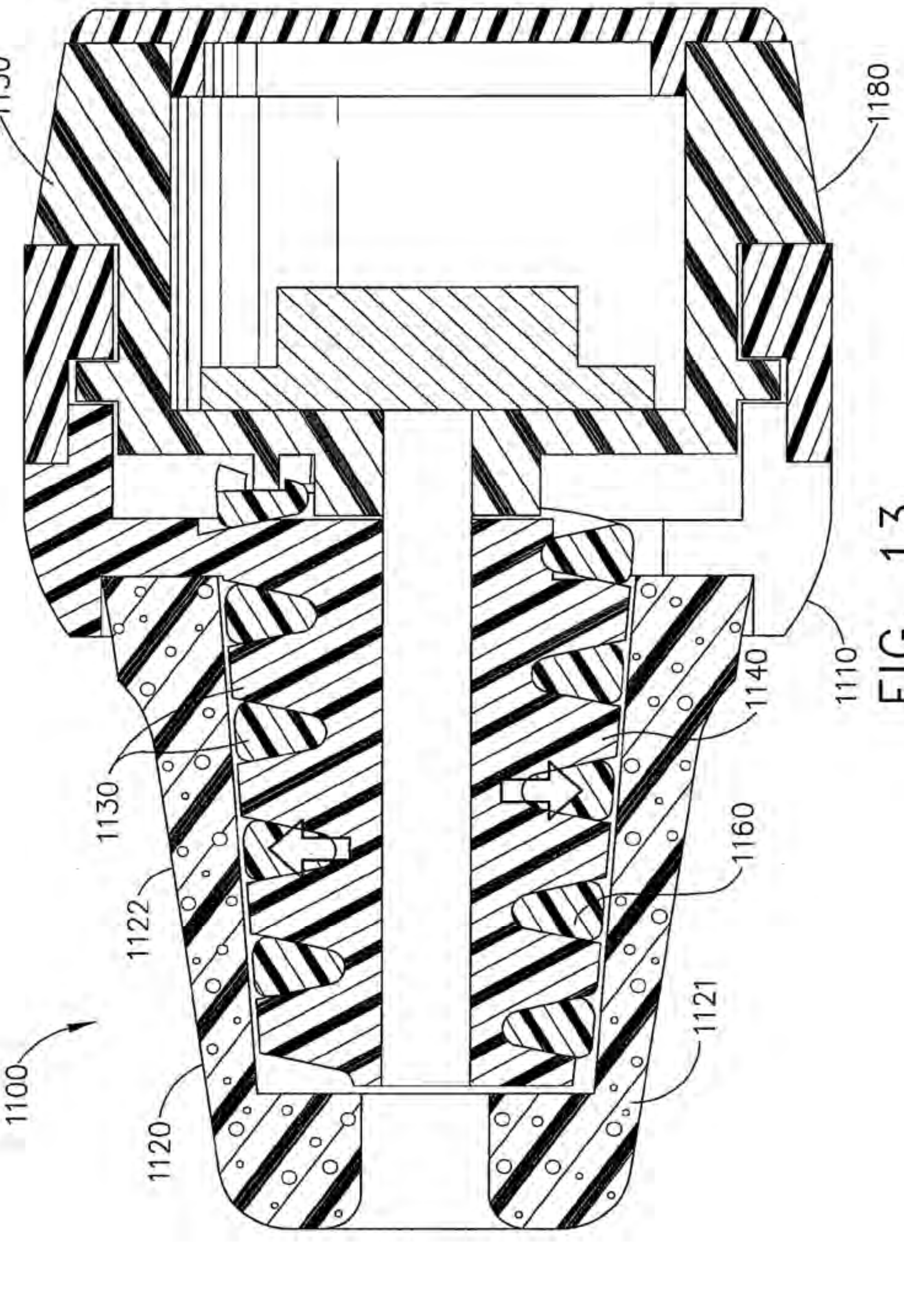

FIG. 13

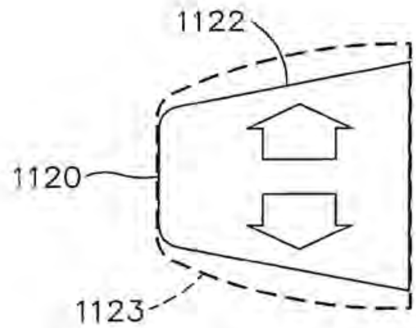

FIG. 14A

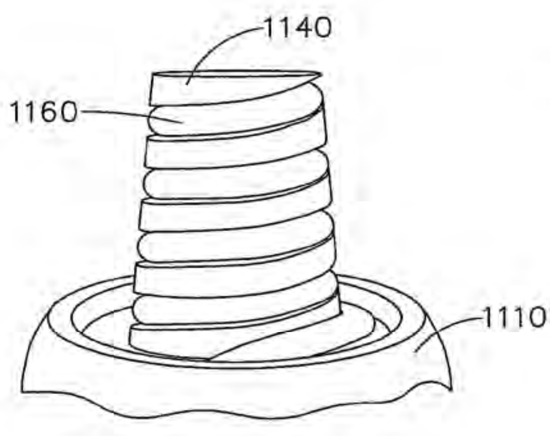

FIG. 14B

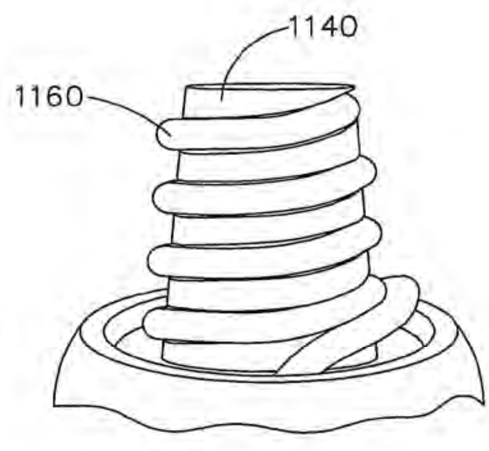

FIG. 14C

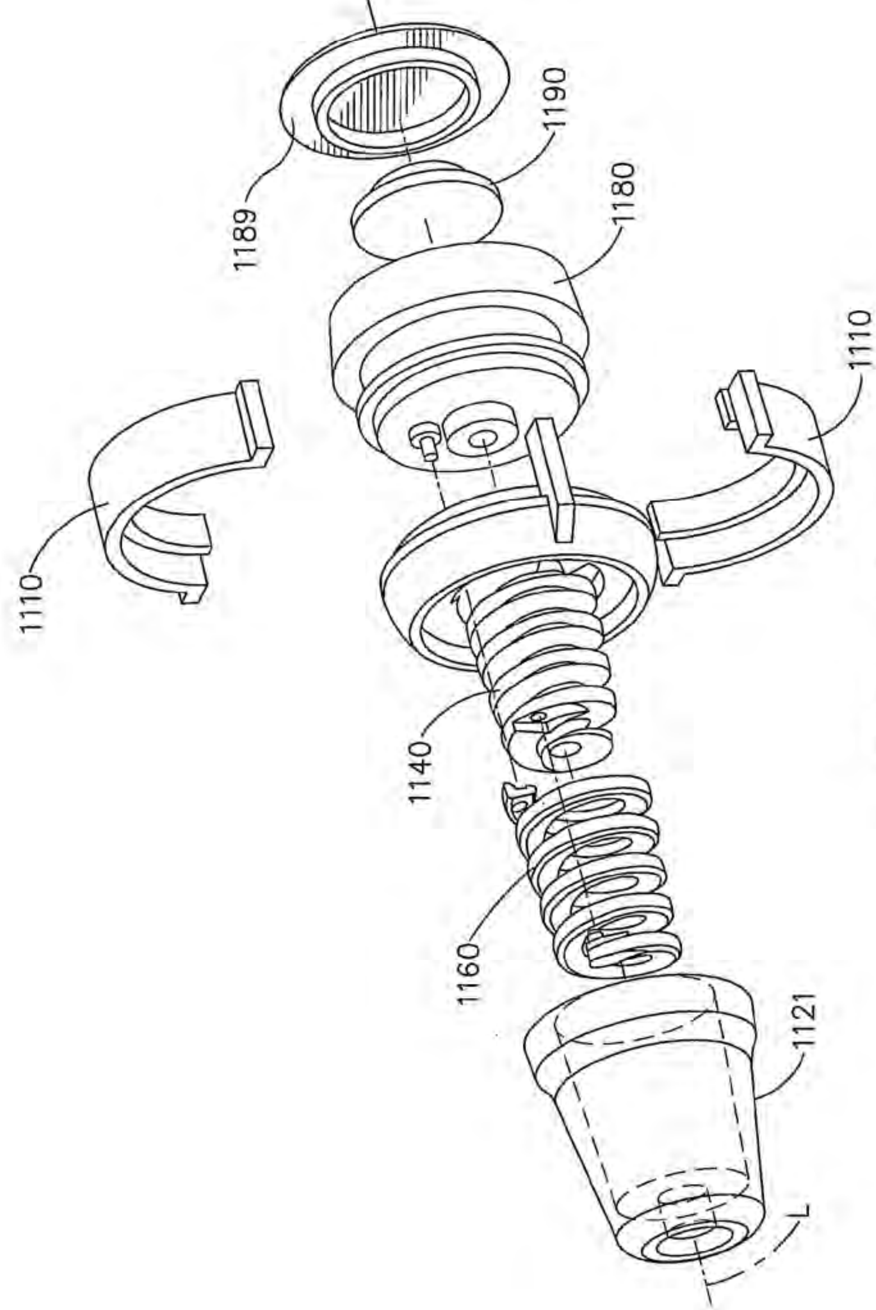

FIG. 15

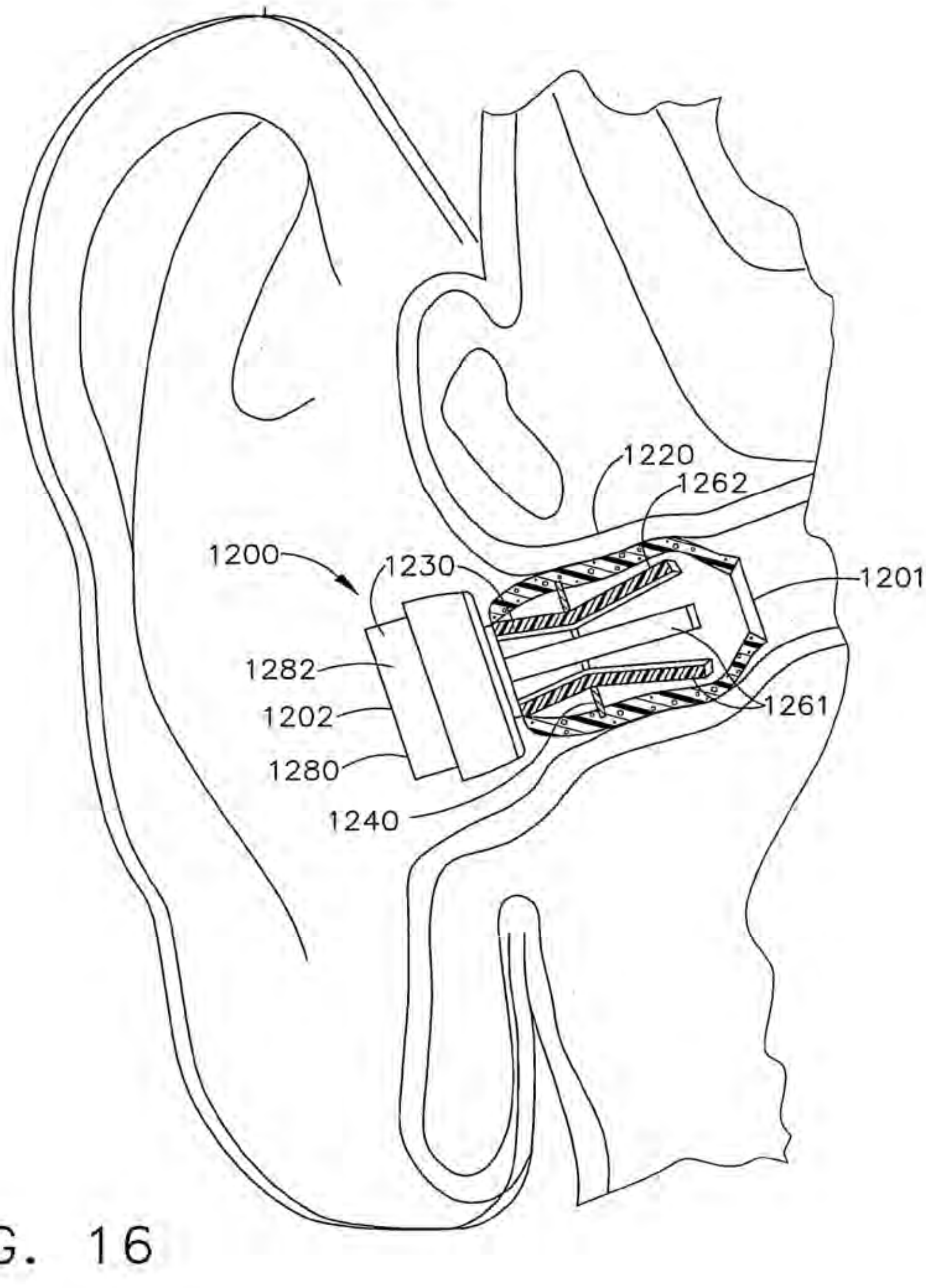

FIG. 16

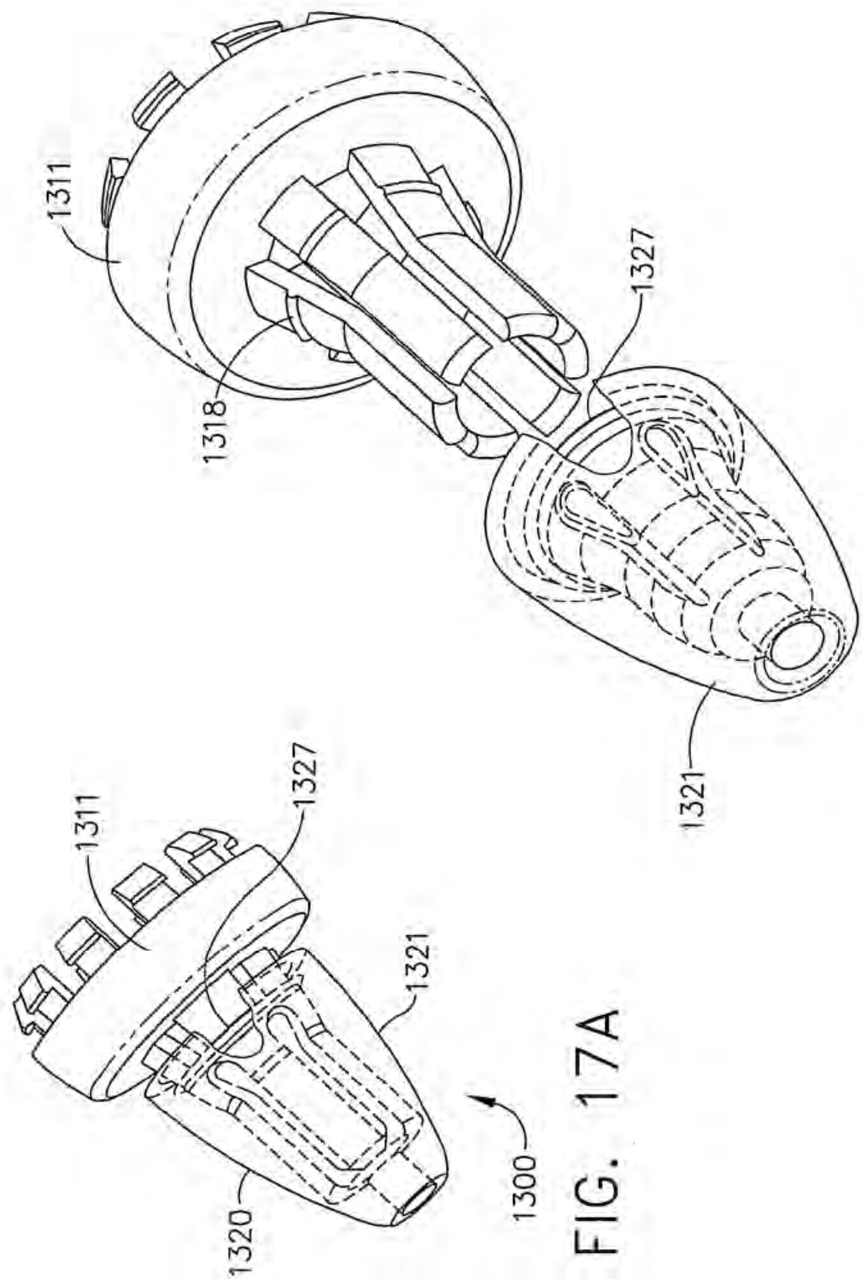

FIG. 17A

FIG. 17B

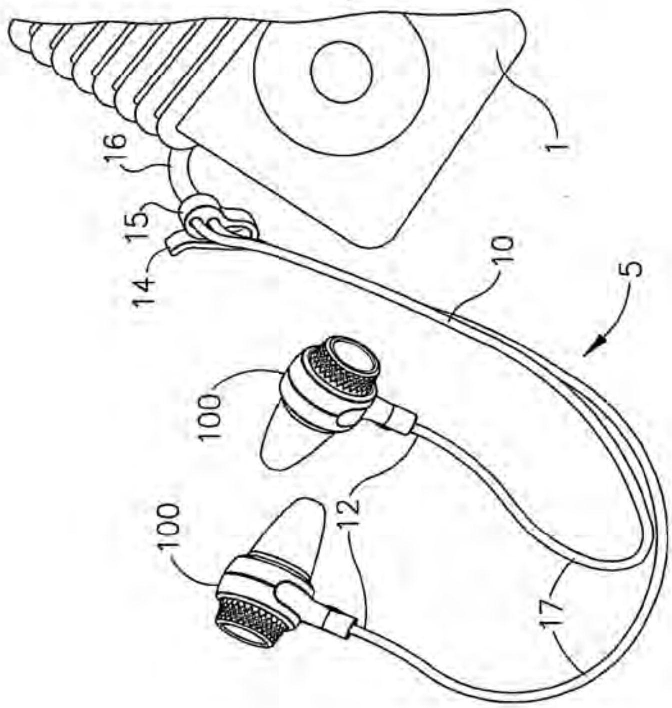

FIG. 18B

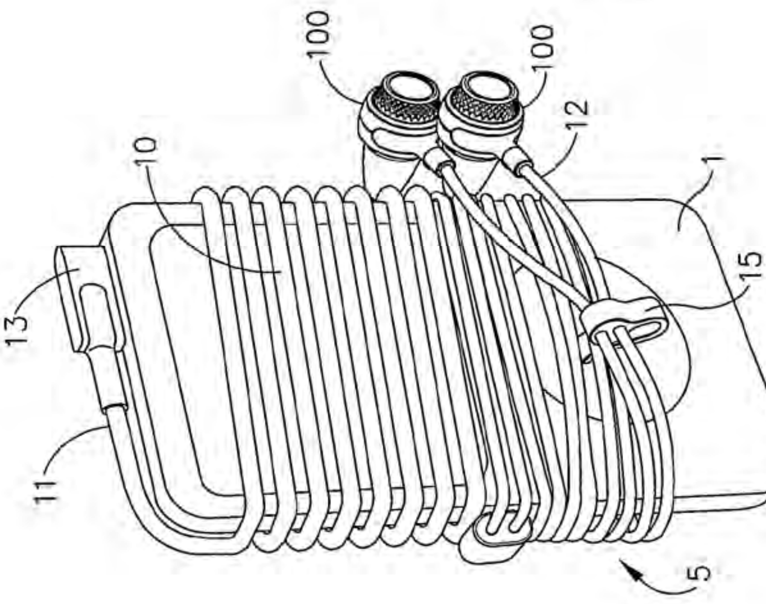

FIG. 18A

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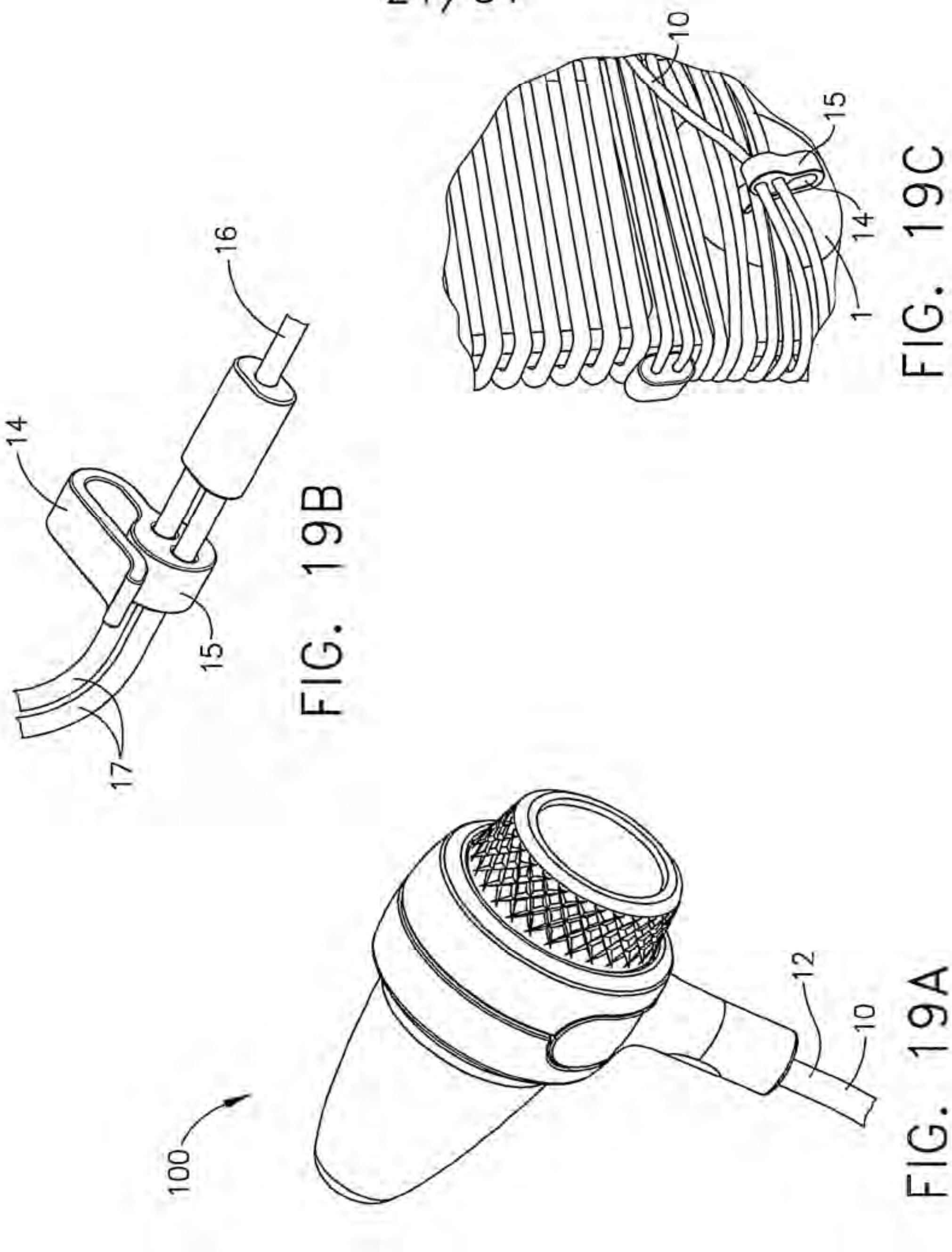

FIG. 19A

FIG. 19B

FIG. 19C

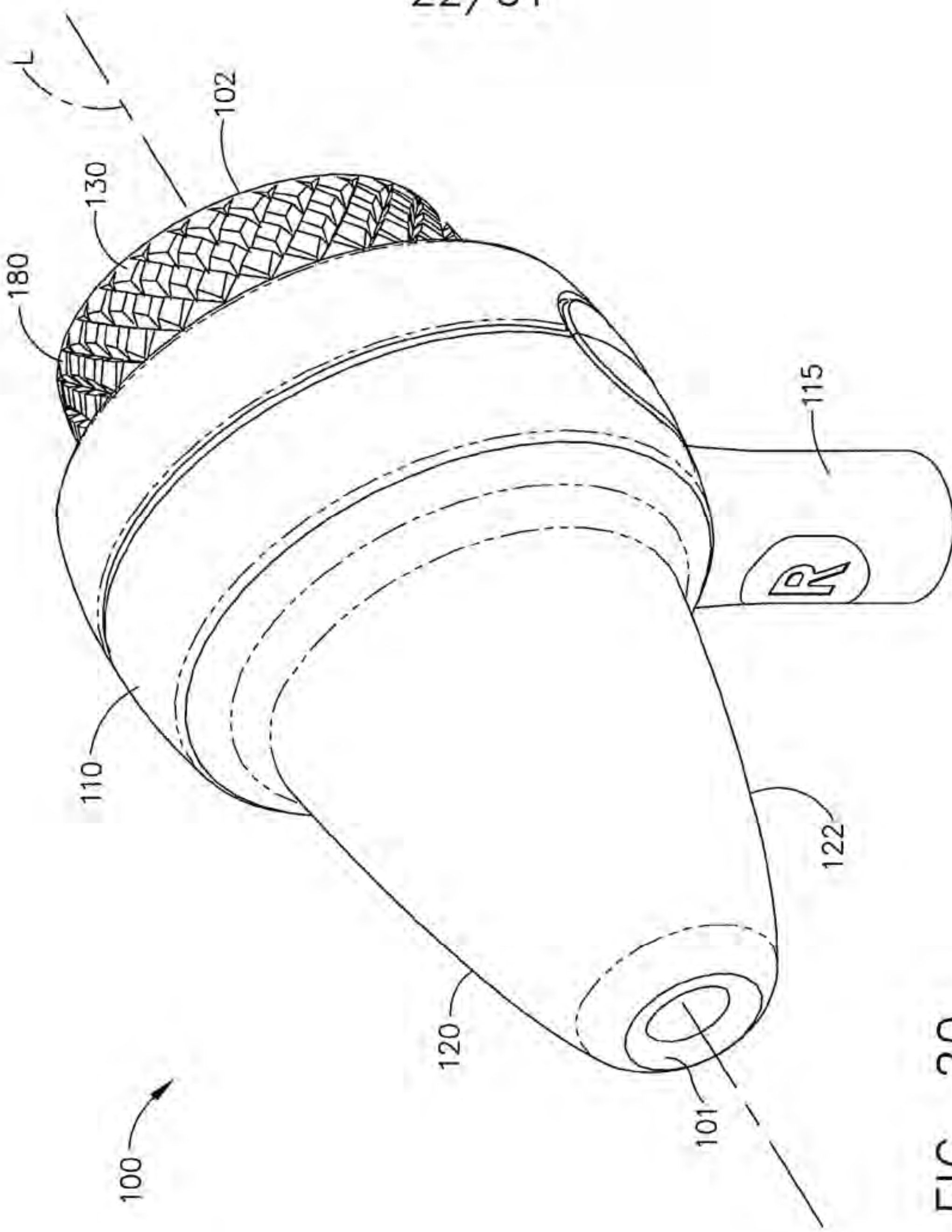

FIG. 20

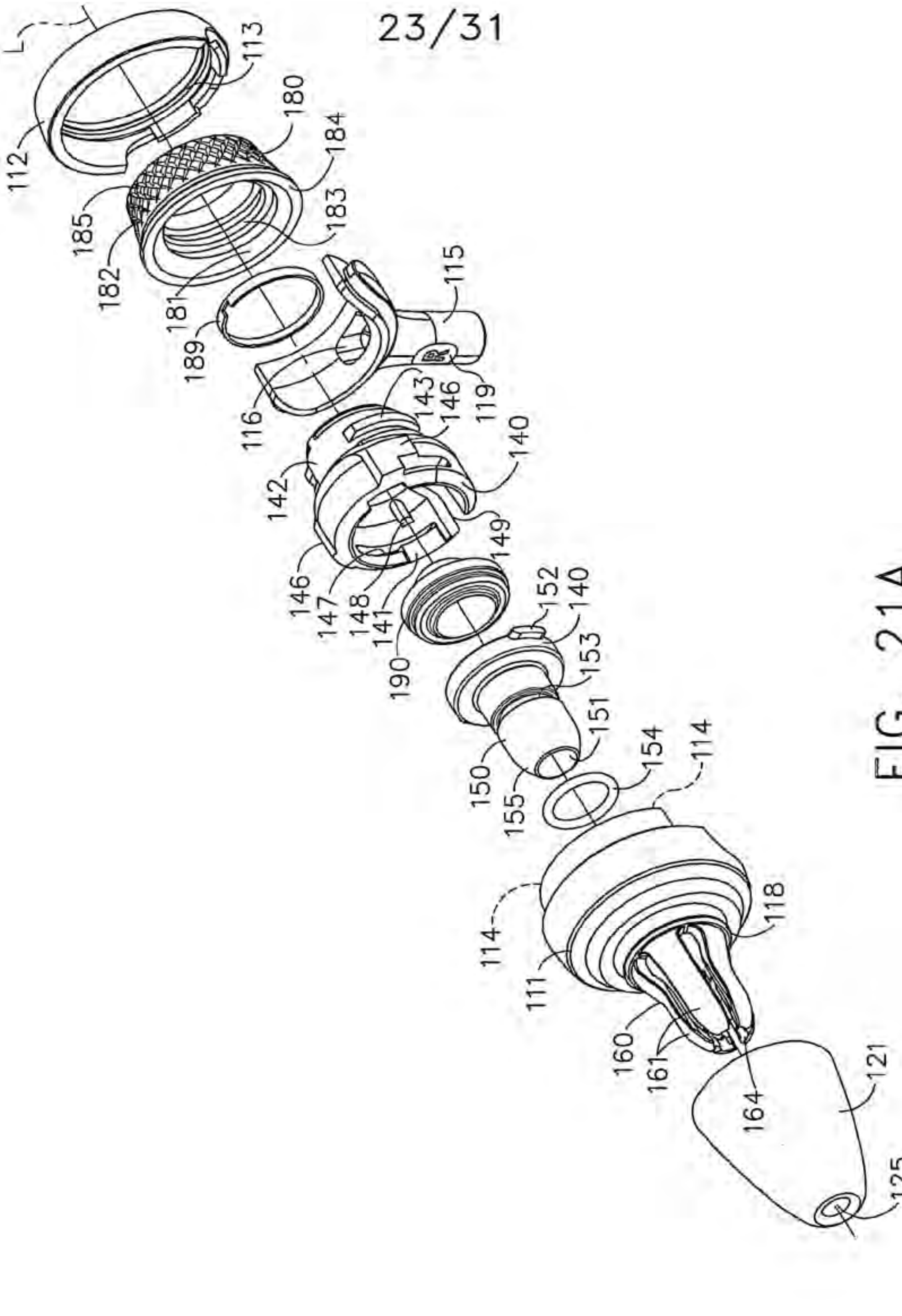
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FIG. 21A

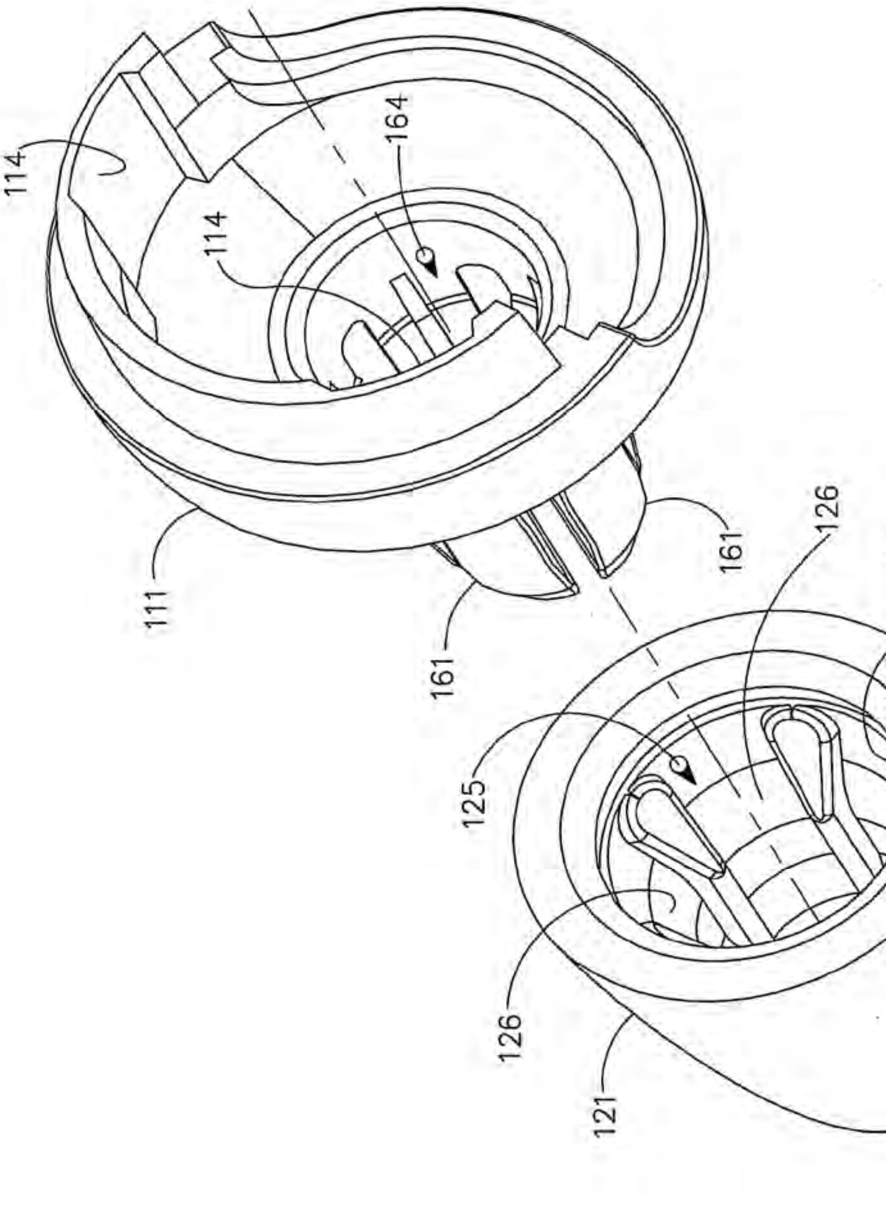

FIG. 21B

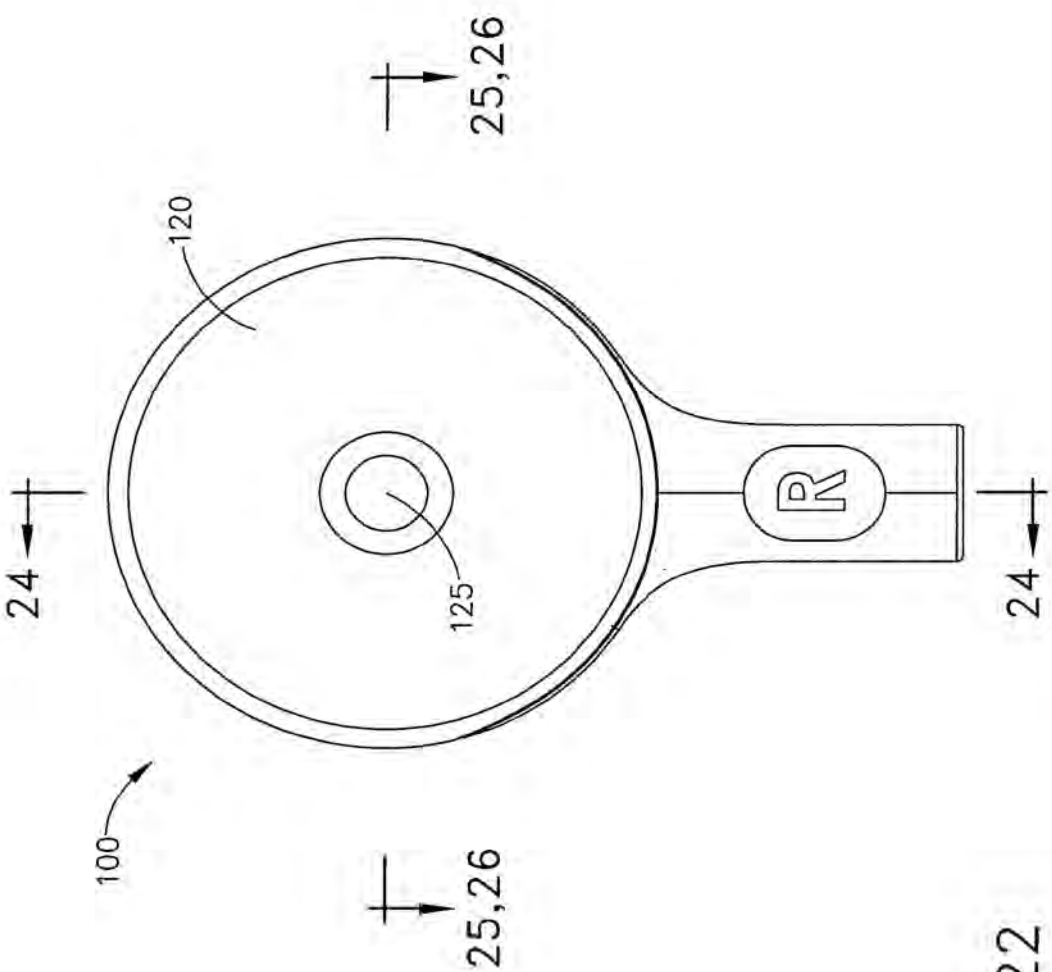

FIG. 22

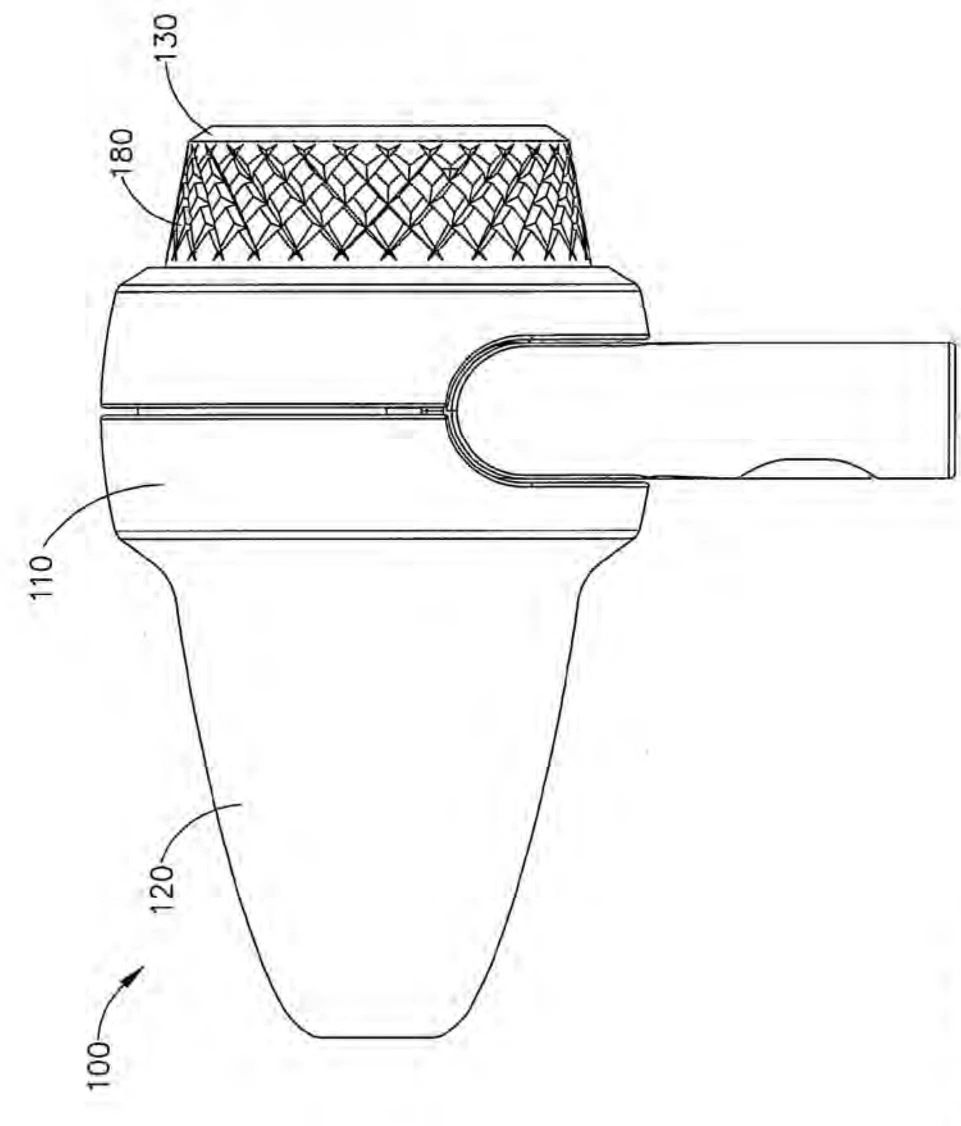

FIG. 23

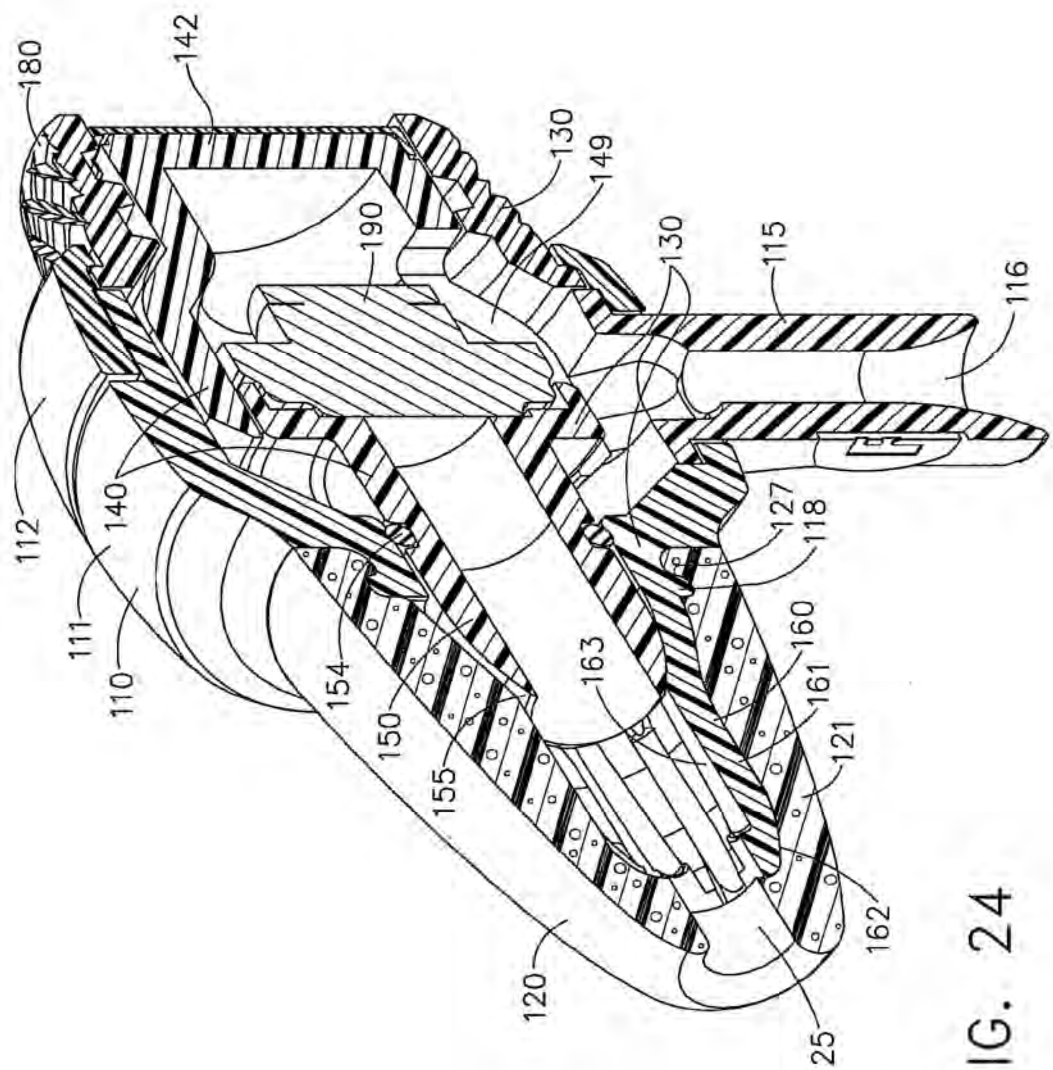
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FIG. 24

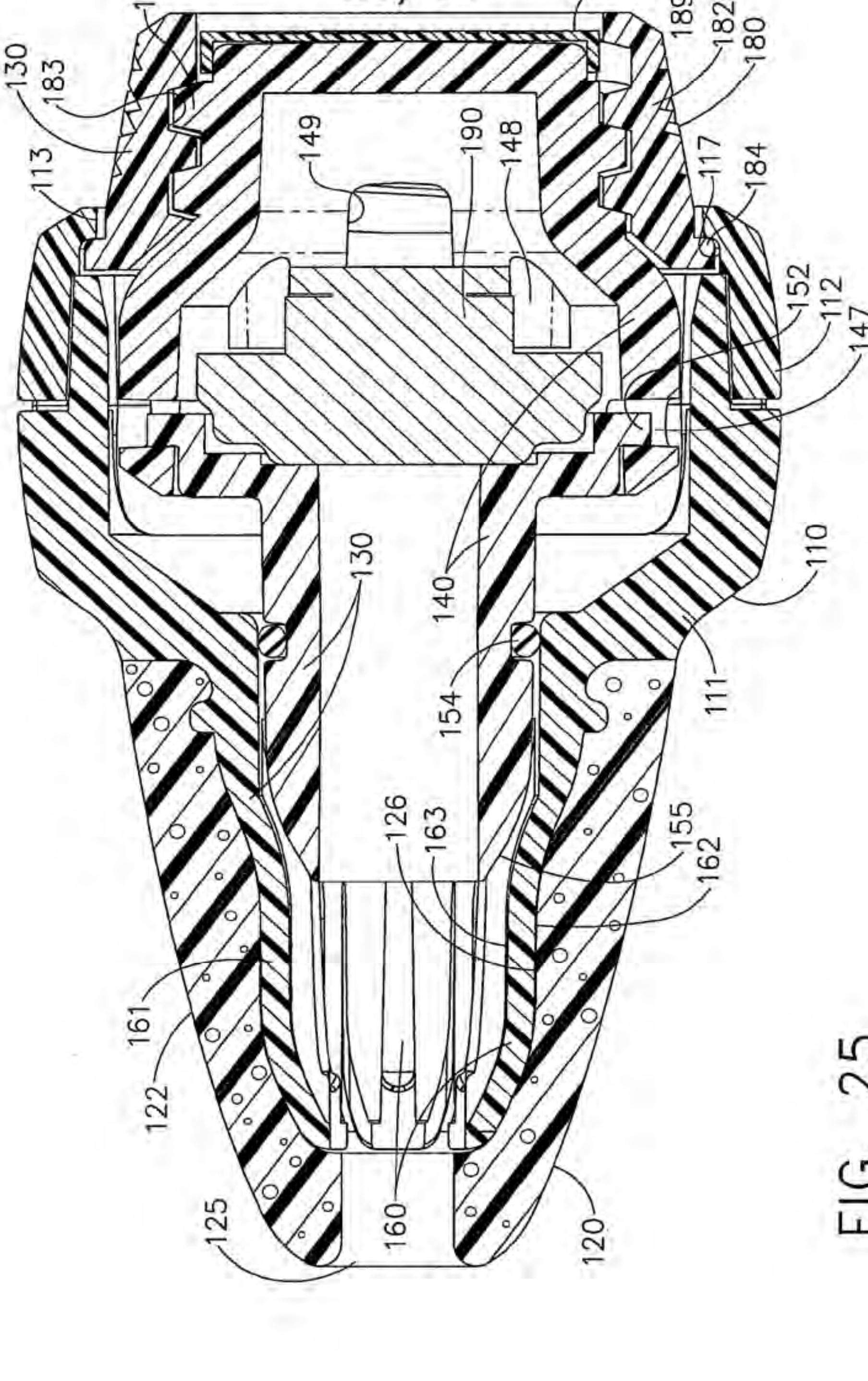
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FIG. 25

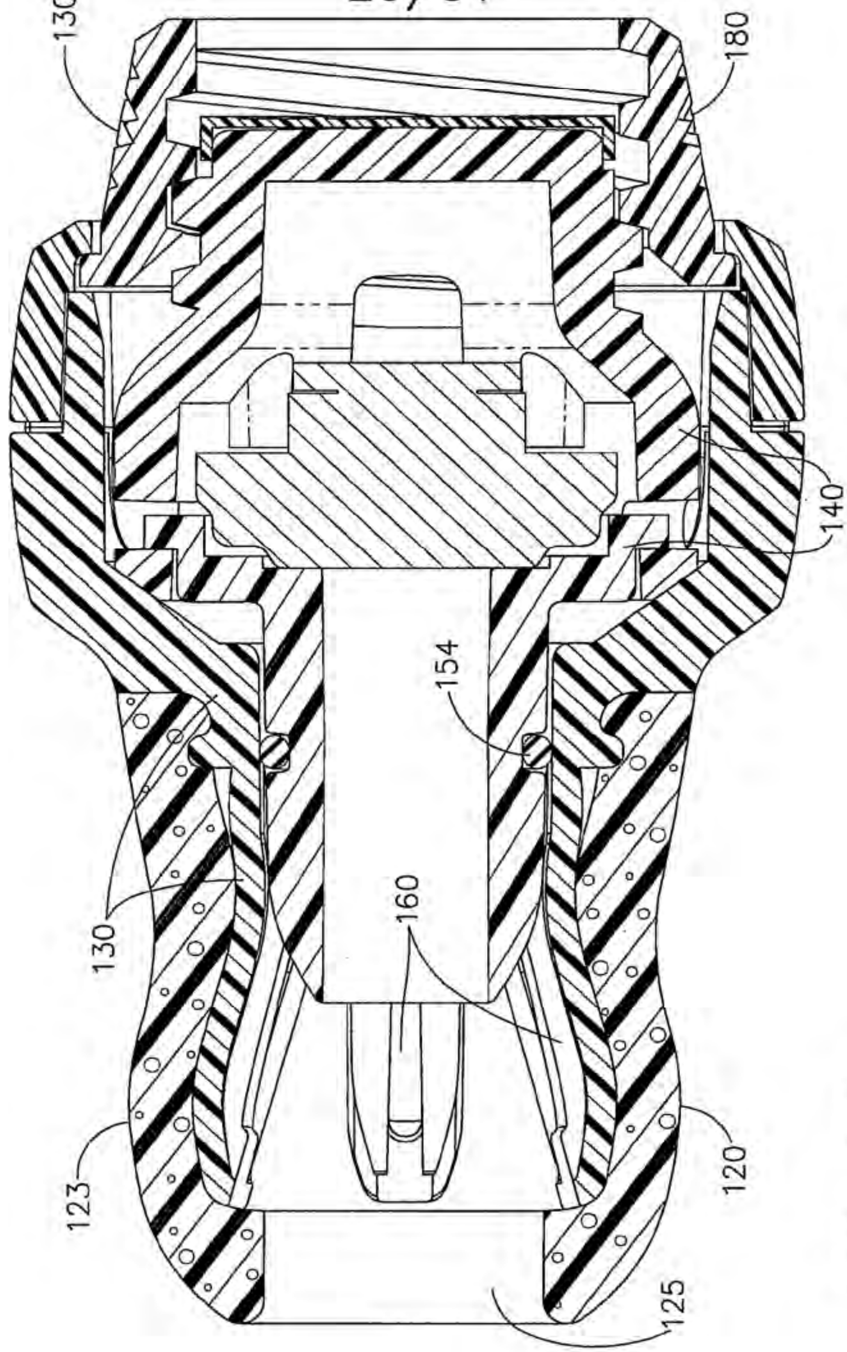

FIG. 26

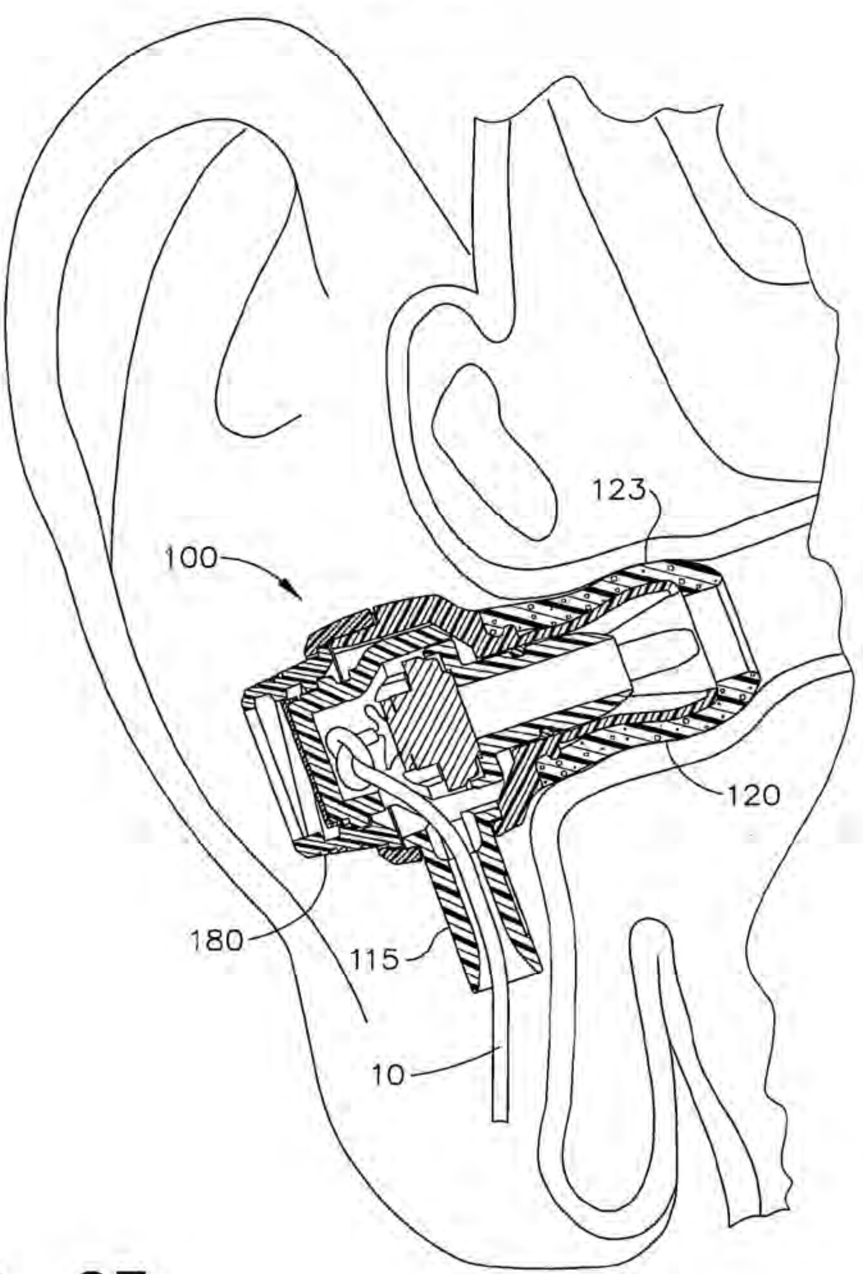

FIG. 27

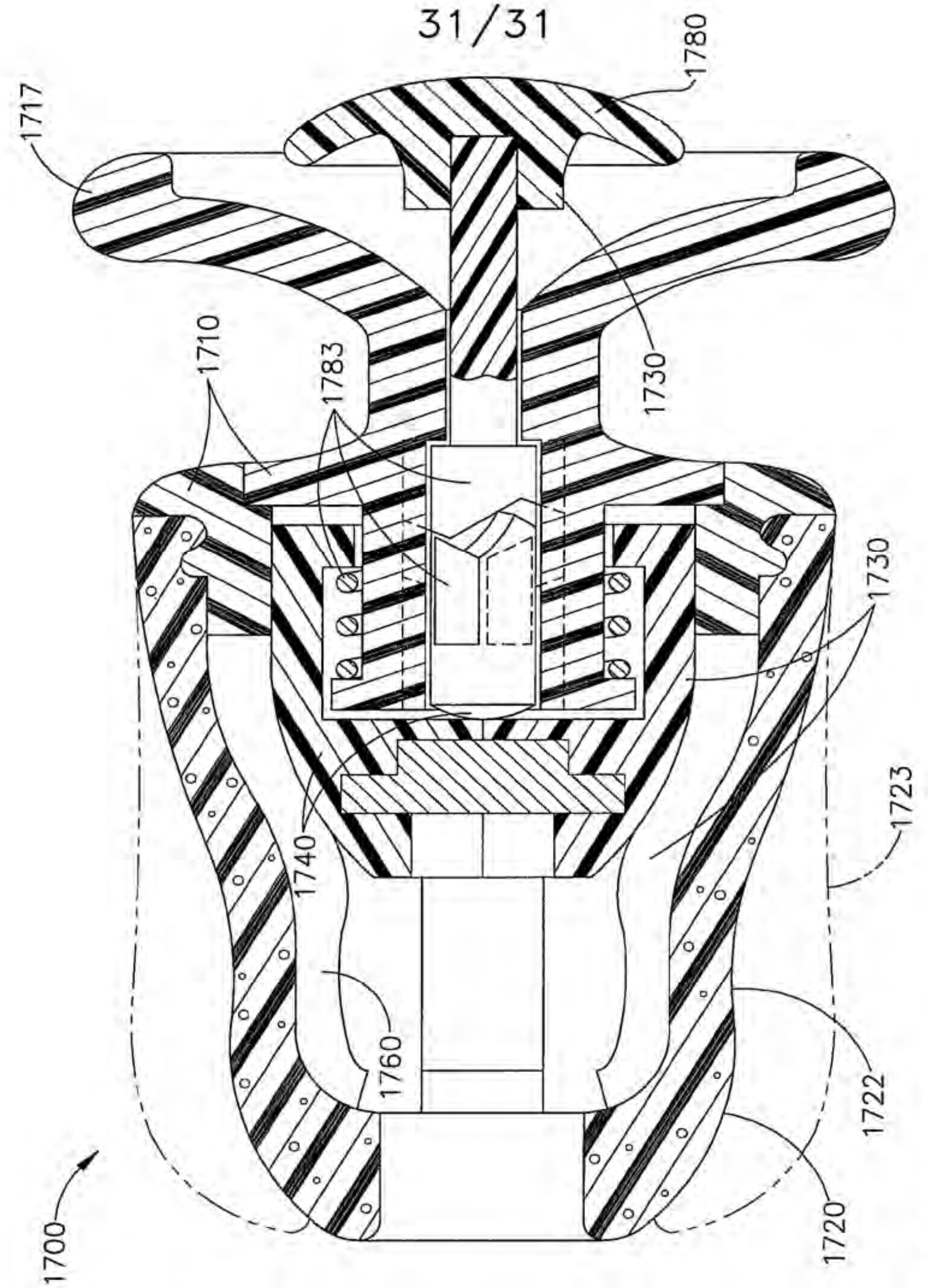

FIG. 28

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/88656

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04R 25/00 (2009.01)
USPC - 381/380
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC: 381/380

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 381/309, 370, 380 (keyword limited - see search terms)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST (USPT, PGPB, EPAB, JPAB); Google Patents; Google
Search Terms Used: adjustable earplug; cantilever arm; actuator; dial; shape; transducer; cord; foam

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 2004/0258263 A1 (SAXTON et al.) 23 December 2004 (23.12.2004), entire document, especially; para [0076], [0078], [0080], [0081], [0083]-[0087], [0093], [0095]	3-5, 8-12, 14, 15, 22, 23, 25, 26, 28 — 1, 2, 6, 7, 13, 16-21,24,27
Y	US 7,182,087 B1 (MARSH) 27 February 2007 (27.02.2007), entire document, especially; col. 2, ln 3-26; col. 3, ln 44-48, 64 - col. 4, ln 29, 31-32; col. 5, ln 25-26	1, 2, 6, 7, 13, 21
Y	US 2007/0218962 A1 (TSAI) 20 September 2007 (20.09.2007), entire document, especially; para [0023], [0024]	16-20
Y	US 2006/0140426 A1 (BERG) 29 June 2006 (29.06.2006), entire document, especially; para [0021]	24, 27
Y	US 2002/0090099 A1 (HWANG) 11 July 2002 (11.07.2002), entire document, especially; para [0015]	17

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 February 2009 (04.02.2009)	17 FEB 2009

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2007)

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS
First Named Inventor/Applicant Name:	Michael J. Pelland
Filer:	Mark G. Knedeisen/Mona Cornelia
Attorney Docket Number:	080188PCTUS

Filed as Small Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Basic National Stage Fee	2631	1	165	165
Natl Stage Search Fee - U.S. was the ISA	2641	1	50	50
Natl Stage Exam Fee - all other cases	2633	1	110	110
Pages:				
Claims:				
Claims in excess of 20	2615	13	26	338
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**663**

Electronic Acknowledgement Receipt

EFS ID:	8564450
Application Number:	12936488
International Application Number:	PCT/US09/39754
Confirmation Number:	3553
Title of Invention:	WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS
First Named Inventor/Applicant Name:	Michael J. Pelland
Customer Number:	26285
Filer:	Mark G. Knedeisen/Mona Cornelia
Filer Authorized By:	Mark G. Knedeisen
Attorney Docket Number:	080188PCTUS
Receipt Date:	05-OCT-2010
Filing Date:	
Time Stamp:	16:35:19
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$663
RAM confirmation Number	3081
Deposit Account	111110
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	Transmittal_of_371_Application.pdf	265182 [illegible]	no	3

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2		Preliminary_Amendment.pdf	578359 [illegible]	yes	9

Multipart Description/PDF files in .zip description

Document Description	Start	End
Preliminary Amendment	1	1
Claims	2	8
Applicant Arguments/Remarks Made in an Amendment	9	9

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3		IDS.pdf	384663 [illegible]	yes	4

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Information Disclosure Statement (IDS) Filed (SB/08)	2	4

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
4	Foreign Reference	WO2007136620A2.pdf	1410935 [illegible]	no	28

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
5	Foreign Reference	WO2008054985A2.pdf	1321312 [illegible]	no	39

Warnings:

Information:

6	Foreign Reference	WO2009086555A1.pdf	2694584 [illegible]	no	72
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Information:					
7	NPL Documents	IT_Review.pdf	232299 [illegible]	no	4
Warnings:					
Information:					
8	Fee Worksheet (PTO-875)	fee-info.pdf	36588 [illegible]	no	2
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		Total Files Size (in bytes):	6923922		

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 October 2009 (15.10.2009)

PCT

(10) International Publication Number
WO 2009/126614 A1

(51) International Patent Classification:
H04R 1/02 (2006.01)

(21) International Application Number:
PCT/US2009/039754

(22) International Filing Date:
7 April 2009 (07.04.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/123,265 7 April 2008 (07.04.2008) US

(71) Applicant *(for all designated States except US)*: **KOSS CORPORATION** [US/US]; 4129 North Port Washington Avenue, Milwaukee, WI 53212 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **PELLAND, Michael, J.** [US/US]; N 4626 Wildwood Lane, Princeton, WI 54968-8738 (US). **KOSS, Michael, J.** [US/US]; 2800 West Bradley Road, Milwaukee, WI 53217 (US). **SAGAN, Michael** [US/US]; 598 Woodberry Street, Marshall, WI 53559 (US). **RECKAMP, Steven** [US/US]; 1158 Atcheson Avenue, Sun Prairie, WI 53590-3812 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

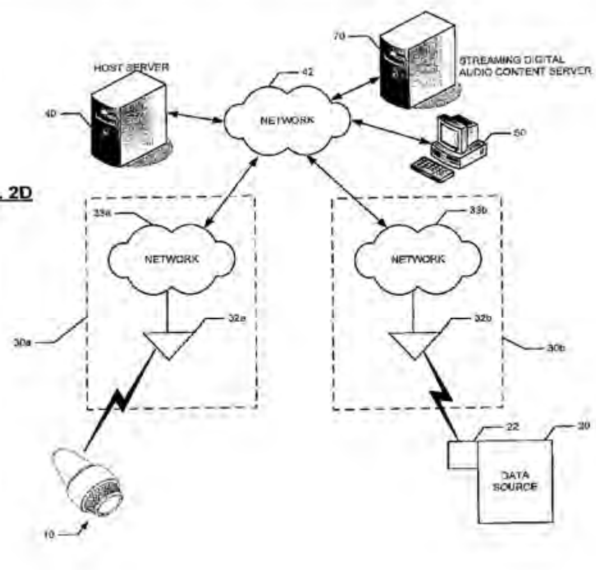
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

[Continued on next page]

(54) Title: WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

Fig. 2D



(57) Abstract: A wireless earphone that comprises a transceiver circuit for receiving streaming audio from a data source over a local ad hoc wireless network. When the data source and the earphone are out of range, they transition automatically to an infrastructure wireless network. If there is no common infrastructure wireless network for both the data source and the speakerphone set, the earphone connects t a host server via an available wireless network.

WO 2009/126614 A1

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *with international search report (Art. 21(3))*

WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

Inventors: Michael J. Pelland, Michael J. Koss, Michael Sagan, Steven Reckamp, Greg Hollingstad, Jeff Bovee, and Morgan Lowery

PRIORITY CLAIM

The present application claims priority to United States provisional application serial number 61/123,265, filed April 7, 2008, which is incorporated herein by reference.

BACKGROUND

Digital audio players, such as MP3 players and iPods, that store and play digital audio files, are very popular. Such devices typically comprise a data storage unit for storing and playing the digital audio, and a headphone set that connects to the data storage unit, usually with a ¼" or a 3.5 mm jack and associated cord. Often the headphones are in-ear type headphones. The cord, however, between the headphones and the data storage unit can be cumbersome and annoying to users, and the length of the cord limits the physical distance between the data storage unit and the headphones. Accordingly, some cordless headphones have been proposed, such as the Monster iFreePlay cordless headphones from Apple Inc., which include a docking port on one of the earphones that can connect directly to an iPod Shuffle. Because they have the docking port, however, the Monster iFreePlay cordless headphones from Apple are quite large and are not in-ear type phones. Recently, cordless headphones that connect wirelessly via IEEE 802.11 to a WLAN-ready laptop or personal computer (PC) have been proposed, but such headphones are also quite large and not in-ear type phones.

SUMMARY

In one general aspect, the present invention is directed to a wireless earphone that comprises a transceiver circuit for receiving streaming audio from a data source, such as a digital audio player or a computer, over an ad hoc wireless network. When the data source and the earphone are out of range via the ad hoc wireless network, they may transition automatically to a common infrastructure wireless network (e.g., a wireless LAN). If there is no common infrastructure wireless network for both the data source and the earphone, the earphone may connect via an available infrastructure wireless network to a host server. The host server may, for example, broadcast streaming audio to the earphone and/or transmit to the earphone a network address (e.g., an Internet Protocol (IP) address) for a network-connected content server that

streams digital audio. The earphone may then connect to the content server using the IP address. The content server may be an Internet radio server, including, for example, an Internet radio server that broadcasts streaming audio from the data source or some other content.

These and other advantageous, unique aspects of the wireless earphone are described below.

FIGURES

Various embodiments of the present invention are described herein by way of example in conjunction with the following figures, wherein:

Figures 1A-1E are views of a wireless earphone according to various embodiments of the present invention;

Figures 2A-2D illustrate various communication modes for a wireless earphone according to various embodiments of the present invention;

Figure 3 is a block diagram of a wireless earphone according to various embodiments of the present invention;

Figures 4A-4B show the wireless earphone connected to another device according to various embodiments of the present invention;

Figure 5 is a diagram of a process implemented by a host server according to various embodiments of the present invention;

Figure 6 is a diagram of a process implemented by the wireless earphone to transition automatically between wireless networks according to various embodiments of the present invention;

Figures 7, 8 and 10 illustrate communication systems involving the wireless earphone according to various embodiments of the present invention;

Figure 9 is a diagram of a headset including a wireless earphone and a microphone according to various embodiments of the present invention; and

Figure 11 is a diagram of a pair of wireless earphones with a dongle according to various embodiments of the present invention.

DESCRIPTION

In one general aspect, the present invention is directed to a wireless earphone that receives streaming audio data via ad hoc wireless networks and infrastructure wireless networks, and that transitions seamlessly between wireless networks. The earphone may comprise one or more in-ear, on-ear, or over-ear speaker elements. Two exemplary in-ear earphone shapes for the wireless earphone 10 are shown in Figures 1A and 1B, respectively, although in other embodiments the earphone may take different shapes and the exemplary shapes shown in Figures 1A and 1B are not intended to be limiting. In one embodiment, the earphone transitions automatically and seamlessly, without user intervention, between communication modes. That is, the earphone may transition automatically from an ad hoc wireless network to an infrastructure wireless network, without user intervention. As used herein, an "ad hoc wireless network" is a network where two (or more) wireless-capable devices, such as the earphone and a data source, communicate directly and wirelessly, without using an access point. An "infrastructure wireless network," on the other hand, is a wireless network that uses one or more access points to allow a wireless-capable device, such as the wireless earphone, to connect to a computer network, such as a LAN or WAN (including the Internet).

Figures 1A and 1B show example configurations for a wireless earphone 10 according to various embodiments of the present invention. The examples shown in Figures 1A and 1B are not limiting and other configurations are within the scope of the present invention. As shown in Figures 1A and 1B, the earphone 10 may comprise a body 12. The body 12 may comprise an ear canal portion 14 that is inserted in the ear canal of the user of the earphone 10. In various embodiments, the body 12 also may comprise an exterior portion 15 that is not inserted into user's ear canal. The exterior portion 15 may comprise a knob 16 or some other user control (such as a dial, a pressure-activated switch, lever, etc.) for adjusting the shape of the ear canal portion 14. That is, in various embodiments, activation (e.g. rotation) of the knob 16 may cause the ear canal portion 14 to change shape so as to, for example, radially expand to fit snugly against all sides of the user's ear canal. Further details regarding such a shape-changing earbud earphone are described in application PCT/US08/88656, filed 31 December 2008, entitled "Adjustable Shape Earphone," which is incorporated herein by reference in its entirety. The earphone 10 also may comprise a transceiver circuit housed within the body 12. The transceiver circuit, described further below, may transmit and receive the wireless signals, including receive streaming audio for playing by the earphone 10. The transceiver circuit may be housed in the exterior portion 15 of the earphone 10 and/or in the ear canal portion 14.

Although the example earphones 10 shown in Figures 1A and 1B include a knob 16 for adjusting the shape of the ear canal portion 14, the present invention is not so limited, and in other embodiments, different means besides a knob 16 may be used to adjust the ear canal portion 14. In addition, in other embodiments, the earphone 10 may not comprise a shape-changing ear canal portion 14.

In various embodiments, the user may wear two discrete wireless earphones 10: one in each ear. In such embodiments, each earphone 10 may comprise a transceiver circuit. In such embodiments, the earphones 10 may be connected by a string or some other cord-type connector to keep the earphones 10 from being separated.

In other embodiments, as shown in Figure 1C, a headband 19 may connect the two (left and right) earphones 10. The headband 19 may be an over-the-head band, as shown in the example of Figure 1C, or the headband may be a behind-the-head band. In embodiments comprising a headband 19, each earphone 10 may comprise a transceiver circuit; hence, each earphone 10 may receive and transmit separately the wireless communication signals. In other embodiments comprising a headband 19, only one earphone 10 may comprise the transceiver circuit, and a wire may run along the headband 19 to the other earphone 10 to connect thereby the transceiver circuit to the acoustic transducer in the earphone that does not comprise the transceiver circuit. The embodiment shown in Figure 1C comprises on-ear earphones 10; in other embodiments, in-ear or over-ear earphones may be used.

In other embodiments, the earphone 10 may comprise a hanger bar 17 that allows the earphone 10 to clip to, or hang on, the user's ear, as shown in the illustrated embodiment of Figures 1D-1E. Figure 1D is a perspective view of the earphone and Figure 1E is a side view according to one embodiment. As shown in the illustrated embodiment, the earphone 10 may comprise dual speaker elements 106-A, 106-B. One of the speaker elements (the smaller one) 106-A is sized to fit into the cavum concha of the listener's ear and the other element (the larger one) 106-B is not. The listener may use the hanger bar to position the earphone on the listener's ear. In that connection, the hanger bar may comprise a horizontal section that rests upon the upper external curvature of the listener's ear behind the upper portion of the auricula (or pinna). The earphone may comprise a knurled knob that allows the user to adjust finely the distance between the horizontal section of the hanger bar and the speaker elements, thereby providing, in such embodiments, another measure of adjustability for the user. More details regarding such a dual element, adjustable earphone may be found in United States provisional patent application Serial No. 61/054,238, which is incorporated herein by reference in its entirety.

Figures 2A-2D illustrate various communication modes for a wireless data communication system involving the earphone 10 according to embodiments of the present invention. As shown in Figure 2A, the system comprises a data source 20 in communication with the earphone 10 via an ad hoc wireless network 24. The earphone 10, via its transceiver circuit (described in more detail below), may communicate wirelessly with a data source 20, which may comprise a wireless network adapter 22 for transmitting the digital audio wirelessly. For example, the data source 20 may be a digital audio player (DAP), such as an mp3 player or an iPod, or any other suitable digital audio playing device, such as a laptop or personal computer, that stores and/or plays digital audio files. In other embodiments, the data source 20 may generate analog audio, and the wireless network adapter 22 may encode the analog audio into digital format for transmission to the earphone 10.

The wireless network adapter 22 may be an integral part of the data source 20, or it may be a separate device that is connected to the data source 20 to provide wireless connectivity for the data source 20. For example, the wireless network adapter 22 may comprise a wireless network interface card (WNIC) or other suitable transceiver that plugs into a USB port or other port or jack of the data source 20 (such as a TRS connector) to stream data, e.g., digital audio files, via a wireless network (e.g., the ad hoc wireless network 24 or an infrastructure wireless network). The digital audio transmitted from the data source 20 to the earphone 10 via the wireless networks may comprise compressed or uncompressed audio. Any suitable file format may be used for the audio, including mp3, lossy or lossless WMA, Vorbis, Musepack, FLAC, WAV, AIFF, AU, or any other suitable file format.

When in range, the data source 20 may communicate with the earphone 10 via the ad hoc wireless network 24 using any suitable wireless communication protocol, including Wi-Fi (e.g., IEEE 802.11a/b/g/n), WiMAX (IEEE 802.16), Bluetooth, Zigbee, UWB, or any other suitable wireless communication protocol. For purposes of the description to follow, it is assumed that the data source 20 and the earphone 10 communicate using a Wi-Fi protocol, although the invention is not so limited and other wireless communication protocols may be used in other embodiments of the invention. The data source 20 and the earphone 10 are considered in range for the ad hoc wireless network 24 when the signal strengths (e.g., the RSSI) of the signals received by the two devices are above a threshold minimum signal strength level. For example, the data source 20 and the earphone 10 are likely to be in range for an ad hoc wireless network when then are in close proximity, such as when the wearer of the earphone 10 has the data source 20 on his/her person, such as in a pocket, strapped to their waist or arm, or holding the data source in their hand.

When the earphone 10 and the data source 20 are out of range for the ad hoc wireless network 24, that is, when the received signals degrade below the threshold minimum signal strength level, both the earphone 10 and the data source 20 may transition automatically to communicate over an infrastructure wireless network (such as a wireless LAN (WLAN)) 30 that is in the range of both the earphone 10 and the data source 20, as shown in Figure 2B. The earphone 10 and the data source 20 (e.g., the wireless network adapter 22) may include firmware, as described further below, that cause the components to make the transition to a common infrastructure wireless network 30 automatically and seamlessly, e.g., without user intervention. The earphone 10 may cache the received audio in a buffer or memory for a time period before playing the audio. The cached audio may be played after the connection over the ad hoc wireless network is lost to give the earphone 10 and the data source 20 time to connect via the infrastructure wireless network.

For example, as shown in Figure 2B, the infrastructure network may comprise an access point 32 that is in the range of both the data source 20 and the earphone 10. The access point 32 may be an electronic hardware device that acts as a wireless access point for, and that is connected to, a wired and/or wireless data communication network 33, such as a LAN or WAN, for example. The data source 20 and the earphone 10 may both communicate wirelessly with the access point 32 using the appropriate network data protocol (a Wi-Fi protocol, for example). The data source 20 and the earphone 10 may both transition automatically to an agreed-upon WLAN 30 that is in the range of both devices when they cannot communicate satisfactorily via the ad hoc wireless network 24. A procedure for specifying an agreed-upon infrastructure wireless network 30 is described further below. Alternatively, the infrastructure wireless network 30 may have multiple access points 32a-b, as shown in Figure 2C. In such an embodiment, the data source 20 may communicate wirelessly with one access point 32b and the earphone 10 may communicate wirelessly with another access point 32a of the same infrastructure wireless network 30. Again, the data source 20 and the earphone 10 may transition to an agreed-upon WLAN.

If there is no suitable common infrastructure wireless network over which the earphone 10 and the data source 20 can communicate, as shown in Fig. 2D, the earphone 10 may transition to communicate with an access point 32a for an available (first) wireless network (e.g., WLAN) 30a that is in the range of the earphone 10. In this mode, the earphone 10 may connect via the wireless network 30a to a network-enabled host server 40. The host server 40 may be connected to the wireless network 30a via an electronic data communication network 42, such as the Internet. In one mode, the host server 40 may transmit streaming digital audio via the networks 33a, 42 to the earphone 10. In another mode, the host server 40 may transmit to the earphone 10 a network address, such as an Internet Protocol (IP) address, for a streaming digital audio content server 70 on the network 42. Using the received IP address, the earphone 10 may connect to the streaming digital audio content server 70 via the networks 30a, 42 to receive and process digital audio from the streaming digital audio content server 70.

The digital audio content server 70 may be, for example, an Internet radio station server. The digital audio content server 70 may stream digital audio over the network 42 (e.g., the Internet), which the earphone 10 may receive and process. In one embodiment, the streaming digital audio content server 70 may stream digital audio received by the streaming digital audio content server 70 from the data source 20. For example, where the data source 20 is a wireless-capable device, such as a portable DAP, the data source 20 may connect to the streaming digital audio content server 70 via a wireless network 30b and the network 42. Alternatively, where for example the data source 20 is non-wireless-capable device, such as a PC, the data source 20 may have a direct wired connection to the network 42. After being authenticated by the streaming digital audio content server 70, the data source 20 may stream digital audio to the streaming digital audio content server 70, which may broadcast the received digital audio over the network 42 (e.g., the Internet). In such a manner, the user of the earphone 10 may listen to audio from the data source 20 even when (i) the earphone 10 and the data source 20 are not in communication via an ad hoc wireless network 24 and (ii) the earphone 10 and the data source 20 are not in communication via a common local infrastructure wireless network 30.

Figure 3 is a block diagram of the earphone 10 according to various embodiments of the present invention. In the illustrated embodiment, the earphone 10 comprises a transceiver circuit 100 and related peripheral components. As shown in Figure 3, the peripheral components of the earphone 10 may comprise a power source 102, a microphone 104, one or more acoustic transducers 106 (e.g., speakers), and an antenna 108. The transceiver circuit 100 and some of the peripheral components (such as the power source 102 and the acoustic transducers 106) may be housed within the body 12 of the earphone 10 (see Figure 1). Other peripheral components, such as the microphone 104 and the antenna 108 may be external to the body 12 of the earphone 10. In addition, some of the peripheral components, such as the microphone 104, are optional in various embodiments.

In various embodiments, the transceiver circuit 100 may be implemented as a single integrated circuit (IC), such as a system-on-chip (SoC), which is conducive to miniaturizing the components of the earphone 10, which is advantageous if the earphone 10 is to be relatively small in size, such as an in-ear earphone (see Figures 1A-1B for example). In alternative embodiments, however, the components of the transceiver circuit 100 could be realized with two or more discrete ICs or other components, such as separate ICs for the processors, memory, and RF (e.g., Wi-Fi) module, for example.

The power source 102 may comprise, for example, a rechargeable or non-rechargeable battery (or batteries). In other embodiments, the power source 102 may comprise one or more ultracapacitors (sometimes referred to as supercapacitors) that are charged by a primary power source. In embodiments where the power source 102 comprises a rechargeable battery cell or an ultracapacitor, the battery cell or ultracapacitor, as the case may be, may be charged for use, for example, when the earphone 10 is connected to a docking station or computer. The docking station may be connected to or part of a computer device, such as a laptop computer or PC. In addition to charging the rechargeable power source 102, the docking station and/or computer may facilitate downloading of data to and/or from the earphone 10. In other embodiments, the power source 102 may comprise capacitors passively charged with RF radiation, such as described in U.S. Patent No. 7,027,311. The power source 102 may be coupled to a power source control module 103 of transceiver circuit 100 that controls and monitors the power source 102.

The acoustic transducer(s) 106 may be the speaker element(s) for conveying the sound to the user of the earphone 10. According to various embodiments, the earphone 10 may comprise one or more acoustic transducers 106. For embodiments having more than one transducer, one transducer may be larger than the other transducer, and a crossover circuit (not shown) may transmit the higher frequencies to the smaller transducer and may transmit the lower frequencies to the larger transducer. More details regarding dual element earphones are provided in U.S. Patent 5,333,206, assigned to Koss Corporation, which is incorporated herein by reference in its entirety.

The antenna 108 may receive and transmit the wireless signals from and to the wireless networks 24, 30. A RF (e.g., Wi-Fi) module 110 of the transceiver circuit 100 in communication with the antenna 108 may, among other things, modulate and demodulate the signals transmitted from and received by the antenna 108. The RF module 110 communicates with a baseband processor 112, which performs other functions necessary for the earphone 10 to communicate using the Wi-Fi (or other communication) protocol.

The baseband processor 112 may be in communication with a processor unit 114, which may comprise a microprocessor 116 and a digital signal processor (DSP) 118. The microprocessor 116 may control the various components of the transceiver circuit 100. The DSP 114 may, for example, perform various sound quality enhancements to the digital audio received by the baseband processor 112, including noise cancellation and sound equalization. The processor unit 114 may be in communication with a volatile memory unit 120 and a non-volatile memory unit 122. A memory management unit 124 may control the processor unit's access to the memory units 120, 122. The volatile memory 122 may comprise, for example, a random access memory (RAM) circuit. The non-volatile memory unit 122 may comprise a read only memory (ROM) and/or flash memory circuits. The memory units 120, 122 may store firmware that is executed by the processor unit 114. Execution of the firmware by the processor unit 114 may provide various functionality for the earphone 10, such as the automatic transition between wireless networks as described herein. The memory units 120, 122 may also cache received digital audio.

A digital-to-analog converter (DAC) 125 may convert the digital audio from the processor unit 114 to analog form for coupling to the acoustic transducer(s) 106. An I^2S interface 126 or other suitable serial or parallel bus interface may provide the interface between the processor unit 114 and the DAC 125. An analog-to-digital converter (ADC) 128, which also communicates with the I^2S interface 126, may convert analog audio signals picked up by the microphone 104 for processing by the processor unit 114.

The transceiver circuit 100 also may comprise a USB or other suitable interface 130 that allows the earphone 10 to be connected to an external device via a USB cable or other suitable link. As shown in Figure 4A, the external device may be a docking station 200 connected to a computer device 202. Also, in various embodiments, the earphone 10 could be connected directly to the computer 202 without the docking station 200. In addition, the external device may be a DAP 210, as shown in Figure 4B. In that way, the earphone 10 could connect directly to a data source 20, such as the DAP 210 or the computer 202, through the USB port 130. In addition, through the USB port 130, the earphone 10 may connect to a PC 202 or docking station 202 to charge up the power source 102 and/or to get downloads (e.g., data or firmware).

According to various embodiments, the earphone 10 may have an associated web page that a user may access through the host server 40 (see Figure 2D) or some other server. An authenticated user could log onto the website from a client computing device 50 (e.g., laptop, PC, handheld computer device, etc., including the data source 20) (see Figure 2D) to access the web page for the earphone 10 to set various profile values for the earphone 10. For example, at the web site, the user could set various content features and filters, as well as adjust various sound control features, such as treble, bass, frequency settings, noise cancellation settings, etc. In addition, the user could set preferred streaming audio stations, such as preferred Internet radio stations or other streaming audio broadcasts. That way, instead of listening to streaming audio from the data source 20, the user could listen to Internet radio stations or other streaming audio broadcasts received by the earphone 10. In such an operating mode, the earphone user, via the web site, may prioritize a number of Internet radio stations or other broadcast sources (hosted by streaming digital audio content servers 70). With reference to Figure 7, the host server 40 may send the IP address for the earphone user's desired (e.g., highest priority) Internet radio station to the earphone 10. A button 11 on the earphone 10, such as on the rotating dial 16 as shown in the examples of Figures 1A and 1B, may allow the user to cycle through the preset preferred Internet radio stations. That is, for example, when the user presses the button 11, an electronic communication may be transmitted to the host server 40 via the wireless network 30, and in response to receiving the communication, the host server 40 may send the IP address for the user's next highest rated Internet radio station via the network 42 to the earphone 10. The earphone 10 may then connect to the streaming digital audio content server 70 for that Internet radio station using the IP address provided by the host server 40. This process may be repeated, e.g., cycled through, for each preset Internet radio station configured by the user of the earphone 10.

At the web site for the earphone 10 hosted on the host server 40, in addition to establishing the identification of digital audio sources (e.g., IDs for the user's DAP or PC) and earphones, the user could set parental or other user controls. For example, the user could restrict certain Internet radio broadcasts based on content or parental ratings, etc. That is, for example, the user could configure a setting through the web site that prevents the host server 40 from sending an IP address for a streaming digital audio content server 70 that broadcasts explicit content based on a rating for the content. In addition, if a number of different earphones 10 are registered to the same user, the user could define separate controls for the different earphones 10 (as well as customize any other preferences or settings particular to the earphones 10, including Internet radio stations, sound quality settings, etc. that would later be downloaded to the earphones 10). In addition, in modes where the host server 40 streams audio to the earphone 10, the host server 40 may log the files or content streamed to the various earphones 10, and the user could view at the web site the files or content that were played by the earphones 10. In that way, the user could monitor the files played by the earphones 10.

In addition, the host server 40 may provide a so-called eavesdropping function according to various embodiments. The eavesdropping service could be activated via the web site. When the service is activated, the host server 40 may transmit the content that it is delivering to a first earphone 10a to another, second earphone 10b, as shown in Figure 8. Alternatively, the host server 40 may transmit to the second earphone 10b the most recent IP address for a streaming digital audio content server 70 that was sent to the first earphone 10a. The second earphone 10b may then connect to the streaming digital audio content server 70 that the first earphone 10a is currently connected. That way, the user of the second earphone 10b, which may be a parent, for example, may directly monitor the content being received by the first earphone 10a, which may belong to a child of the parent.

This function also could be present in the earphones 10 themselves, allowing a parent (or other user) to join an ad-hoc wireless network and listen to what their child (or other listener) is hearing. For example, with reference to Figure 10, a first earphone 10a may receive wireless audio, such as from the data source 20 or some other source, such as the host server 40. The first earphone 10a may be programmed with firmware to broadcast the received audio to a second earphone 10b via an ad hoc wireless network 24. That way, the wearer of the second earphone 10b can monitor in real-time the content being played by the first earphone 10a.

At the web site, the user may also specify the identification number ("ID") of their earphone(s) 10, and the host server 40 may translate the ID to the current internet protocol (IP) addresses for the earphone 10 and for the data source 20. This allows the user to find his or her data source 20 even when it is behind a firewall or on a changing IP address. That way, the host server 40 can match the audio from the data source 20 to the appropriate earphone 10 based on the specified device ID. The user also could specify a number of different data sources 20. For example, the user's DAP may have one specified IP address and the user's home (or work) computer may have another specified IP address. Via the web site hosted by the host server 40, the user could specify or prioritize from which source (e.g., the user's DAP or computer) the earphone 10 is to receive content.

The host server 40 (or some other server) may also push firmware upgrades and/or data updates to the earphone 10 using the IP addresses of the earphone 10 via the networks 30, 42. In addition, a user could download the firmware upgrades and/or data updates from the host server 40 to the client computing device 202 (see Figure 4A) via the Internet, and then download the firmware upgrades and/or data updates to the earphone 10 when the earphone 10 is connected to the client computer device 202 (such as through a USB port and/or the docking station 200).

Whether the downloads are transmitted wirelessly to the earphone 10 or via the client computing device 202 may depend on the current data rate of the earphone 10 and the quantity of data to be transmitted to the earphone 10. For example, according to various embodiments, as shown in the process flow of Figure 5, the host server 40 may be programmed, at step 50, to make a determination, based on the current data rate for the earphone 10 and the size of the update, whether the update should be pushed to the earphone 10 wirelessly (e.g., via the WLAN 30a in Figure 2D). If the update is too large and/or the current data rate is too low that the performance of the earphone 10 will be adversely affected, the host server 40 may refrain from pushing the update to the earphone 10 wirelessly and wait instead to download the update to the client computing device 202 at step 51. Conversely, if the host server 40 determines that, given the size of the update and the current data rate for the earphone 10 that the performance of the earphone 10 will not be adversely affected, the host server 40 may transmit the update wirelessly to the earphone 10 at step 52.

As mentioned above, the processor unit 114 of the speakerphones 14 may be programmed, via firmware stored in the memory 120, 122, to have the ability to transition automatically from the ad hoc wireless network 24 to an infrastructure wireless network 30 (such as a WLAN) when the quality of the signal on the ad hoc wireless network 24 degrades below a suitable threshold (such as when the data source 20 is out of range for an ad hoc wireless network). In that case, the earphone 10 and the data source 20 may connect to a common infrastructure wireless network (e.g., WLAN) (see, for example, Figures 2B-2C). Through the web site for the earphone 10, described above, the user could specify a priority of infrastructure wireless networks 30 for the data source 20 and the earphone 10 to connect to when the ad hoc wireless network 24 is not available. For example, the user could specify a WLAN servicing his/her residence first, a WLAN servicing his/her place of employment second, etc. During the time that the earphone 10 and the data source 20 are connected via the ad hoc wireless network 24, the earphone 10 and the data source 20 may exchange data regarding which infrastructure networks are in range. When the earphone 10 and the data source 20 are no longer in range for the ad hoc wireless network 24 (that is, for example, the signals between the device degrade below an acceptable level), they may both transition automatically to the highest prioritized infrastructure wireless network whose signal strength is above a certain threshold level. That way, even though the earphone 10 and the data source 20 are out of range for the ad hoc wireless network 24, the earphone 10 may still receive the streaming audio from the data source 20 via the infrastructure wireless network 30 (see Figs. 2B-2C).

When none of the preferred infrastructure networks is in range, the earphone 10 may connect automatically to the host server 40 via an available infrastructure wireless network 30 (see Fig. 2D), e.g., the infrastructure wireless network 30 having the highest RSSI and to which the earphone 10 is authenticated to use. The host server 40, as mentioned above, may transmit IP addresses to the earphone 10 for streaming digital audio content servers 70 or the host sever 40 may stream digital audio to the earphone 10 itself when in this communication mode.

Figure 6 is a diagram of the process flow, according to one embodiment, implemented by the transceiver circuit 100 of the earphone 10. The process shown in Figure 6 may be implemented in part by the processor unit 114 executing firmware stored in a memory unit 120, 122 of the transceiver circuit 100. At step 61, the earphone 10 may determine if it can communicate with the data source 20 via an ad hoc wireless network 24. That is, the earphone 10 may determine if the strength of the wireless signals from the data source 20 exceed some minimum threshold. If so, the data source 20 and the earphone 10 may communicate wirelessly via the ad hoc wireless network 24 (see Figure 2A). While in this communication mode, at step 62, the data source 20 and the earphone 10 also may exchange data regarding the local infrastructure wireless networks, if any, in the range of the data source 20 and the earphone 10, respectively. For example, the earphone 10 may transmit the ID of local infrastructure wireless networks 30 that the earphone 10 can detect whose signal strength (e.g., RSSI) exceeds some minimum threshold level. Similarly, the data source 20 may transmit the ID the local infrastructure wireless networks 30 that the data source 20 can detect whose signal strength (e.g., RSSI) exceeds some minimum threshold level. The earphone 10 may save this data in a memory unit 120, 122. Similarly, the data source 20 may store in memory the wireless networks that the earphone 10 is detected.

The data source 20 and the earphone 10 may continue to communicate via the ad hoc wireless network mode 24 until they are out of range (e.g., the signal strengths degrade below a minimum threshold level). If an ad hoc wireless network 24 is not available at block 61, the transceiver circuit 100 and the data source 20 may execute a process, shown at block 63, to connect to the user's highest prioritized infrastructure wireless network 30. For example, of the infrastructure wireless networks whose signal strength exceeded the minimum threshold for both the earphone 10 and the data source 20 determined at step 62, the earphone 10 and the data source 20 may both transition to the infrastructure wireless network 30 having the highest priority, as previously set by the user (seen Figures 2B-2C, for example). For example, if the user's highest prioritized infrastructure wireless network 30 is not available, but the user's second highest prioritized infrastructure wireless network 30 is, the earphone 10 and the data source 20 may both transition automatically to the user's second highest prioritized infrastructure wireless network 30 at block 64. As shown by the loop with block 65, the earphone 10 and the data source 20 may continue to communicate via one of the user's prioritized infrastructure wireless networks 30 as long as the infrastructure wireless network 30 is available. If the infrastructure wireless network becomes unavailable, the process may return to block 61.

If, however, no ad hoc wireless network and none of the user's prioritized infrastructure wireless networks are available, the earphone 10 may transition automatically to connect to the host server 40 at block 66 (see Figure 2D) using an available infrastructure wireless network 30. At block 67, the host server 40 may transmit an IP address to the earphone 10 for one of the streaming digital audio content servers 70, and at block 68 the earphone 10 may connect to the streaming digital audio content server 70 using the received IP address. At step 69, as long as the earphone 10 is connected to the streaming digital audio content server 70, the earphone 10 may continue to communicate in this mode. However, if the earphone 10 loses its connection to the digital audio content server 70, the process may return to block 61 in one embodiment. As mentioned above, at block 67, instead of sending an IP address for a streaming digital audio content server 70, the host server 40 may stream digital audio to the earphone 10. The user, when configuring their earphone 10 preferences via the web site, may specify and/or prioritize whether the host server 40 is to send IP addresses for the streaming digital audio content servers 70 and/or whether the host server 40 is to stream audio to the earphone 10 itself.

In another embodiment, the earphone 10 may be programmed to transition automatically to the host server 40 when the earphone 10 and the data source 20 are not in communication via the ad hoc wireless network 24. That is, in such an embodiment, the earphone 10 may not try to connect via a local infrastructure wireless network 30 with the data source 20, but instead transition automatically to connect to the host server 40 (see Figure 2D).

In various embodiments, as shown in Figure 1B, the button 11 or other user selection device that allows the wearer of the earphone 10 to indicate approval and/or disapproval of songs or other audio files listened to by the wearer over an Internet radio station. The approval/disapproval rating, along with metadata for the song received by the earphone 10 with the streaming audio, may be transmitted from the transceiver circuit 100 of the earphone 10 back to the host server 40, which may log the songs played as well as the ratings for the various songs/audio files. In addition to being able to view the logs at the website, the host server 40 (or some other server) may send an email or other electronic communication to the earphone user, at a user specified email address or other address, which the user might access from their client communication device 50 (see Figure 2D). The email or other electronic communication may contain a listing of the song/audio files for which the user gave approval ratings using the button 11 or other user selection device. Further, the email or other electronic communication may provide a URL link for a URL at which the user could download song/audio files that the user rated (presumably song/audio files for which the user gave an approval rating). In some instances, the user may be required to pay a fee to download the song/audio file.

The user song ratings also may be used by the host server 40 to determine the user's musical preferences and offer new music that the user might enjoy. More details about generating user play lists based on song ratings may be found in published U.S. patent applications Pub. No. 2006/0212444, Pub. No. 2006/0206487, and Pub. No. 2006/0212442, and U.S. Patent 7,003,515, which are incorporated herein by reference in their entirety.

In addition or alternatively, the user could log onto a web site hosted by the host server 40 (or some other server) to view the approval/disapproval ratings that the user made via the button 11 on the earphone 10. The web site may provide the user with the option of downloading the rated songs/audio files (for the host server 40 or some other server system) to their client computer device 50. The user could then have their earphone 10 connect to their client computer device 50 as a data source 20 via an ad hoc wireless network 24 (see Figure 2A) or via an infrastructure wireless network (see Figures 2B-2D) to listen to the downloaded songs. In addition, the user could download the song files from their client computer device 50 to their DAP and listen to the downloaded song files from their DAP by using their DAP as the data source 20 in a similar manner.

Another application of the headsets may be in vehicles equipped with Wi-Fi or other wireless network connectivity. Published PCT application WO 2007/136620, which is incorporated herein by reference, discloses a wireless router for providing a Wi-Fi or other local wireless network for a vehicle, such as a car, truck, boat, bus, etc. In a vehicle having a Wi-Fi or other local wireless network, the audio for other media systems in the vehicle could be broadcast over the vehicle's wireless network. For example, if the vehicle comprises a DVD player, the audio from the DVD system could be transmitted to the router and broadcast over the vehicle's network. Similarly, the audio from terrestrial radio stations, a CD player, or an audio cassette player could be broadcast over the vehicle's local wireless network. The vehicle's passengers, equipped with the earphones 10, could cycle through the various audio broadcasts (including the broadcasts from the vehicle's media system as well as broadcasts from the host server 40, for example) using a selection button 11 on the earphone 10. The vehicle may also be equipped with a console or terminal, etc., through which a passenger could mute all of the broadcasts for direct voice communications, for example.

As described above, the earphones 10 may also include a microphone 104, as shown in the example of Figure 9. The headset 90 shown in Figure 9 includes two earphones 10, both of which may include a transceiver circuit 100 or only one of which may include the transceiver circuit, as discussed above. The microphone 104 could be used to broadcast communications from one earphone wearer to another earphone wearer. For example, one wearer could activate the microphone by pressing a button 92 on the headset 90. The headset 90 may then transmit a communication via an ad hoc wireless network 24 or other wireless network to a nearby recipient (or recipients) equipped with a headset 90 with a transceiver circuit 100 in one or both of the earphones 10. When such communication is detected by the recipient's headset 90, the streaming audio received over the wireless network by the recipient's headset 90 may be muted, and the intercom channel may be routed to the transducer(s) of the recipient's headset 90 for playing for the recipient. This functionality may be valuable and useful where multiple wearers of the headsets 90 are in close proximity, such as on motorcycles, for example.

Another exemplary use of the earphones 10 is in a factory, warehouse, construction site, or other environment that might be noisy. Persons (e.g., workers) in the environment could use the earphones 10 for protection from the surrounding noise of the environment. From a console or terminal, a person (e.g., a supervisor) could select a particular recipient for a communication over the Wi-Fi network (or other local wireless network). The console or terminal may have buttons, dials, or switches, etc., for each user/recipient, or it could have one button or dial through which the sender could cycle through the possible recipients. In addition, the console or terminal could have a graphical user interface, through which the sender may select the desired recipient(s).

As mentioned above, the earphones 10 may comprise a USB port. In one embodiment, as shown in Figure 11, the user may use an adapter 150 that connects to the USB port of each earphone 10. The adapter 150 may also have a plug connector 152, such as a 3.5 mm jack, which allows the user to connect the adapter 150 to devices having a corresponding port for the connector 152. When the earphones 10 detect a connection via their USB interfaces in such a manner, the Wi-Fi (or other wireless protocol) components may shut down or go into sleep mode, and the earphones 10 will route standard headphone level analog signals to the transducer(s) 106. This may be convenient in environments where wireless communications are not permitted, such as airplanes, but where there is a convenient source of audio contact. For example, the adapter 150 could plug into a person's DAP. The DSP 118 of the earphone 10 may still be operational in such a non-wireless mode to provide noise cancellation and any applicable equalization.

The examples presented herein are intended to illustrate potential and specific implementations of the embodiments. It can be appreciated that the examples are intended primarily for purposes of illustration for those skilled in the art. No particular aspect of the examples is/are intended to limit the scope of the described embodiments.

According to various embodiments, therefore, the present invention is directed to an earphone 10 that comprises a body 12, where the body 12 comprises: (i) at least one acoustic transducer 106 for converting an electrical signal to sound; (ii) an antenna 108; and (iii) a transceiver circuit 100 in communication with the at least one acoustic transducer 106 and the antenna 108. The transceiver circuit 100 is for receiving and transmitting wireless signals via the antenna 108, and the transceiver circuit 100 is for outputting the electrical signal to the at least one acoustic transducer 106. The wireless transceiver circuit also comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to: (i) receive digital audio wirelessly from a data source 20 via an ad hoc wireless network 24 when the data source 20 is in wireless communication range with the earphone 10 via the ad hoc wireless network 24; and (ii) when the data source 20 is not in wireless communication range with the earphone 10 via the ad hoc wireless network 24, transition automatically to receive digital audio via an infrastructure wireless network 30.

According to various implementations, the data source may comprise a portable digital audio player, such as an MP3 player, iPod, or laptop computer, or a nonportable digital audio player, such as a personal computer. In addition, the transceiver circuit 100 may comprise: (i) a wireless communication module 110 (such as a Wi-Fi or other wireless communication protocol module); (ii) a processor unit 114 in communication with the wireless communication module 110; (iii) a non-volatile memory unit 122 in communication with the processor unit 114; and (iv) a volatile memory 120 unit in communication with the processor unit 114. The infrastructure wireless network may comprise a WLAN. The transceiver circuit 100 may receive digital audio from the data source 20 via the infrastructure wireless network 30 when the data source 20 is not in wireless communication range with the earphone 10 via the ad hoc wireless network 24. The transceiver circuit firmware, when executed by the transceiver circuit 100, may cause the transceiver circuit 100 of the earphone 10 to transition automatically to a pre-set infrastructure wireless network 30 that the data source 20 transitions to when the data source 20 is not in wireless communication range with the earphone 10 via the ad hoc wireless network 24 and when the pre-set infrastructure wireless network 30 is in range of both the earphone 10 and the data source 20. In addition, the transceiver circuit firmware, when executed by the transceiver circuit 100, may cause the transceiver circuit 100 of the earphone 10 to transmit data via the ad hoc wireless network 24 to the data source 20 regarding one or more infrastructure wireless networks 30 detected by the transceiver circuit 100 when the earphone 10 and the data source 20 are communicating via the ad hoc wireless network 24.

In addition, the transceiver circuit firmware, when executed by the transceiver circuit 100, may cause the transceiver circuit 100 of the earphone 10 to connect to a host server 40 via an available infrastructure wireless network 30 when the data source 20 is not in wireless communication range with the earphone 10 via the ad hoc wireless network 24. The earphone 10 may receive streaming digital audio from the host server 40 via the infrastructure wireless network 30. In addition, the earphone 10 may receive a first network address for a first streaming digital audio content server 70 from the host server 40 via the infrastructure wireless network 30. In addition, the earphone 10 may comprise a user control, such as button 11, dial, pressure switch, or other type of user control, that, when activated, causes the earphone 10 to transmit an electronic request via the infrastructure wireless network 30 to the host server 40 for a second network address for a second streaming digital audio content server 70.

In other embodiments, the present invention is directed to a system that comprises: (i) a data source 20 for wirelessly transmitting streaming digital audio; and (ii) a wireless earphone 10 that is in wireless communication with the data source 20. In yet other embodiments, the present invention is directed to a communication system that comprises: (i) a host server 40; (ii) a first streaming digital audio content server 70 that is connected to the host server 40 via a data network

42; and (iii) a wireless earphone 10 that is in communication with the host server 40 via a wireless network 30. The host server 40 is programmed to transmit to the earphone 10 a first network address for the first streaming digital audio content server 70 on the data network 42. The host server 40 and the streaming digital audio content server(s) 70 each may comprise one or more processor circuits and one or more memory circuits (e.g., ROM circuits and/or RAM circuits).

In yet another embodiment, the present invention is directed to a headset that comprises: (i) a first earphone 10a that comprises one or more acoustic transducers 10b for converting a first electrical signal to sound; and (ii) a second earphone 10b, connected to the first earphone 10a, wherein the second earphone 10b comprises one or more acoustic transducers10b for converting a second electrical signal to sound. In one embodiment, the first earphone 10a comprises: (i) a first antenna 108; and (ii) a first transceiver circuit 100 in communication with the one or more acoustic transducers 106 of the first earphone 10a and in communication with the first antenna 108. The first transceiver circuit 100 is for receiving and transmitting wireless signals via the first antenna 108, and for outputting the first electrical signal to the one or more acoustic transducers 10b of the first earphone 10a. The first transceiver circuit 100 also may comprise firmware, which when executed by the first transceiver circuit 100, causes the first transceiver circuit 100 to: (i) receive digital audio wirelessly from a data source 20 via an ad hoc wireless network 24 when the data source 20 is in wireless communication range with the first earphone 10a via the ad hoc wireless network 24; and (ii) when the data source 20 is not in wireless communication range with the first earphone 10a via the ad hoc wireless network 24, transition automatically to receive digital audio via an infrastructure wireless network 30.

In various implementations, the headset further may comprise a head band 19 that is connected to the first and second earphones 10. In addition, the headset 19 further may comprise a microphone 104 having an output connected to the first transceiver circuit 100. In one embodiment, the first transceiver circuit 100 is for outputting the second electrical signal to the one or more acoustic transducers 106 of the second earphone 10b. In another embodiment, the second earphone 10b comprises: (i) a second antenna 108; and (ii) a second transceiver circuit 100 in communication with the one or more acoustic transducers 106 of the second earphone 10b and in communication with the second antenna 108. The second transceiver circuit 100 is for receiving and transmitting wireless signals via the second antenna 108, and for outputting the second electrical signal to the one or more acoustic transducers 106 of the second earphone 10b. The second transceiver circuit 100 may comprise firmware, which when executed by the second transceiver circuit 100, causes the second transceiver circuit 100 to: (i) receive digital audio wirelessly from the data source 20 via the ad hoc wireless network 24 when the data source 20 is in wireless communication range with the second earphone10b via the ad hoc wireless network 24; and (ii) when the data source 20 is not in wireless communication range with the second earphone 10b via the ad hoc wireless network 24, transition automatically to receive digital audio via the infrastructure wireless network 30.

In addition, according to various embodiments, the first earphone 10a may comprise a first data port and the second earphone 10b may comprise a second data port. In addition, the headset may further comprise an adapter or dongle 150 connected to the first data port of the first earphone 10a and to the second data port of the second earphone 10b, wherein the adapter 150 comprises an output plug connector 152 for connecting to a remote device.

In addition, according to other embodiments, the present invention is directed to a method that comprises the steps of: (i) receiving, by a wireless earphone, via an ad hoc wireless network, digital audio from a data source when the data source is in wireless communication with the earphone via the ad hoc wireless network; (ii) converting, by the wireless earphone, the digital audio to sound; and (iii) when the data source is not in wireless communication with the earphone, transitioning automatically, by the earphone, to receive digital audio via an infrastructure wireless network.

In various implementations, the step of transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network may comprises transitioning automatically to receive digital audio from the data source via an infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network. In addition, the method may further comprise the step of receiving by the wireless earphone from the data source via the ad hoc wireless network data regarding one or more infrastructure wireless networks detected by data source when the earphone and the data source are communicating via the ad hoc wireless network.

In addition, the step of transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises may transitioning automatically to receive digital audio from a host sever via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network. Additionally, the step of transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network may comprise: (i) receiving, by the wireless earphone via the infrastructure wireless network, from a host server connected to the infrastructure wireless network, a network address for a streaming digital audio content server; and (ii) connecting, by the wireless earphone, to the streaming digital audio content server using the network address received from the host server.

It is to be understood that the figures and descriptions of the embodiments have been simplified to illustrate elements that are relevant for a clear understanding of the embodiments, while eliminating, for purposes of clarity, other elements. For example, certain operating system details for the various computer-related devices and systems are not described herein. Those of ordinary skill in the art will recognize, however, that these and other elements may be desirable in a typical processor or computer system. Because such elements are well known in the art and because they do not facilitate a better understanding of the embodiments, a discussion of such elements is not provided herein.

In general, it will be apparent to one of ordinary skill in the art that at least some of the embodiments described herein may be implemented in many different embodiments of software, firmware and/or hardware. The software and firmware code may be executed by a processor or any other similar computing device. The software code or specialized control hardware that may be used to implement embodiments is not limiting. For example, embodiments described herein may be implemented in computer software using any suitable computer software language type. Such software may be stored on any type of suitable computer-readable medium or media, such as, for example, a magnetic or optical storage medium. The operation and behavior of the embodiments may be described without specific reference to specific software code or specialized hardware components. The absence of such specific references is feasible, because it is clearly understood that artisans of ordinary skill would be able to design software and control hardware to implement the embodiments based on the present description with no more than reasonable effort and without undue experimentation.

Moreover, the processes associated with the present embodiments may be executed by programmable equipment, such as computers or computer systems and/or processors. Software that may cause programmable equipment to execute processes may be stored in any storage device, such as, for example, a computer system (nonvolatile) memory, an optical disk, magnetic tape, or magnetic disk. Furthermore, at least some of the processes may be programmed when the computer system is manufactured or stored on various types of computer-readable media.

A "computer," "computer system," "host," "host server," "server," or "processor" may be, for example and without limitation, a processor, microcomputer, minicomputer, server, mainframe, laptop, personal data assistant (PDA), wireless e-mail device, cellular phone, pager, processor, fax machine, scanner, or any other programmable device configured to transmit and/or receive data over a network. Such components may comprise: one or more processor circuits; and one more memory circuits, including ROM circuits and RAM circuits. Computer systems and computer-based devices disclosed herein may include memory for storing certain software applications used in obtaining, processing, and communicating information. It can be appreciated that such memory may be internal or external with respect to operation of the disclosed embodiments. The memory may also include any means for storing software, including a hard disk, an optical disk, floppy disk, ROM (read only memory), RAM (random access memory), PROM (programmable ROM), EEPROM (electrically erasable PROM) and/or other computer-readable media.

In various embodiments disclosed herein, a single component may be replaced by multiple components and multiple components may be replaced by a single component to perform a given function or functions. Except where such substitution would not be operative, such substitution is within the intended scope of the embodiments. Any servers described herein, such as the host server 40, for example, may be replaced by a "server farm" or other grouping of networked servers (such as server blades) that are located and configured for cooperative functions. It can be appreciated that a server farm may serve to distribute workload between/among individual components of the farm and may expedite computing processes by harnessing the collective and cooperative power of multiple servers. Such server farms may employ load-balancing software that accomplishes tasks such as, for example, tracking demand for processing power from different machines, prioritizing and scheduling tasks based on network demand and/or providing backup contingency in the event of component failure or reduction in operability.

While various embodiments have been described herein, it should be apparent that various modifications, alterations, and adaptations to those embodiments may occur to persons skilled in the art with attainment of at least some of the advantages. The disclosed embodiments are therefore intended to include all such modifications, alterations, and adaptations without departing from the scope of the embodiments as set forth herein.

CLAIMS

What is claimed is:

1. An earphone comprising:

a body, wherein the body comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:

receive digital audio wirelessly from a data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network; and

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive digital audio via an infrastructure wireless network.

2. The earphone of claim 1, wherein the data source comprises a digital audio player.

3. The earphone of claim 1, wherein the transceiver circuit comprises:

a wireless communication module;

a processor unit in communication with the wireless communication module;

a non-volatile memory unit in communication with the processor unit; and

a volatile memory unit in communication with the processor unit.

4. The earphone of claim 3, wherein the wireless communication module comprises a Wi-Fi communication module.

5. The earphone of claim 1, wherein the infrastructure wireless network comprises a WLAN.

6. The earphone of claim 1, wherein the transceiver circuit is for receiving digital audio from the data source via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

7. The earphone of claim 6, wherein the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

8 The earphone of claim 7, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network.

9. The earphone of claim 8, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

10. The earphone of claim 1, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

11. The earphone of claim 10, wherein the earphone is for receiving streaming digital audio from the host server via the infrastructure wireless network.

12. The earphone of claim 10, wherein the earphone is for receiving a first network address for a first streaming digital audio content server from the host server via the infrastructure wireless network.

13. The earphone of claim 12, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

14. The earphone of claim 13, wherein the user control comprises a button.

15. A system comprising:

a data source for wirelessly transmitting streaming digital audio; and

a wireless earphone that comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:

receive the streaming digital audio wirelessly from the data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network; and

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive streaming digital audio via an infrastructure wireless network.

16. The system of claim 15, wherein the data source comprises a digital audio player.

17. The system of claim 15, further comprising a host server that is in communication with the wireless earphone via the infrastructure wireless network.

18. The system of claim 17, wherein the firmware of the transceiver circuit of the wireless earphone, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to the host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

19. The system of claim 17, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

20. The system of claim 17, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network

21. The system of claim 20, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

22. The earphone of claim 21, wherein the user control comprises a button.

23. The system of claim 18, wherein the host server hosts a web page for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone.

24. The system of claim 15, wherein the infrastructure wireless network comprises a WLAN.

25. The system of claim 15, wherein the firmware, when executed by the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

26. The system of claim 25, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to transmit data via the ad hoc wireless network to

the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network.

27. The system of claim 26, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

28. The system of claim 27, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

29. The system of claim 27, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network

30. The system of claim 29, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

31. The earphone of claim 30, wherein the user control comprises a button.

32. A system comprising:

a host server;

a first streaming digital audio content server that is connected to the host server via a data network; and

a wireless earphone that is in communication with the host server via a wireless network, wherein the host server is programmed to transmit to the earphone a first network address for the first streaming digital audio content server.

33. The system of claim 32, wherein the wireless earphone comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware that is executed by the transceiver circuit.

34. The system of claim 33, wherein the host server hosts a web page for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone.

35. The system of claim 34, wherein the one or more settings comprise the first streaming digital audio content server and a second streaming digital audio content server.

36. The system of claim 35, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the wireless network to the host server for a second network address for the second streaming digital audio content server.

37. A headset comprising:

a first earphone that comprises one or more acoustic transducers for converting a first analog electrical signal to sound; and

a second earphone, connected to the first earphone, wherein the second earphone comprises one or more acoustic transducers for converting a second analog electrical signal to sound, and

wherein the first earphone comprises:

a first antenna; and

a first transceiver circuit in communication with the one or more acoustic transducers of the first earphone and in communication with the first antenna, wherein the first transceiver circuit is for receiving and transmitting wireless signals via the first antenna, and wherein the first transceiver circuit is for outputting the first analog electrical signal to the one or more acoustic transducers of the first earphone, and wherein the first transceiver circuit comprises firmware, which when executed by the first transceiver circuit, causes the first transceiver circuit to:

receive digital audio wirelessly from a data source via an ad hoc wireless network when the data source is in wireless communication range with the first earphone via the ad hoc wireless network; and

when the data source is not in wireless communication range with the first earphone via the ad hoc wireless network, transition automatically to receive digital audio via an infrastructure wireless network.

38. The headset of claim 37, further comprising a head band, wherein the first and second earphones are connected to the headband.

39. The headset of claim 37, further comprising a microphone having an output connected to the first transceiver circuit.

40. The headset of claim 37, wherein the first transceiver circuit is for outputting the second analog electrical signal to the one or more acoustic transducers of the second earphone.

41. The headset of claim 37, wherein the second earphone comprises:

a second antenna; and

a second transceiver circuit in communication with the one or more acoustic transducers of the second earphone and in communication with the second antenna, wherein the second transceiver circuit is for receiving and transmitting wireless signals via the second antenna, and wherein the second transceiver circuit is for outputting the second analog electrical signal to the one or more acoustic transducers of the second earphone, and wherein the second transceiver circuit comprises firmware, which when executed by the second transceiver circuit, causes the second transceiver circuit to:

receive digital audio wirelessly from the data source via the ad hoc wireless network when the data source is in wireless communication range with the second earphone via the ad hoc wireless network; and

when the data source is not in wireless communication range with the second earphone via the ad hoc wireless network, transition automatically to receive digital audio via the infrastructure wireless network.

42. The headset of claim 37, wherein the first earphone comprises a first data port and the second earphone comprises a second data port, and wherein the headset further comprises an adapter connected to the first data port of the first earphone and to the second data port of the second earphone, and wherein the adapter comprises an output plug connector for connecting to a remote device.

43. A method comprising:

receiving, by a wireless earphone, via an ad hoc wireless network, digital audio from a data source when the data source is in wireless communication with the earphone via the ad hoc wireless network;

converting, by the wireless earphone, the digital audio to sound; and

when the data source is not in wireless communication with the earphone, transitioning automatically, by the earphone, to receive digital audio via an infrastructure wireless network.

44. The method of claim 43, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from the data source via an infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

45. The method of claim 43, further comprising, receiving by the wireless earphone from the data source via the ad hoc wireless network data regarding one or more infrastructure wireless

networks detected by data source when the earphone and the data source are communicating via the ad hoc wireless network.

46. The method of claim 43, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from a host sever via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network

47. The method of claim 43, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises:

receiving, by the wireless earphone via the infrastructure wireless network, from a host server connected to the infrastructure wireless network, a network address for a streaming digital audio content server; and

connecting, by the wireless earphone, to the streaming digital audio content server using the network address received from the host server.

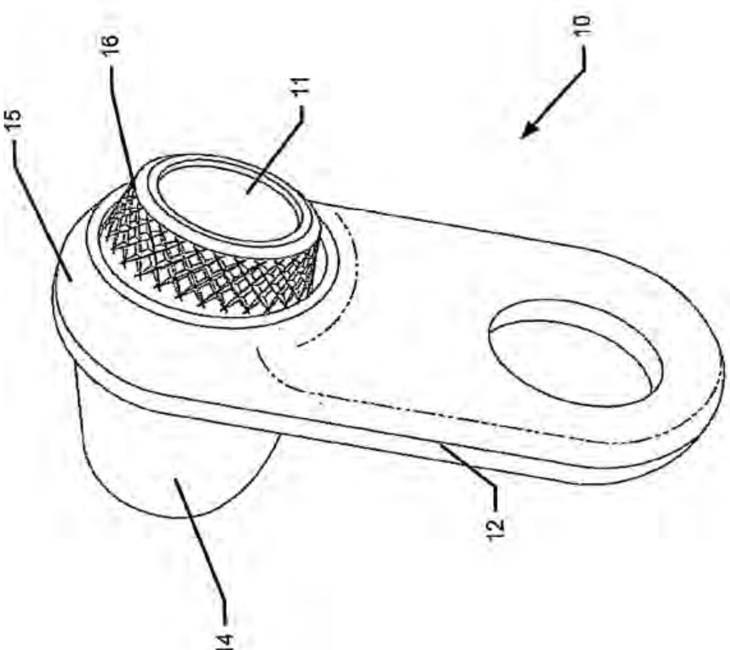


Fig. 1B

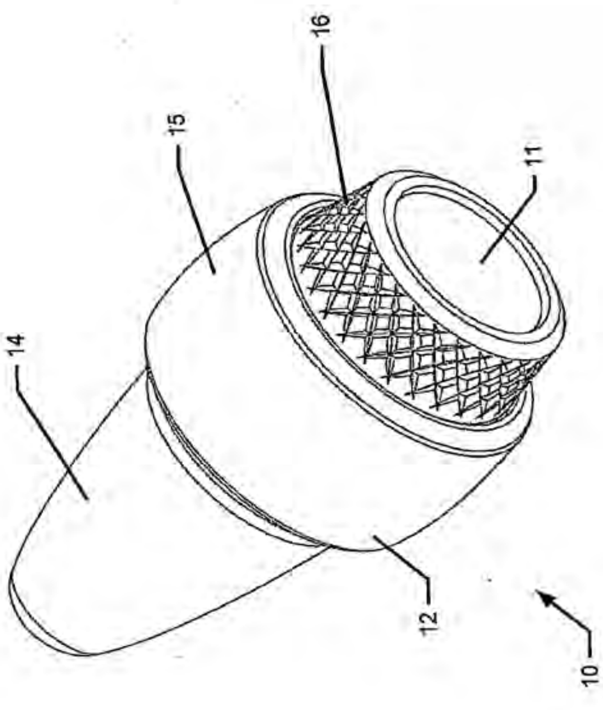


Fig. 1A

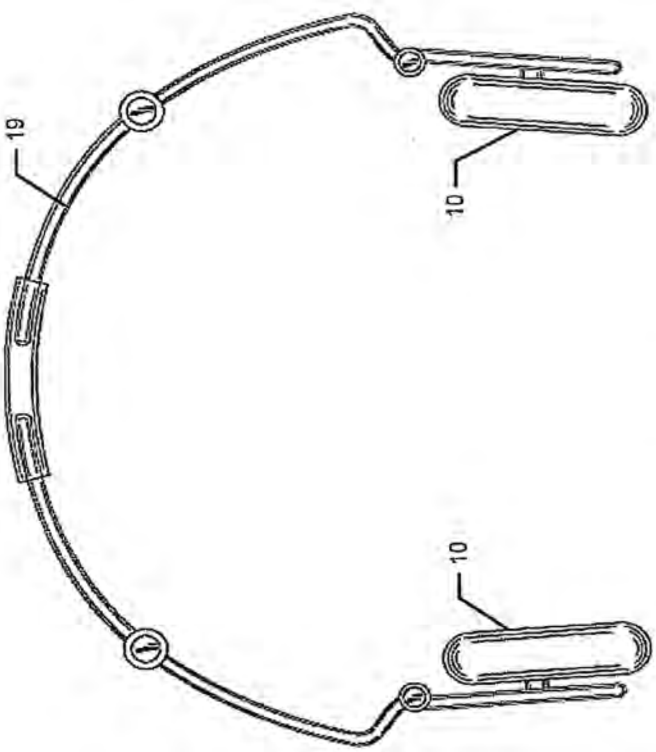


Fig. 1C

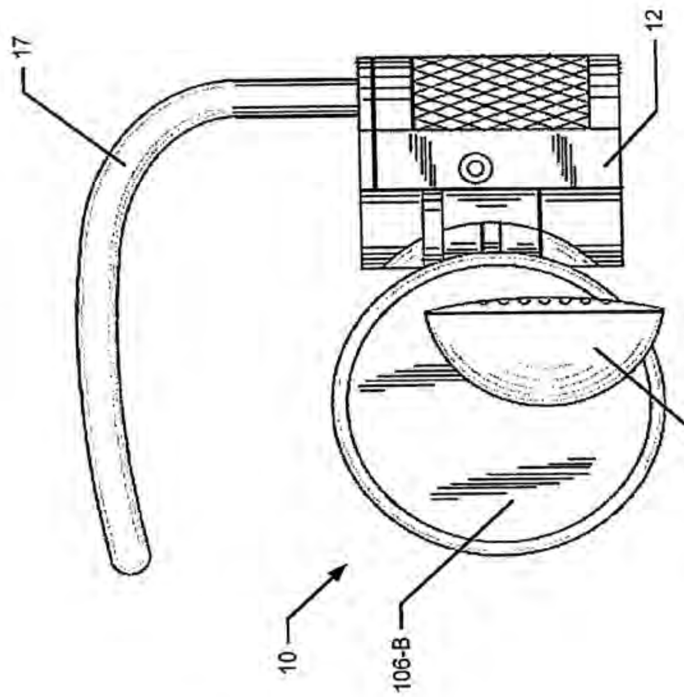


Fig. 1E

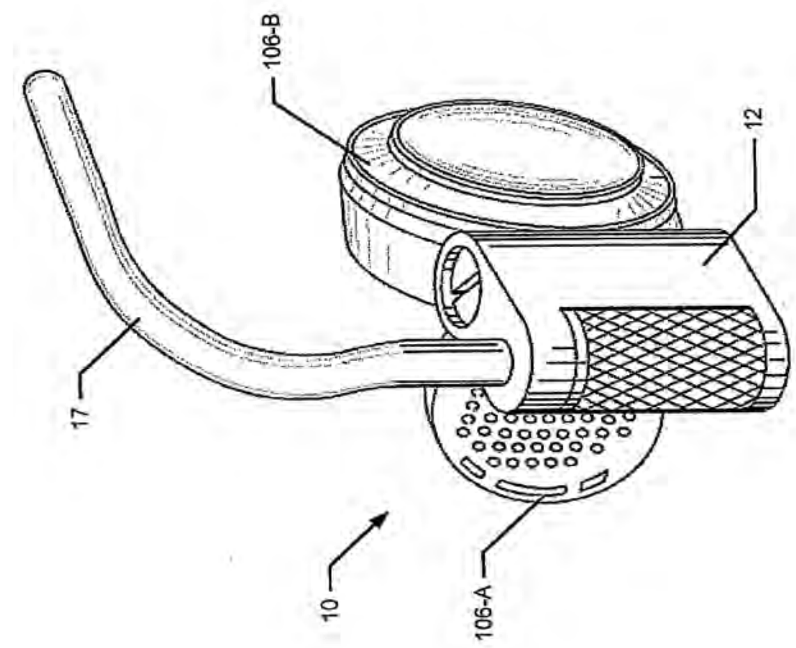
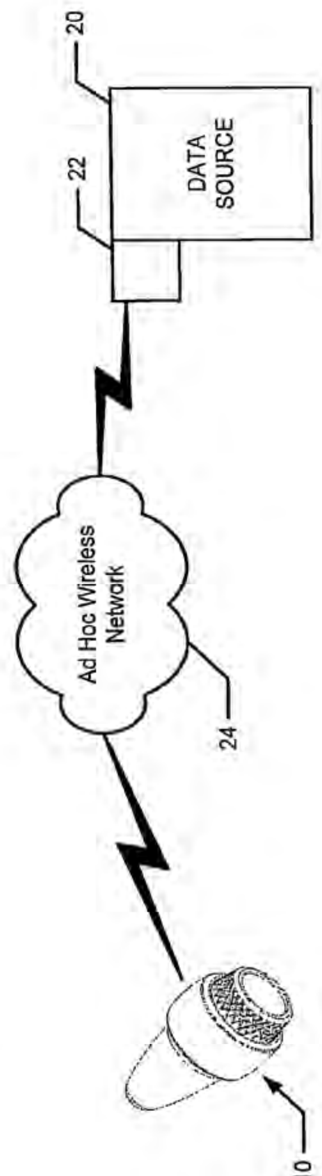


Fig. 1D

Fig. 2A



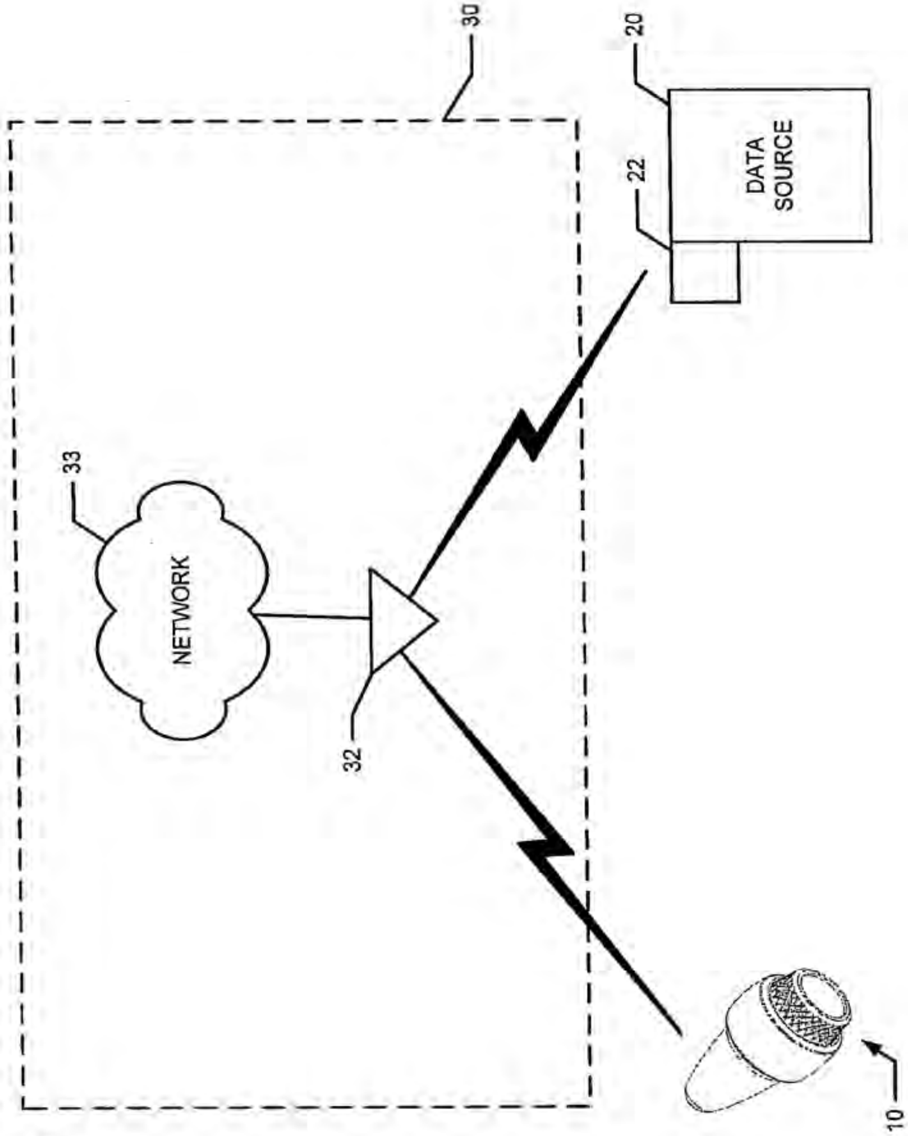


Fig. 2B

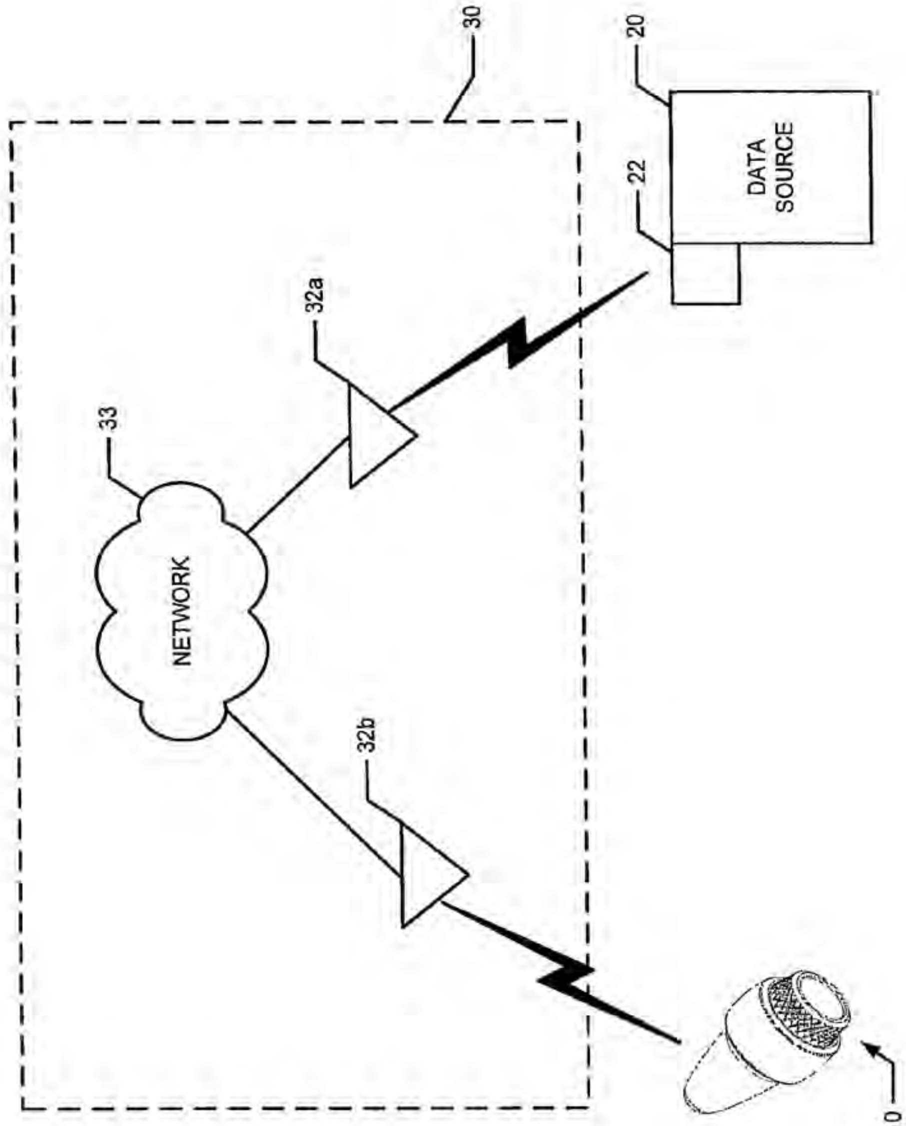


Fig. 2C

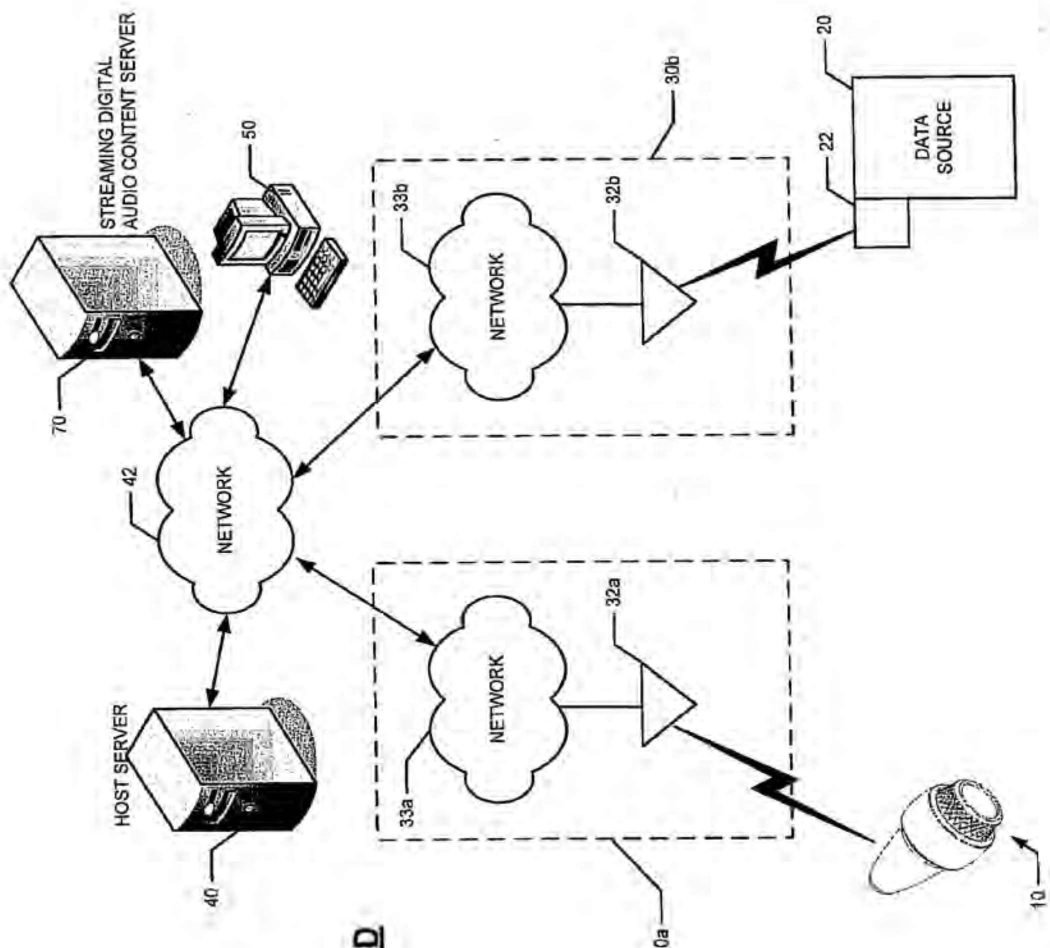

STREAMING DIGITAL AUDIO CONTENT SERVER
70
50
HOST SERVER
40
NETWORK
42
NETWORK
33b
NETWORK
33a
32b
32a
30b
30a
DATA SOURCE
20
22
10

Fig. 2D

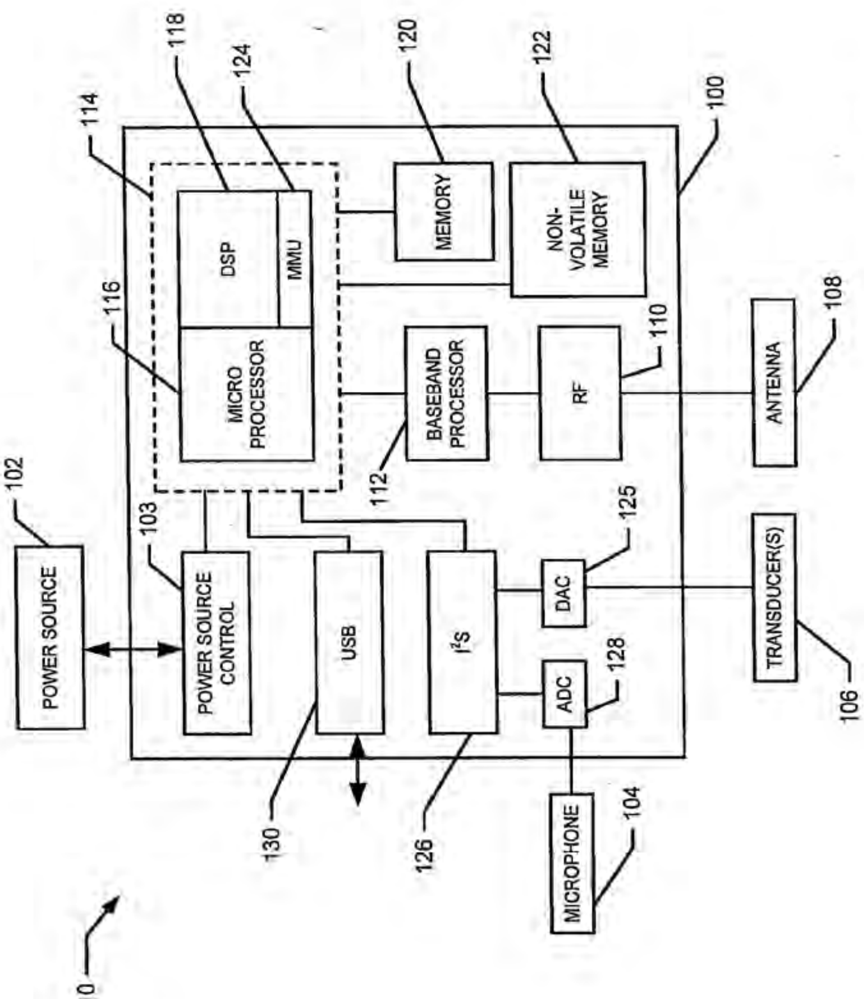

10
POWER SOURCE
102
103
POWER SOURCE CONTROL
USB
130
I²S
126
DAC
125
ADC
128
MICROPHONE
104
TRANSDUCER(S)
106
ANTENNA
108
RF
110
BASEBAND PROCESSOR
112
MICRO PROCESSOR
116
DSP
118
MMU
124
114
MEMORY
120
NON-VOLATILE MEMORY
122
100

Fig. 3

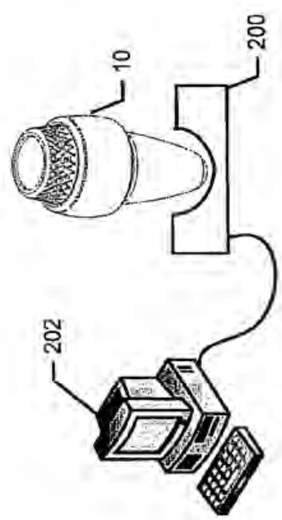


Fig. 4A

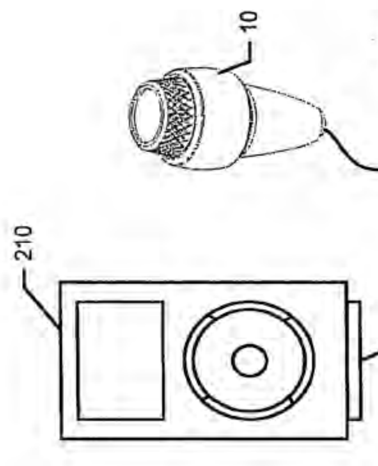


Fig. 4B

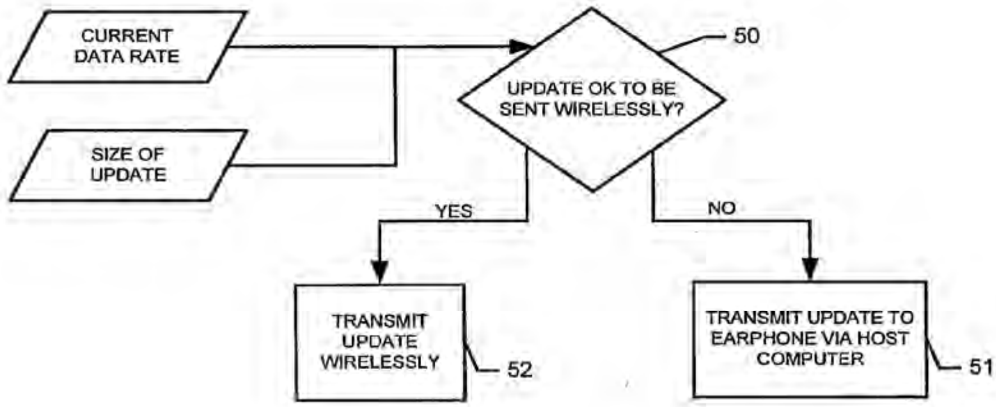

CURRENT DATA RATE
SIZE OF UPDATE
UPDATE OK TO BE SENT WIRELESSLY?
50
YES
NO
TRANSMIT UPDATE WIRELESSLY
52
TRANSMIT UPDATE TO EARPHONE VIA HOST COMPUTER
51

Fig. 5

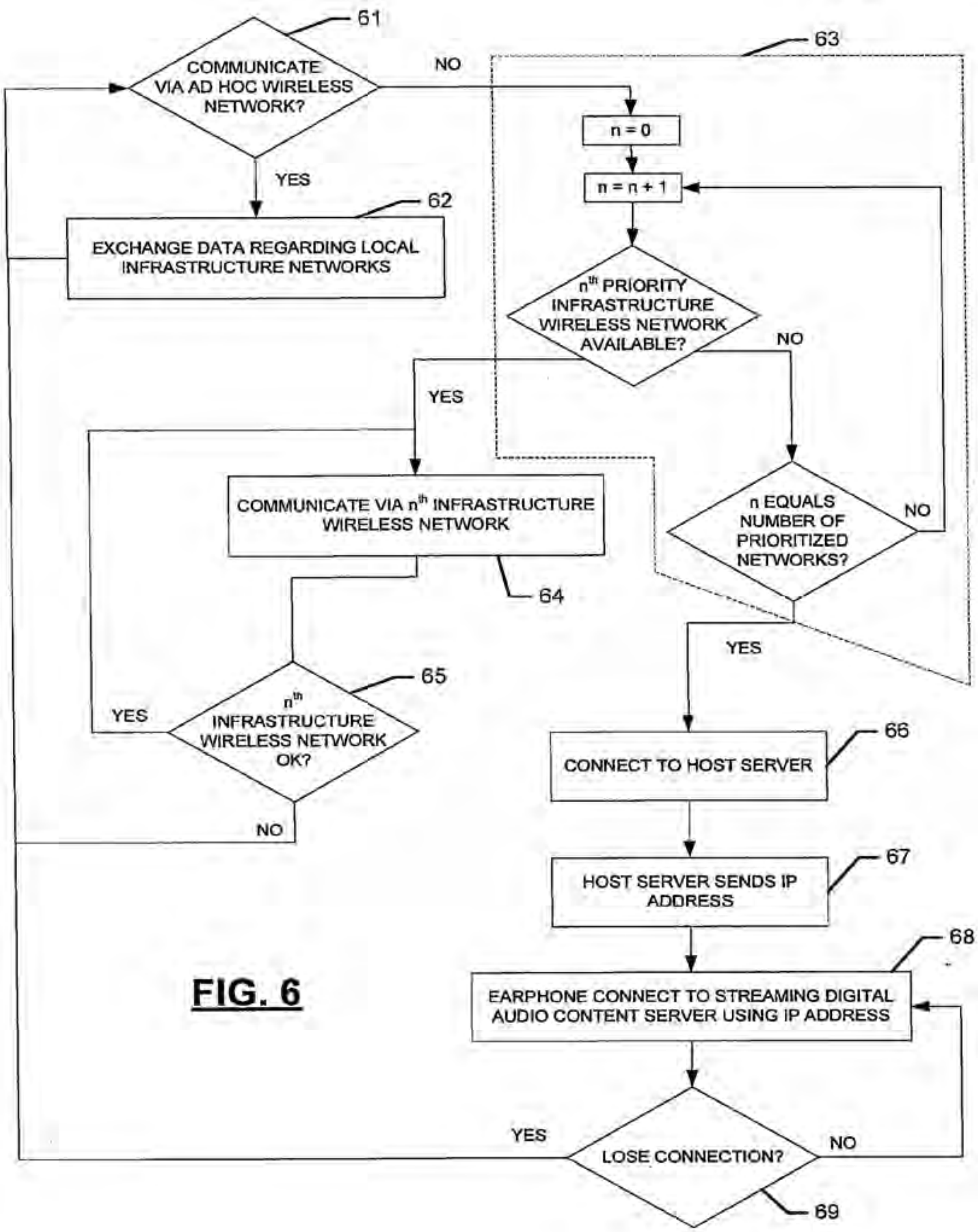

61
COMMUNICATE VIA AD HOC WIRELESS NETWORK?
NO
YES
62
EXCHANGE DATA REGARDING LOCAL INFRASTRUCTURE NETWORKS
63
n = 0
n = n + 1
n^th PRIORITY INFRASTRUCTURE WIRELESS NETWORK AVAILABLE?
NO
YES
COMMUNICATE VIA n^th INFRASTRUCTURE WIRELESS NETWORK
64
n EQUALS NUMBER OF PRIORITIZED NETWORKS?
NO
YES
65
n^th INFRASTRUCTURE WIRELESS NETWORK OK?
YES
NO
66
CONNECT TO HOST SERVER
67
HOST SERVER SENDS IP ADDRESS
68
EARPHONE CONNECT TO STREAMING DIGITAL AUDIO CONTENT SERVER USING IP ADDRESS
YES
LOSE CONNECTION?
NO
69

FIG. 6

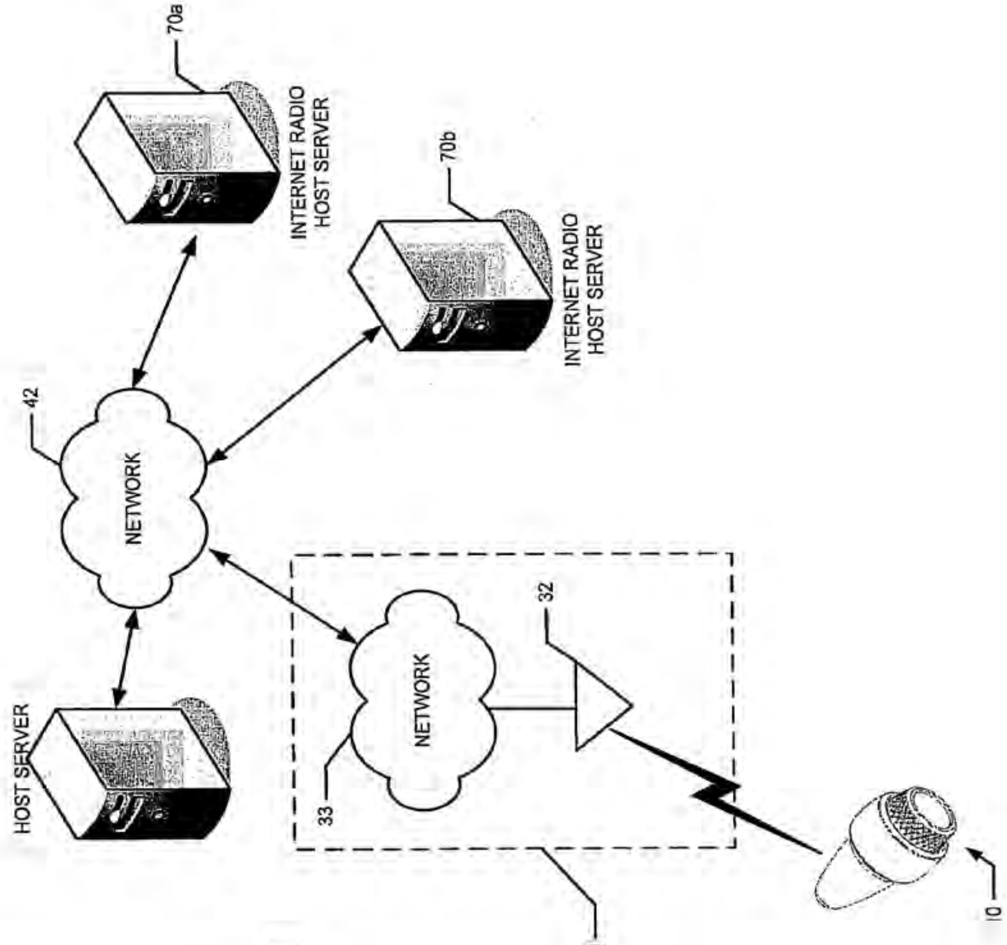

HOST SERVER
NETWORK
42
INTERNET RADIO
HOST SERVER
70a
INTERNET RADIO
HOST SERVER
70b
NETWORK
33
32
30
10

Fig. 7

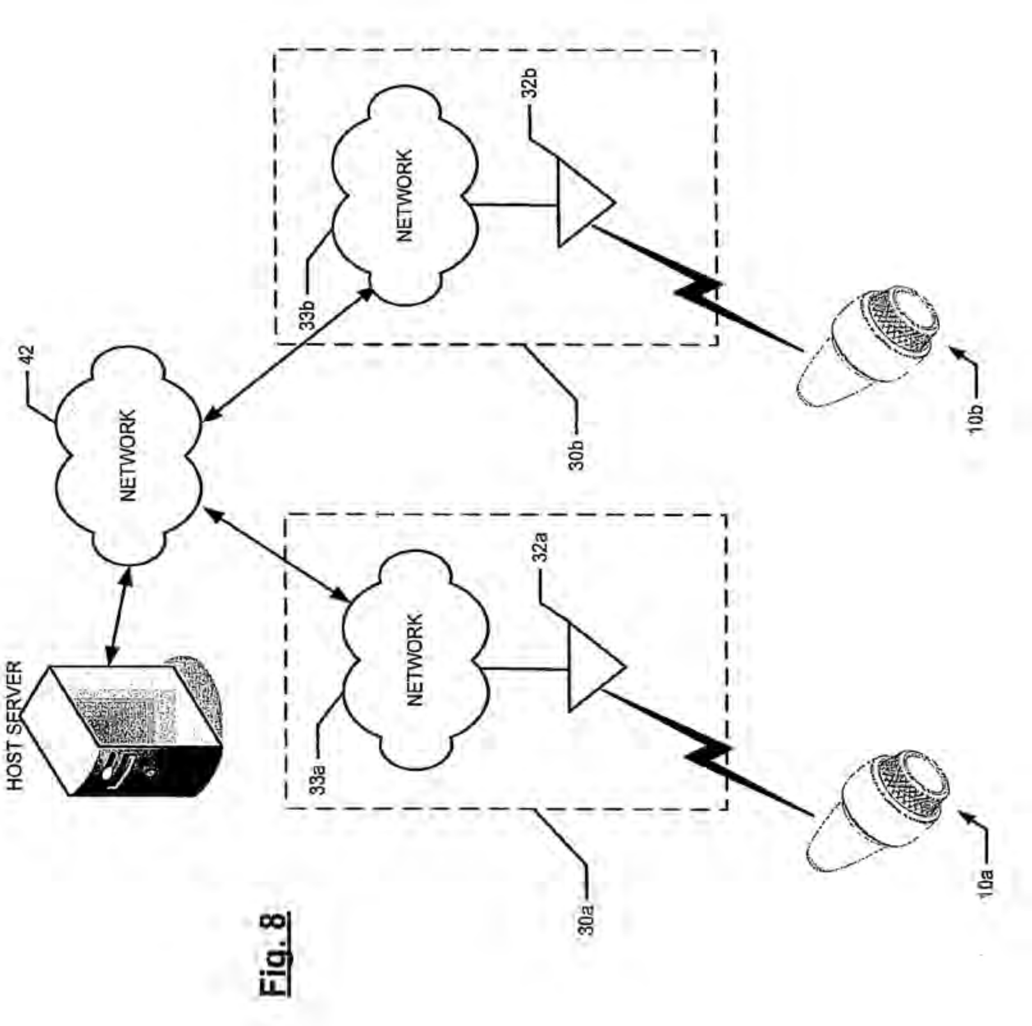

HOST SERVER
NETWORK
42
NETWORK
33b
32b
30b
10b
NETWORK
33a
32a
30a
10a

Fig. 8

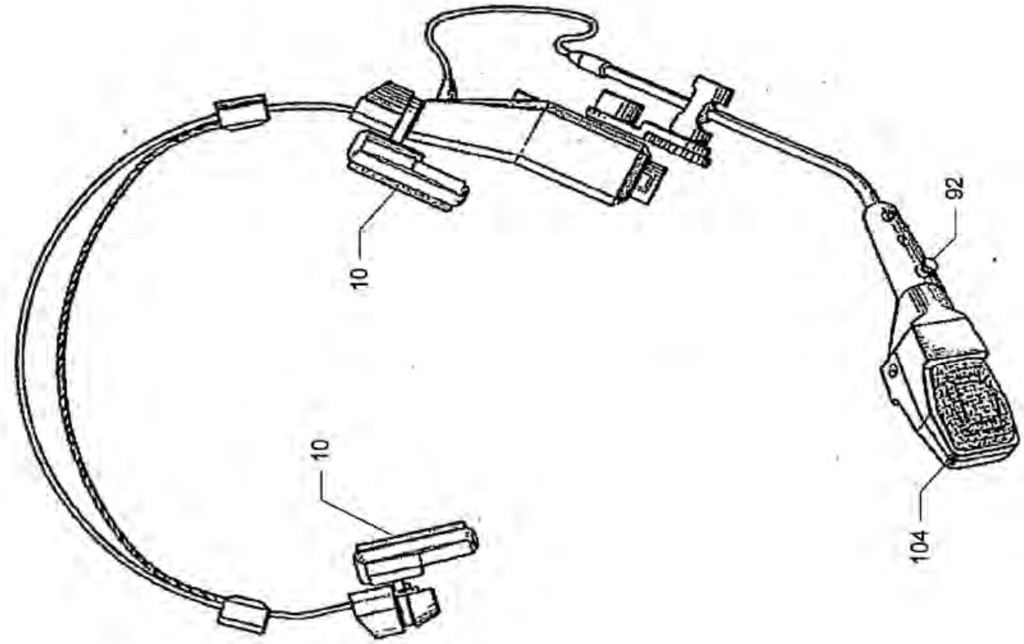
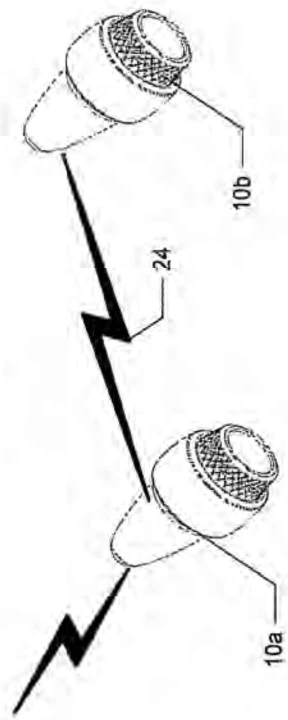


Fig. 9

Fig. 10



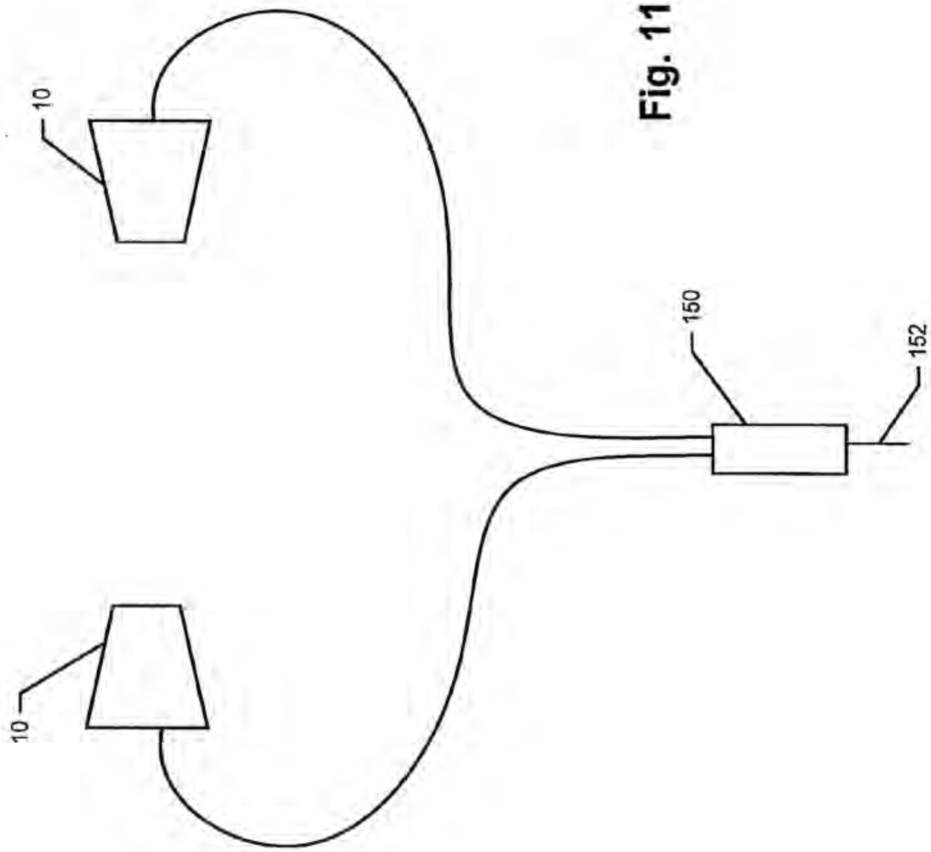


Fig. 11

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US2009/039754

International filing date: 07 April 2009 (07.04.2009)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 61/123,265
Filing date: 07 April 2008 (07.04.2008)

Date of receipt at the International Bureau: 07 May 2009 (07.05.2009)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

World Intellectual Property Organization (WIPO) - Geneva, Switzerland
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FILING DATE: ***April 07, 2008***
RELATED PCT APPLICATION NUMBER: ***PCT/US09/39754***

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS ***US61/123,265***

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PTO/SB/16 (10-07)
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EB616632942US Mailed: April 7, 2008

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Steven	Reckamp	Sun Prairie, WI
Michael	Pelland	Princeton, WI
Michael	Koss	Milwaukee, WI
Greg	Hollingstad	Stoughton, WI
Morgan	Lowery	Lodi, WI

Additional inventors are being named on the __________ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max):

HEADPHONE WITH WIRELESS NETWORK TRANSCEIVER

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☑ The address corresponding to Customer Number: 26285

OR

☐ Firm or Individual Name

Address

City	State	Zip
Country	Telephone	Email

ENCLOSED APPLICATION PARTS *(check all that apply)*

☐ Application Data Sheet. See 37 CFR 1.76

☐ CD(s), Number of CDs ________

☑ Drawing(s) *Number of Sheets* 4

☐ Other (specify) ________

☑ Specification (e.g. description of the invention) *Number of Pages* 19

Fees Due: Filing Fee of $210 ($105 for small entity). If the specification and drawings exceed 100 sheets of paper, an application size fee is also due, which is $260 ($130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

METHOD OF PAYMENT OF THE FILING FEE AND APPLICATION SIZE FEE FOR THIS PROVISIONAL APPLICATION FOR PATENT

☑ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fee and application size fee (if applicable).

☐ Payment by credit card. Form PTO-2038 is attached

$105.00

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PROVISIONAL APPLICATION COVER SHEET
Page 2 of 2

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☑ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: ____________

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SIGNATURE Mark Knedeisen   Date April 7, 2008

TYPED or PRINTED NAME Mark G. Knedeisen   REGISTRATION NO. 42,747
(if appropriate)

TELEPHONE (412) 355-6342   Docket Number: 080188P

PATENT
Docket No. 080188P

HEADPHONE WITH WIRELESS NETWORK TRANSCEIVER

Inventors: Steven Reckamp, a resident of Sun Prairie, WI;
Michael Pelland, a resident of Princeton, WI;
Michael Koss, a resident of Milwaukee, WI;
Greg Hollingstad, a resident of Stoughton, WI; and
Morgan Lowery, a resident of Lodi, WI

BACKGROUND

[0001] Digital audio players, such as MP3 players and iPods, that store and play digital audio files, are very popular. Such devices typically comprise a data storage unit for storing and playing the digital audio, and a headphone set that connects to the data storage unit, usually with a ¼" or a 3.5 mm jack and associated cord. Often the headphones are in-ear type headphones. The cord, however, between the headphones and the data storage unit can be cumbersome and annoying to users, and the length of the cord limits the physical distance between the data storage unit and the headphones. Accordingly, some cordless headphones have been proposed, such as the Monster iFreePlay cordless headphones from Apple Inc., which includes a docking port that can connect directly to an iPod Shuffle. Because they have the docking port, however, the Monster iFreePlay cordless headphones from Apple are quite large and are not in-ear type phones. In addition, headphones that connect wirelessly via IEEE 802.11 to a WLAN-ready laptop or personal computer (PC) have been proposed, but such headphone are also quite large and not in-ear type phones.

SUMMARY

[0002] In one general aspect, the present invention is directed to a speakerphone set where the speakerphones comprise a wireless network transceiver for receiving streaming audio from a data source, such as digital audio player or a computer, over a local ad hoc wireless network. When the data source and the speakerphone set are out of range, they may transition to an infrastructure wireless network (e.g., wireless LAN). If there is no common infrastructure wireless network for both the data source and the speakerphone set, they may both connect via the Internet to a host server, which may receive the data from the data source and transmit it to the speakerphone set. These and other advantageous, unique aspects of the speakerphones are described below.

FIGURES

[0003] Various embodiments of the present invention are described herein by way of example in conjunction with the following figures, wherein:

Figure 1 is diagram of a wireless network comprising a headset with speakerphones according to various embodiments of the present invention;

Figure 2A shows an in-ear speaker element of the headset of Figure 1 according to various embodiments of the present invention;

Figure 2B shows a speakerphone set according to other embodiments of the present invention;

Figure 3 is a diagram of a speakerphone according to various embodiments of the present invention; and

Figure 4 is a diagram of a speakerphone set with a dongle according to various embodiments of the present invention.

DESCRIPTION

[0004] Figure 1 is a diagram of a communication system according to various embodiments of the present invention. The system comprises a data source 10 and a headset 12 comprising one or more speakerphones 14. As shown in the embodiment of Figure 1, the speakerphones 14 may comprise an in-ear speaker element 16, shown better in Figure 2A, although in other embodiments the speakerphones 14 may comprise on-ear or over-ear speaker elements. Each speakerphone 14 may have its own wireless data transceiver 18, described in more detail below in connection with Figure 3. The speakerphones 14, via their associated wireless data transceivers 18, may communicate wirelessly with a data source 20, which may comprise a wireless network adapter 22. For example, the data source 20 may be digital audio player (DAP), such as an mp3 player or an iPod, or any other suitable device, such as a laptop or personal computer, that stores digital audio files. The digital audio files may be for example, (i) compressed audio files, such as mp3, lossy or lossless WMA, Vorbis, Musepack, FLAC, or any other suitable format, or (ii) uncompressed audio files, such as WAV, AIFF, AU, or any other suitable uncompressed file format.

[0005] When in range, the data source 20 may communicate with the wireless transceivers 18 of the headset 10 via an ad hoc wireless network 21 using any suitable wireless communication protocol, including Wi-Fi (e.g., IEEE 802.11a/b/g/n), WiMAX (IEEE 802.16), Bluetooth, Zigbee, UWB, or any other suitable communication protocol. For purposes of the description to follow, it is assumed that the data source 20 and the wireless transceivers 20 communicated using a Wi-Fi protocol.

[0006] When the headset 12 is out of wireless communication range with the data source 20, both the headset 12 and the data source 20 may transition to communicate over an infrastructure wireless network (such as a wireless LAN (WLAN)) that is in the range of both the headset 12 and the data source 20. For example, the infrastructure network may comprise a number of access points, including a first access point 30 in the range of the data source 20 and a second access point 34 in the range of the headset 12.

[0007] If there is no infrastructure wireless network that is in the range of both the headset 12 and the data source 20, the headset 12 and the data source 20 may transition to communicate over a local infrastructure wireless network (such as a wireless LAN (WLAN)). They may both transition to an agreed-upon WLAN or to the WLAN having the strongest signal. A procedure for specifying the agreed-upon infrastructure wireless networks is described further below.

[0008] If there is no suitable common infrastructure wireless network over which the headset 12 and the data source 20 can communicate, the data source 20 may transition to communicate with an access point 30 for a first wireless network 32 (such as a WLAN) that is in the range of the data source 20. Similarly, the wireless transceivers 18 of the speakerphones 14 may transition to communicate with an access point 34 over a second wireless network (e.g., WLAN) 36 that is in the range of the speakerphones 14. In such a communication mode, the data source 20 may transmit (e.g., stream) its audio data over the wireless network 32 to a host server 40, connected to the access point 30 via a communication network 42, such as the Internet. The host server 40 may then transmit (e.g., stream) the audio data that it received from the data source to the speakerphones 14 of the headset 12 via the communication network 42 and the wireless network 36. In that way, even when the wireless transceivers 18 of the headset 12 are out of direct range from the data source 20, the wireless transceivers 18 can still receive the streaming audio data from the data source 20. That way, the data source 20 thereby could serve as audio source for the wearer of the headset 12 even when the wearer/user is not physically near to the data source 20. The operation of transitioning from the ad hoc network 21 to infrastructure wireless networks is described in more detail below.

[0009] The wireless network adapter 22 may be part of the data source 20, or it may be a separate device that is connected to the data source 20 to provide wireless connectivity. For example, the wireless network adapter 22 may comprise a wireless network interface card (WNIC) or other suitable transceiver that plugs into a USB port or a jack of the data source 20 (such as a TRS connector) to stream data, e.g., audio files, to the speakerphones 14.

[0010] In the embodiment shown in Figure 1, the headset 12 comprises a behind-the-head headband 24 connected to each of the speakerphones 14. In other embodiments, the headset 12 may comprise an over-the-head headband 24. In addition, in some embodiments the headset 12 may not comprise any type of headband, but rather just comprise two speakerphones 14, such as in-ear earbuds, as shown in the example of Figure 2B, each with its own wireless data transceiver 18. In such embodiments, the earbud speakerphones 14 may comprise a string or some other cord-type connector to keep the speakerphones 14 from being separate and lost.

[0011] In some embodiments, especially ones with a headband 24, only one of the speakerphones 14 may comprise a wireless data transceiver 18, and the headband 24 may carry a wired connection to the other speakerphone 14, which does not have a wireless transceiver 18.

[0012] Figure 3 is a block diagram of one of the speakerphones 14 according to various embodiments of the present invention. In the illustrated embodiment, the speakerphone 14 comprises a single integrated circuit (IC) 100 and related peripheral components. The IC 100 may comprise a system-on-chip (SoC), which is conducive to miniaturizing the components of the speakerphones 14, which is advantageous if the speakerphones 14 are to be relatively small in size, such as in-ear speakerphones 14. In alternative embodiments, however, the component of the SoC could be realized with two or more discrete IC, such as separate ICs for the processors, memory, and Wi-Fi module.

[0013] As shown in Figure 3, the peripheral components speakerphone 14 may comprise a power source 102, a microphone 104, one or more acoustic transducers 106 (e.g., speakers), and an antenna 108.

[0014] The power source 102 may comprise, for example, a rechargeable or non-rechargeable battery (or batteries). In other embodiments, the power source 102 may comprise one or more ultracapacitors (sometimes referred to as supercapacitors) that are charged by a primary power source. In embodiments where the power source 102 comprises a rechargeable battery cell or an ultracapacitor, the battery cell or ultracapacitor, as the case may be, may be charged for use, for example, when the headset 12 is connected to a docking station, in either a wired or wireless (e.g., Bluetooth) connection. The docking station may be connected to or part of a computer device, such as a laptop computer or PC. In addition to charging the rechargeable power source 12, the docking station may facilitate downloading of data to and/or from the headset 12. In other embodiments, the power source 102 may comprise capacitors passively charged with RF radiation, such as described in U.S. Patent No. 7,027,311. The power source 102 may be coupled to a power source control module 103 of the IC 100 that controls and monitors the power source 102.

[0015] The acoustic transducer(s) 106 may be the speaker element(s) for conveying the sound to the user of the headset 12. According to various embodiments, each speakerphone 14 may comprise one or more acoustic transducers 106. For embodiments having more than one transducer, one transducer may be larger than the other transducer, and a crossover circuit (not shown) may transmit the higher frequencies to the smaller one and may transmit the lower frequencies to the larger transducer.

[0016] The antenna 108 may receive and transmit the wireless signals from and to the ad hoc wireless network 21 and the WLAN 36. A Wi-Fi module 110 in communication with the antenna 108 may, among other things, modulate and demodulate the signals transmitted from and received by the antenna 108. The Wi-Fi module 110 communicates with a baseband processor 112, which performs other functions necessary for the device to communicate using the Wi-Fi (or other communication) protocol.

[0017] The baseband processor 112 may be in communication with a processor unit 114, which comprises a microprocessor 116 and the digital signal processor (DSP) 118. The microprocessor 116 may control the various components of the IC 100. The DSP 114 may, for example, perform various sound quality enhancements to the digital audio signal received baseband processor 112, including noise cancellation and sound equalization. The processor unit 114 may be in communication with a volatile memory unit 120 and a non-volatile memory unit 122. A memory management unit 124 may control the processor unit's access to the memories 120, 122. The volatile memory 122 may comprise, for example, a random access memory (RAM). The non-volatile memory unit 122 may comprise a read only memory (ROM) and/or flash memory.

[0018] A digital-to-analog converter (DAC) 125 may convert the digital audio signals from the processor unit 114 to analog form for coupling to the acoustic transducer(s) 106. An I^2S interface 126 or other suitable serial or parallel bus interface may provide the interface between the processor unit 114 and the DAC 125. An analog-to-digital converter (ADC) 128, which also communicates with the I^2S interface 126, converts analog audio signal picked up by the microphone 104 for processing by the processor unit 100.

[0019] The IC 100 also may comprise a USB or other suitable interface 130 that allows the speakerphone 14 to be connected to an external device via a USB cable or other suitable link. In that way, the speakerphone 14 could connected directly to a data source, such as a DAP or computer, through its USB port, to act as a conventional DAP. In addition, through the USB port, the speakerphone 12 may connect to a PC or docking station to charge up the power source and/or to get downloads (e.g., data or firmware).

[0020] The headset 12 may host an associated web page. An authenticated user could log onto the headset from a client computing device 50 (e.g., laptop, PC, handheld computer device, etc., including the data source 20) to access the web page for the headset 12 to set various profile values for the headset 12. For example, at the web site, the user could adjust various sound control features, such as treble, bass, frequency settings, noise cancellation settings, etc. In addition, the user could set preferred streaming audio stations, such as preferred Internet radio stations. That way, instead of listening to streaming audio from the data source 20, the user could listening to Internet radio stations or other streaming audio broadcasts received by the speakerphones 14. A button (not shown) on the headset 12 may allow the user to cycle through the preset preferred streaming audio broadcasts.

[0021] At the web site hosted on the host server, in addition to establishing the identification of audio sources and headphones, the user could set parental or other user controls. For example, the user could restrict certain Internet radio broadcasts based on content or parental ratings, etc. In addition, if a number of headsets 12 are registered to the same user, the user could define separate controls for the various headsets 12 (as well as customize any other preferences or settings particular to a headset 12, including Internet radio stations, equalization settings, etc. that would later be downloaded to the headphones). In addition, the host server 40 may log the files streamed to the various headsets 12, and the user could view at the web site the files that were played by the headsets 12. In that way, the user could monitor the files played by the headsets 12.

[0022] In addition, the host server 40 may provide a so-called eavesdropping function. The service could be activated via the web site. When the service is activated, the host server 40 may transmit the content that it is delivering to a first headset 12 to another, second headset 12. That way, the user of the second headset 12, which may be a parent, may directly monitor the content being played by the first headset 12, which may belong to a child of the parent. This function could be present in the headphones themselves, allowing a parent to join an ad-hoc network and listen to what the children are listening.

[0023] At the web site, the user may also specify the identification number, and the host processor translates this ID to the current IP addresses for the speakerphones 14 and for the data source 20. This allows the user to find his or her data source even though it is behind a firewall or on a changing IP address. That way, when the data source 20 and the speakerphones 14 are communicating via the host server 40, the host server 40 can match the audio from the data source 20 to the appropriate speakerphones 14 based on the specified device ID. The user could also specify a number of different data sources. For example, the user's DAP may have one specified IP address and the user's home (or work) computer may have another specified IP address.

[0024] The host server 40 (or some other server) may also push firmware upgrades and/or data updates to the headset 12 using the IP addresses of the speakerphone 14. In addition, a user could download the firmware upgrades and/or data updates to the client computing device 50, and then download the firmware upgrades and/or data updates to the headset 12 when the headset is connected to the client computer device 50 (such as through a USB port and/or a docking station). Whether the downloads are transmitted wirelessly to the headset 12 or via the client computing device 50 may depend on the current data rate of the headset 12 and the quantity of data to be transmitted to the headset 12. For example, the host server 12 may make a determination, based on the current data rate for the headset 12 and the size of the update, whether the update should be pushed to the headset via the WLAN 36. If update is too large and/or the current data rate is too low that the performance of the headset 12 will be adversely affected, the host server 12 may refrain from pushing the update to the headset 12 and wait instead to download the update to the client computing device 50. Also, the headphone could connect directly to the internet and download its own update.

[0025] As mentioned above, the processor unit 114 of the speakerphones 14 may be programmed, via firmware stored in the memory 120, 122, to have the ability to transition from the ad hoc wireless network 21 to an infrastructure wireless network such as a WLAN when the quality of the signal on the ad hoc wireless network 21 degrades below a suitable threshold (such as when the data source 20 is out of range). In that case, the speakerphones 14 and the data source 20 may connect to the same infrastructure wireless network (WLAN). Through the web site for the headset 12, described above, the user could specify a priority of infrastructure wireless networks to connect to. For example, the user could specify a WLAN servicing his/her residence first, a WLAN servicing his/her place of employment second, etc. During the time that the speakerphones 14 and the data source 20 are connected via the ad hoc wireless network 21, the speakerphones 14 and the data source 20 may exchange data regarding which infrastructure networks are in range. When the headset 12 and the data source 20 are no longer in range, they may both transition to the highest prioritized infrastructure wireless network whose signal strength is above a certain threshold level. That way, even though the speakerphones 14 and the data source 20 are out of range, the speakerphones 14 may still receive the streaming audio from the data source 20 via the infrastructure network.

[0026] When none of the preferred infrastructure networks is in range, the speakerphones 14 and the data source 20 may connect to, if authenticated, to the infrastructure network that had the highest signal level the last time the speakerphones 14 and the data source 20 exchanged data over the ad hoc network 21 regarding infrastructure networks that were in range. If no infrastructure network is in range of both the speakerphones 14 and the headset 20, or if the speakerphones 14 and the headset 20 were unable to exchange infrastructure network data via the ad hoc wireless network 21, the speakerphones 14 and the data source 20 may both attempt to connect to the host server 40 via different wireless networks 32, 36. The host server 40, as mentioned above, may match the data from the data source 20 to the appropriate speakerphones 14 based on the specified IP addresses. That way, the data source 20 can transmit the audio to the host server 40 via the WLAN 32 and the communication network 42, and the host server 40 can transmit the audio to the headset 12 via the communication network 42 and the WLAN 36.

[0027] In one embodiment, the host server 40 (or some other server) may serve as an IP radio station for the headset 12 when the headset 12 is not listening to audio transmitted from the data source 20. In such an embodiment, the host server 40 may crawl the Internet looking for Internet radio broadcasts. The host server 40 may then broadcast an Internet radio station to the headset 12 using the headset's specified IP address and the preconfigured preferred IP internet radio stations established by the user.

[0028] In various embodiments, the headset 12 may comprise a button (not shown), such as on the speakerphone 14, that allows the wearer of the speakerphones 14 to indicated approval and/or disapproval of songs or other audio files listened to by the wearer over an Internet radio station. The approval/disapproval rating may be transmitted from the headset 12 back to the host server 40, which may log the ratings for the various songs/audio files. The host server 40 (or some other server) may then send an email or other electronic communication to the headset user, which the user might access from the client communication device 50. The email or other electronic communication may contain a listing of the song/audio files for which the user gave approval and/or disapproval ratings. Further, the email or other electronic communication may provide a link by which the user could download song/audio files that the user rated (presumably song/audio files for which the user gave an approval rating). In some instances, the user may be required to pay a fee to download the song/audio file.

[0029] The rating system would also be used by the host server 40 to determine the user's musical preferences and offer new music that the user might enjoy. According to various embodiments, this service may be similar to the services at pandora.com.

[0030] In addition or alternatively, the user could log onto a web site hosted by the host server 40 (or some other server) to view the approval/disapproval ratings. The web site may provide the user with the option of downloading rated songs/audio files.

[0031] Another application of the headsets may be in vehicles equipped with Wi-Fi or other wireless network connectivity. Published PCT application WO 2007/136620, which is incorporated herein by reference, discloses a wireless router for providing a Wi-Fi or other local wireless network for a vehicle, such as a car, truck, boat, bus, etc. In a vehicle having a Wi-Fi or other local wireless network, the audio for other media systems in the vehicle could be broadcast over the vehicle's wireless network. For example, if the vehicle comprises a DVD player, the audio from the DVD system could be transmitted to the router and broadcast over the vehicle's network. Similarly, the audio from terrestrial radio stations, a CD player, or an audio cassette player could be broadcast over the vehicle's local wireless network. The vehicle's passengers, equipped with the speakerphones 14, could cycle through the various audio broadcasts (including the broadcasts from the vehicle's media system as well as broadcasts from the host server 40, for example) using a selection button on the speakerphones 14 or the headset 12. The vehicle may also be equipped with a console or terminal, etc., through which a passenger could mute all of the broadcasts for direct voice communications, for example.

[0032] As described above in connection with Figure 3, the speakerphones 14 may also include a microphone. The microphone could be used to broadcast communications from one headset wearer to another headset wearer. For example, one wearer could activate the microphone by pressing a button on the headset 12 (such as one the microphone). The speakerphone 12 may then transmit a communication via the WLAN to a nearby recipient (or recipients) equipped with the headset 12. When such communication is detected by the recipient's headphones 14, the streaming audio received over the wireless network may be muted, and the intercom channel may be routed to the transducer(s) for playing for the recipient. This functionality may be valuable and useful where multiple wearers of the headset 12 are in close proximity, such as on motorcycles, for example. The WLAN could be an ad hoc network or infrastructure based network.

[0033] Another exemplary use of the speakerphones 14 is in a factory, warehouse, construction site, or other environment that might be noisy. Persons (e.g., workers) in the environment could use the speakerphones 14 for protection from the surrounding noise of the environment. From a console or terminal, a person (e.g., a supervisor) could select a particular recipient for a communication over the Wi-Fi network (or other local wireless network). The console or terminal may have buttons, dials, or switches, etc., for each user/recipient, or it could have one button or dial through which the sender could cycle through the possible recipients. In addition, the console or terminal could have a graphical user interface, through which the sender may select the desired recipient(s).

[0034] As mentioned above, the speakerphones 14 may comprise a USB port. In one embodiment, as shown in Figure 4, the user may use an adapter 150 that connects to the USB port of each speakerphone 14. The adapter 150 may also have a plug connector 152, such as a 3.5 mm jack, which allows the user to connect the adapter 150 to devices having a corresponding port for the connector 152. When the speakerphones 14 detect a connection via their USB interfaces in such a manner, the Wi-Fi (or other wireless protocol) components may shut down or go into sleep mode, and the speakerphones 14 will route standard headphone level analog signals to the transducer. This may be convenient in environments where wireless communications are not permitted, such as airplanes, but where there is a convenient source of audio contact. For example, the adapter 150 could plug into a person's DAP. The DSP __ of the speakerphone 14 may still be operational in such a non-wireless mode to provide noise cancellation and any applicable equalization.

[0035] According to various embodiments, the docking station for the headset 12 may comprise a communication port for communicating with a sound system, such as home stereo system, for example. The communication port of the docking station may support an optical communication link, such as TOSLINK, or any other suitable communication link. That way, the headset 12 could act as a receiver or a source for the connected sound system.

[0036] The examples presented herein are intended to illustrate potential and specific implementations of the embodiments. It can be appreciated that the examples are intended primarily for purposes of illustration for those skilled in the art. No particular aspect of the examples is/are intended to limit the scope of the described embodiments.

[0037] It is to be understood that the figures and descriptions of the embodiments have been simplified to illustrate elements that are relevant for a clear understanding of the embodiments, while eliminating, for purposes of clarity, other elements. For example, certain operating system details for the various computer-related devices and systems are not described herein. Those of ordinary skill in the art will recognize, however, that these and other elements may be desirable in a typical processor or computer system. Because such elements are well known in the art and because they do not facilitate a better understanding of the embodiments, a discussion of such elements is not provided herein.

[0038] In general, it will be apparent to one of ordinary skill in the art that at least some of the embodiments described herein may be implemented in many different embodiments of software, firmware and/or hardware. The software and firmware code may be executed by a processor or any other similar computing device. The software code or specialized control hardware that may be used to implement embodiments is not limiting. For example, embodiments described herein may be implemented in computer software using any suitable computer software language type. Such software may be stored on any type of suitable computer-readable medium or media, such as, for example, a magnetic or optical storage medium. The operation and behavior of the embodiments may be described without specific reference to specific software code or specialized hardware components. The absence of such specific references is feasible, because it is clearly understood that artisans of ordinary skill would be able to design software and control hardware to implement the embodiments based on the present description with no more than reasonable effort and without undue experimentation.

[0039] Moreover, the processes associated with the present embodiments may be executed by programmable equipment, such as computers or computer systems and/or processors. Software that may cause programmable equipment to execute processes may be stored in any storage device, such as, for example, a computer system (nonvolatile) memory, an optical disk, magnetic tape, or magnetic disk. Furthermore, at least some of the processes may be programmed when the computer system is manufactured or stored on various types of computer-readable media.

[0040] A "computer," "computer system," "host," or "processor" may be, for example and without limitation, a processor, microcomputer, minicomputer, server, mainframe, laptop, personal data assistant (PDA), wireless e-mail device, cellular phone, pager, processor, fax machine, scanner, or any other programmable device configured to transmit and/or receive data over a network. Computer systems and computer-based devices disclosed herein may include memory for storing certain software applications used in obtaining, processing, and communicating information. It can be appreciated that such memory may be internal or external with respect to operation of the disclosed embodiments. The memory may also include any means for storing software, including a hard disk, an optical disk, floppy disk, ROM (read only memory), RAM (random access memory), PROM (programmable ROM), EEPROM (electrically erasable PROM) and/or other computer-readable media.

[0041] In various embodiments disclosed herein, a single component may be replaced by multiple components and multiple components may be replaced by a single component to perform a given function or functions. Except where such substitution would not be operative, such substitution is within the intended scope of the embodiments. Any servers described herein, for example, may be replaced by a "server farm" or other grouping of networked servers (such as server blades) that are located and configured for cooperative functions. It can be appreciated that a server farm may serve to distribute workload between/among individual components of the farm and may expedite computing processes by harnessing the collective and cooperative power of multiple servers. Such server farms may employ load-balancing software that accomplishes tasks such as, for example, tracking demand for processing power from different machines, prioritizing and scheduling tasks based on network demand and/or providing backup contingency in the event of component failure or reduction in operability.

[0042] While various embodiments have been described herein, it should be apparent that various modifications, alterations, and adaptations to those embodiments may occur to persons skilled in the art with attainment of at least some of the advantages. The disclosed embodiments are therefore intended to include all such modifications, alterations, and adaptations without departing from the scope of the embodiments as set forth herein.

CLAIMS

What is claimed is:

1 An earphone as described herein.

ABSTRACT

A speakerphone set where the speakerphones comprise a wireless network transceiver for receiving streaming audio from a data source over a local ad hoc wireless network. When the data source and the speakerphone set are out of range, they transition to an infrastructure wireless network. If there is no common infrastructure wireless network for both the data source and the speakerphone set, they connect via the Internet to a host server, which may receive the data from the data source and transmit it to the speakerphone set.

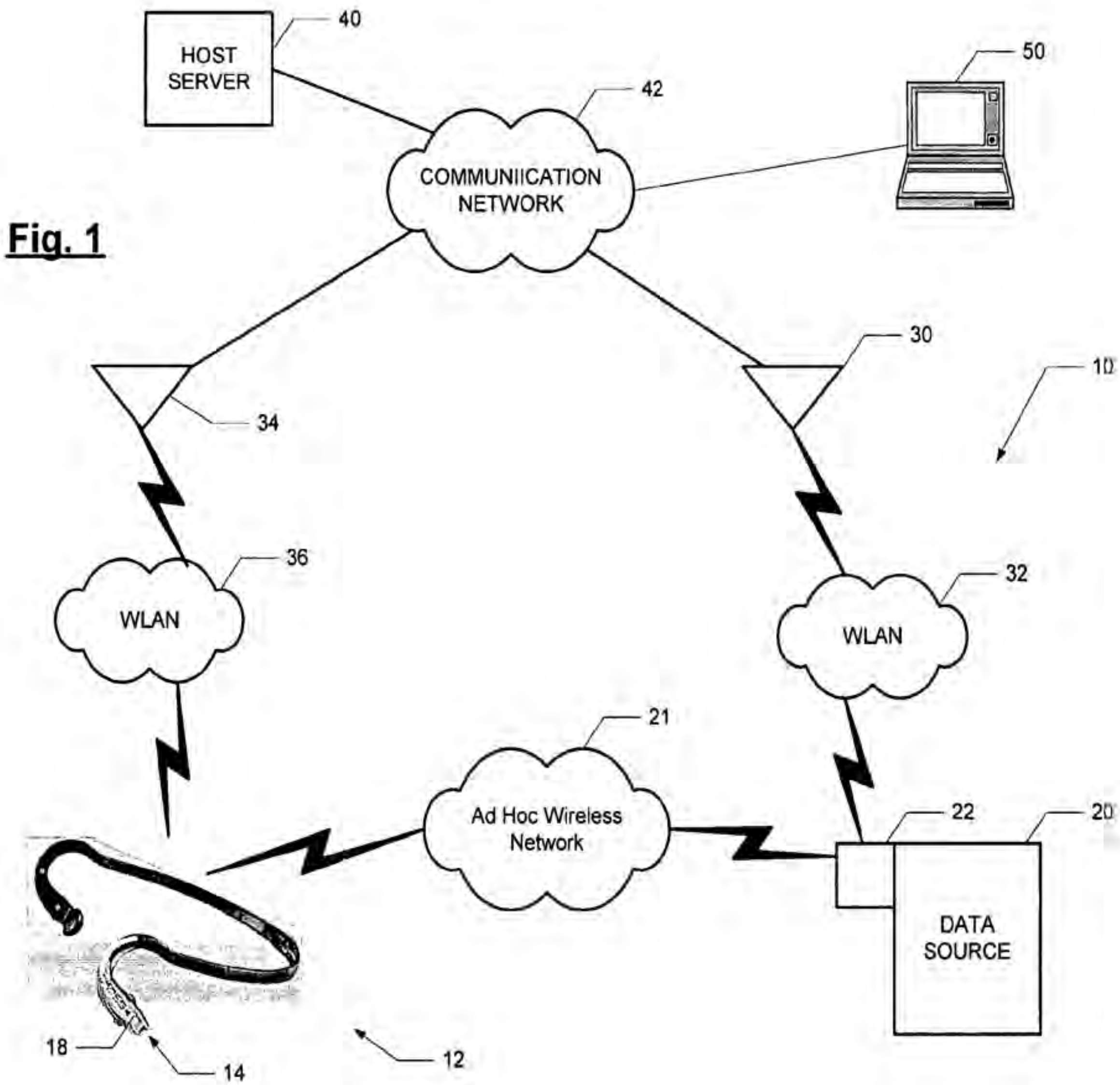
40
HOST
SERVER
42
COMMUNIICATION
NETWORK
50
30
10
34
36
WLAN
32
WLAN
21
Ad Hoc Wireless
Network
22
20
DATA
SOURCE
18
14
12

Fig. 1

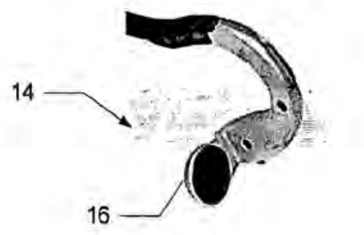

Fig. 2A

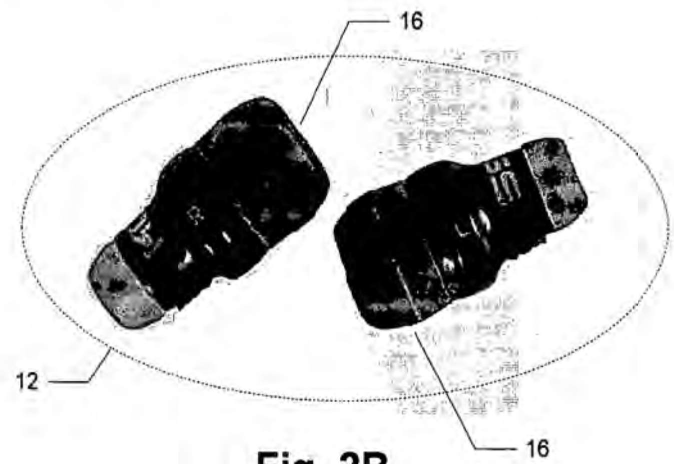

Fig. 2B

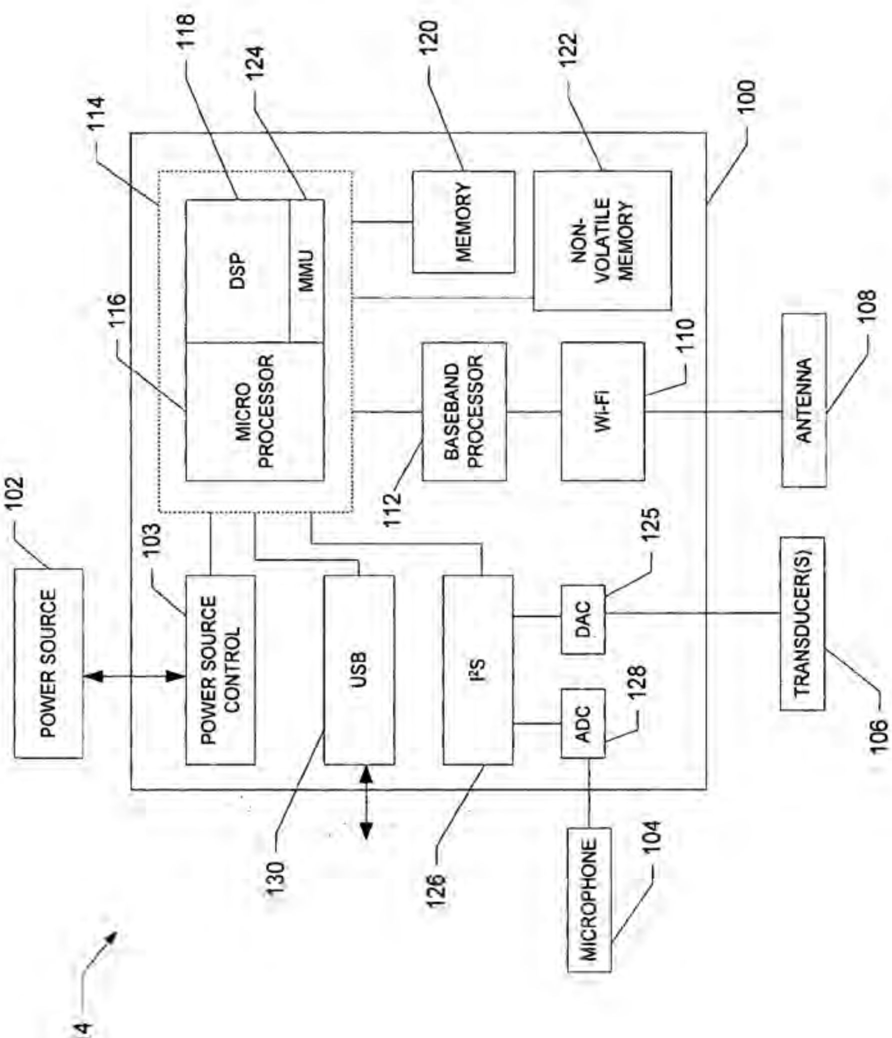
14
POWER SOURCE
102
POWER SOURCE CONTROL
103
USB
130
I²S
126
MICROPHONE
104
ADC
128
DAC
125
TRANSDUCER(S)
106
MICRO PROCESSOR
116
DSP
118
MMU
124
114
BASEBAND PROCESSOR
112
MEMORY
120
NON-VOLATILE MEMORY
122
Wi-Fi
110
ANTENNA
108
100

Fig. 3

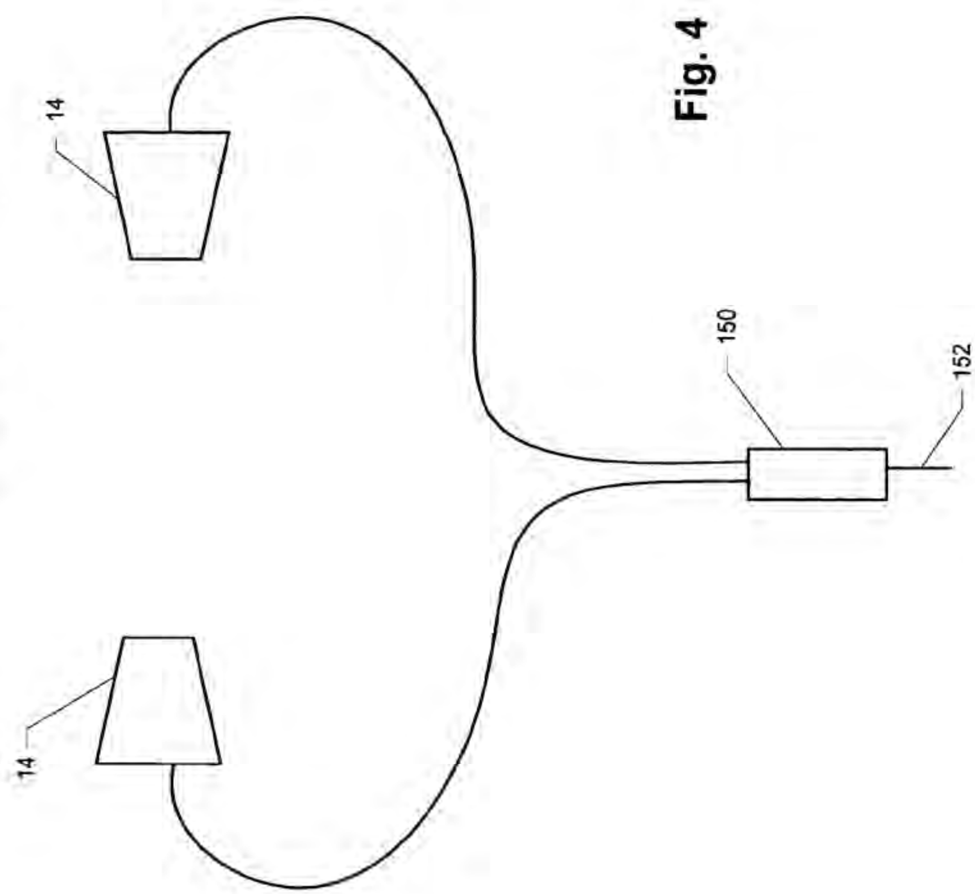

Fig. 4

Box No. VIII (ii) DECLARATION: ENTITLEMENT TO APPLY FOR AND BE GRANTED A PATENT

The declaration must conform to the standardized wording provided for in Section 212; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (ii). If this Box is not used, this sheet should not be included in the request.

Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51*bis*.1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate:

In relation to international application No. PCT/US2009/039754,

KOSS CORPORATION is entitled to apply for and be granted a patent by virtue of the following:

- KOSS CORPORATION is entitled as employer of the inventor, KOSS, Michael J.

- an agreement between KOSS CORPORATION and VISUALIZE INC. dated 6 February 2008, and VISUALIZE INC. was entitled as employer of the inventor, PELLAND, Michael J.

- an agreement between KOSS CORPORATION and VISUALIZE INC. dated 6 February 2008, and VISUALIZE INC. was entitled as employer of the inventor, SAGAN, Michael

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- an agreement between KOSS CORPORATION and VISUALIZE INC. dated 6 February 2008, and VISUALIZE INC. was entitled as employer of the inventor, HALLINGSTAD, Gregory J.

- an agreement between KOSS CORPORATION and VISUALIZE INC. dated 6 February 2008, and VISUALIZE INC. was entitled as employer of the inventor, BOVEE, Jeffery K.

- an agreement between KOSS CORPORATION and VISUALIZE INC. dated 6 February 2008, and VISUALIZE INC. was entitled as employer of the inventor, LOWERY, Morgan J.

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (ii)".

Box No. VIII (iii) DECLARATION: ENTITLEMENT TO CLAIM PRIORITY

The declaration must conform to the standardized wording provided for in Section 213; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iii). If this Box is not used, this sheet should not be included in the request.

Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application specified below, where the applicant is not the applicant who filed the earlier application or where the applicant's name has changed since the filing of the earlier application (Rules 4.17(iii) and 51*bis*.1(a)(iii)):

In relation to international application No. PCT/US2009/039754,

KOSS CORPORATION is entitled to claim priority of earlier United States provisional patent application Serial No. 61/123,265 by virtue of the following:

- KOSS CORPORATION is entitled as employer of the inventor, KOSS, Michael J.

- an agreement between KOSS CORPORATION and VISUALIZE INC. dated 6 February 2008, and VISUALIZE INC. was entitled as employer of the inventor, PELLAND, Michael J.

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☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iii)".

Box No. VIII (ii) DECLARATION: ENTITLEMENT TO APPLY FOR AND BE GRANTED A PATENT

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☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (ii)".

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	
12/936,488	12/20/2010	☐ To be Mailed

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT	10/05/2010	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 33	Minus	** 33	= 0	X $26 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $110 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/ROSALIND BALL/

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
12/936,488	Michael J. Pelland	080188PCTUS

26285
K&L GATES LLP
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

INTERNATIONAL APPLICATION NO.	
PCT/US09/39754	
I.A. FILING DATE	PRIORITY DATE
04/07/2009	04/07/2008

CONFIRMATION NO. 3553
371 FORMALITIES LETTER

OC000000044168619

Date Mailed: 10/26/2010

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as a Designated Office (37 CFR 1.494):

- Indication of Small Entity Status
- Priority Document
- Copy of the International Application filed on 10/05/2010
- Copy of the International Search Report filed on 10/05/2010
- Preliminary Amendments filed on 10/05/2010
- Information Disclosure Statements filed on 10/05/2010
- U.S. Basic National Fees filed on 10/05/2010
- Priority Documents filed on 10/05/2010
- Specification filed on 10/05/2010
- Claims filed on 10/05/2010
- Abstracts filed on 10/05/2010
- Drawings filed on 10/05/2010

The applicant needs to satisfy supplemental fees problems indicated below.

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.
- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.492(h) of $65 for a small entity in compliance with 37 CFR 1.27, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fees required for this application is $**65** for a Small Entity:

- $**65** Surcharge.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE OR BY 32 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

PAULETTE R KIDWELL

Telephone: (571) 272-0398

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 2, 2008

Application or Docket Number: 12/936488

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	LARGE ENTITY RATE	LARGE ENTITY FEE
U.S. NATIONAL STAGE FEES							
BASIC FEE	SMALL ENT.=$165	LARGE ENT.=$330	BASIC FEE	165	OR	BASIC FEE	
EXAMINATION FEE	SMALL ENT. = $110	LARGE ENT. = $220	EXAM. FEE	110		EXAM. FEE	
SEARCH FEE	U.S. is ISA = $50/$100 ALL other countries = $215/$430	ALL other situations = $270/$540	SEARCH FEE	50		SEARCH FEE	
FEE FOR EXTRA SPEC. PGS.	45 minus 100 =	/ 50 =	X $ 135 =			X $ 270 =	
TOTAL CHARGEABLE CLAIMS	33 minus 20 =	13	X $ 26 =	338	OR	X $ 52 =	
INDEPENDENT CLAIMS	2 minus 3 =		X $ 110 =	—	OR	X $ 220 =	
MULTIPLE DEPENDENT CLAIM PRESENT			+ $ 195 =		OR	+ $ 390 =	
			TOTAL	603	OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total	*	Minus	**	=	X $ 26 =		OR	X $ 52 =	
Independent	*	Minus	***	=	X $ 110 =		OR	X $ 220 =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐	+ $ 195 =		OR	+ $ 390 =	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
Total	*	Minus	**	=	X $ 26 =		OR	X $ 52 =	
Independent	*	Minus	***	=	X $ 110 =		OR	X $ 220 =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐	+ $ 195 =		OR	+ $ 390 =	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than "20", enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than "3", enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 02/2005)

Patent and Trademark Office - U.S. DEPARTMENT OF COMMERCE

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET (FOR USE WITH FORM PTO-875)	SERIAL NO 12936488	FILING DATE
	APPLICANT(S)	

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT			AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.		IND.	DEP.	IND.	DEP.	IND.	DEP.
1							51						
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43							93						
44							94						
45							95						
46							96						
47							97						
48							98						
49							99						
50							100						
TOTAL IND.	5	↓	2	↓		↓	TOTAL IND.		↓		↓		↓
TOTAL DEP.	42	←	[illegible]	←		←	TOTAL DEP.		←		←		←
TOTAL CLAIMS	47		[illegible]				TOTAL CLAIMS						

PTO-1360 (REV. 11/04)

U.S. DEPARTMENT of COMMERCE
Patent and Trademark Office

Practitioner's Docket No. 080188PCTUS

IN THE UNITED STATES DESIGNATED OFFICE (DO/US)

PCT/US09/39754	April 7, 2009	April 7, 2008
INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED

WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS
TITLE OF INVENTION

Michael J. Pelland et al.
APPLICANT(S) FOR DO/US

VIA ELECTRONIC FILING **December 20, 2010**

Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

COMPLETION OF FILING REQUIREMENTS FOR INTERNATIONAL APPLICATION ENTERING NATIONAL STAGE IN U.S. DESIGNATED OFFICE (DO/US) UNDER 35 U.S.C. § 371

(check and complete the following item, if applicable)

☒ This replies to the Notice of Missing Requirements under 35 U.S.C. § 371 and 37 C.F.R. § 1.494 (FORM PCT/DO/EO/905).

☒ A copy of FORM PCT/DO/EO/905 accompanies this response.

WARNING: *Where the items being submitted to complete the entry of the international application into the national phase are filed subsequent to the initial application is still considered to be in the international stage. If mailing procedures are utilized to obtain a date, the express mail procedure of 37 C.F.R. § 1.10 must be used (because international application papers are not covered by an ordinary certificate of mailing. 37 C.F.R. § 1.8(2)(xi).*

NOTE: Documents and fees must be clearly identified as a submission to enter the national stage under 35 U.S.C. § 371. Otherwise, the submission will be considered as being made under 35 U.S.C. § 111. 37 C.F.R. § 1.494(f).

EXPRESS MAILING UNDER 37 C.F.R. § 1.10*
(Express Mail label number is mandatory.)
(Express Mail certification is optional.)

I hereby certify that this paper, along with any document referred to, is being deposited with the United States Postal Service on this date ______ in an envelope addressed to Mail Stop: PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 as "Express Mail Post Office to Addressee" Mailing Label No. ______

(type or print name of person mailing paper)

Signature of person certifying

WARNING: *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

**WARNING:* *Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. 1.10(b). "Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

DECLARATION OR OATH

NOTE: *37 C.F.R. § 1.495(c): "If applicant complies with paragraph (b) of this section before expiration of thirty months from the priority date but omits . . . the oath or declaration of the inventor (35 U.S.C. 371(c)(4) and § 1.497), if a declaration of inventorship in compliance with § 1.497 has not been previously submitted in the international application under PCT Rule 4.17(iv) within the time limits provided for in PCT Rule 26ter.1, applicant will be so notified and given a period of time within which to file the . . . oath or declaration in order to prevent abandonment of the application . . . . The payment of the surcharge set forth in § 1.492(e) is required for acceptance of the oath or declaration of the inventor later than the expiration of thirty months after the priority date."*

I. ☒ No original declaration or oath was filed. Enclosed is the original declaration or oath for this application.

OR

☐ The declaration or oath that was filed was determined to be defective. A new original or oath or declaration is attached.

NOTE: *For surcharge fee for filing declaration after filing date, complete item IV(2).*

NOTE: *Acceptable minimums in the declaration in an ordinarily filed U.S. application for identification of the specification to which it applies are:*

(A) application number (consisting of the series code and the serial number, e.g., 08/123,456);

(B) serial number and filing date;

(C) attorney docket number which was on the specification as filed;

(D) title of the inventor which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

(E) title of the inventor which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number, e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration.

M.P.E.P. § 602, 8th ed.

NOTE: *Another minimum found acceptable in the declaration is the filing date (i.e., date of express mail) and the express mail number, useful where the serial number is not yet known. But note the practice where the express mail deposit is a Saturday, Sunday or holiday within the District of Columbia. 37 C.F.R. § 1.10(c).*

NOTE: *37 C.F.R. § 1.41(a) points out that "Full names must be stated, including the family name and at least one given name without abbreviation together with any other given name or initial."*

(complete (a) or (b), if applicable)

Attached is a

(a) ☐ Statement by a registered attorney that the application filed in the PTO is the application that the inventor executed by signing the declaration.

(b) ☐ Statement that the "attached" specification is a copy of the specification and any amendments thereto that were filed in the PTO to obtain the filing date.

AMENDMENT

(complete as applicable)

II.

☐ An amendment in accordance with 37 C.F.R. § 1.1212 is attached.

☐ The attached amendment cancels claims __________ inclusively.

TRANSMITTAL OF ENGLISH TRANSLATION OF NON-ENGLISH LANGUAGE PAPERS

NOTE: *37 C.F.R. § 1.495(c): "If applicant complies with paragraph (b) of this section before expiration of thirty months from the priority date but omits . . . a translation of the international application, as filed, into the English language, if it was originally filed in another language (35 U.S.C. 371(c)(2)). . . . applicant will be so notified and given a period of time within which to file the translation . . . in order to prevent abandonment of the application. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than the expiration of thirty months after the priority date . . . . A 'Sequence Listing' need not be translated if the 'Sequence Listing' complies with PCT Rule 12.1(d) and the description complies with PCT Rule 5.2(b)."*

III. ☐ Submitted herewith, is an English translation of the non-English language international application papers as originally filed. It is requested that this translation be used as the copy for examination purposes in the PTO. (*See 37 C.F.R. § 1.495(c)*).

NOTE: *For fee for processing a non-English application, and submission of an English translation later than 30 months after the priority date, complete item IV(3) below.*

NOTE: *A non-English oath or declaration in the form provided or approved by the PTO need not be translated. 37 C.F.R. § 1.69(b).*

FEES

IV.

1. Examination, Search and Additional Page Fee

WARNING: The USPTO is considering changing the amount of the search fee and examination fee charged in national stage in the near future. Please refer to www.uspto.gov for the current fees.

☐ Examination fee

☐ Search fee

☐ Additional Page Fee

NOTE: *See 37 C.F.R. § 1.28(a).*

2. Fees for claims

☐ Each independent claim in excess of 3 (37 C.F.R. § 1.492(b)–$220.00; small entity–$110.00) $ ____________

☐ Each claim in excess of 20 (37 C.F.R. § 1.492(c)–$52.00; small entity–$26.00) $ ____________

☐ Multiple dependent claim(s) (37 C.F.R. § 1.492(d) –$390.00; small entity–$195.00) $ ____________

3. Surcharge fees

☒ Surcharge for filing the oath or declaration later than thirty months from the priority date pursuant to § 1.495(c) and § 1.492(e): $130.00; small entity–$65.00 $65.00

NOTE: *The processing fee in the next item (Number 3) below is not subject to a reduction for small entity status.*

4. ☐ For filing an English translation of an international application later than thirty months after the priority date (§ 1.495(c)) and § 1.492(f): $130.00 $ ____________

Total fees $65.00

SMALL ENTITY STATUS

V. ☒ An assertion that this filing is by a small entity

(check and complete applicable items)

a. ☐ is attached.

☐ was filed on ______________ (original).

☒ was made by paying the basic national filing fee as a small entity.

☐ is being made now by paying the basic national filing fee as a small entity.

b. ☐ A separate refund request accompanies this paper.

EXTENSION OF TIME

(complete (a) or (b), as applicable)

VI.

NOTE: 37 C.F.R. § 1.704(b) ". . .an applicant shall be deemed to have failed to engage in reasonable efforts to conclude processing or examination of an application for the cumulative total of any periods of time in excess of three months that are taken to reply to any notice or action by the Office making any rejection, objection, argument, or other request, measuring such three-month period from the date the notice or action was mailed or given to the applicant, in which case the period of adjustment set forth in § 1.703 shall be reduced by the number of days, if any, beginning on the day after the date that is three months after the date of mailing or transmission of the Office communication notifying the applicant of the rejection, objection, argument, or other request and ending on the date the reply was filed. The period, or shortened statutory period, for reply that is set in the Office action or notice has no effect on the three-month period set forth in this paragraph."

The proceedings herein are for a patent application. The provisions of 37 C.F.R. § 1.136(a) apply.

(a) ☐ Applicant petitions for an extension of time, the fees for which are set out in 37 C.F.R. § 1.17(a)(1)-(4), for the total number of months checked out below

☐	one month	$ 130.00	$ 65.00
☐	two months	$ 490.00	$ 245.00
☐	three months	$ 1,110.00	$ 555.00
☐	four months	$ 1,730.00	$ 865.00
☐	five months	$ 2350.00	$1,175.00

Fee: $ ____________

If an additional extension of time is required, please consider this a petition therefore.

(check and complete the next item, if applicable)

☐ An extension for ________ months has already been secured. The fee paid therefor of $ ______________ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request $______

or

(b) ☒ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

TOTAL FEE DUE

VII. The total fee due is:

Completion fee(s) $65.00

Extension fee (if any) $____

TOTAL FEE DUE $65.00

PAYMENT OF FEES

VIII.

☐ Attached is a ☐ check ☐ money order in the amount of $____

☒ **Authorization is hereby made to charge the amount of $65.00**

☒ **to Deposit Account No. 11-1110**

☐ to Credit card as shown on the attached credit card information authorization form PTO-2038.

WARNING: *Credit card information should **not** be included on this form as it may become public.*

☒ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above.

AUTHORIZATION TO CHARGE ADDITIONAL FEES

IX.

WARNING: *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: *"A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).*

NOTE: *"Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).*

NOTE: *The previous practice of holding applications abandoned if an authorization to charge fees under 37 C.F.R. § 1.16 has been provided instead of an authorization to charge fees under 37 C.F.R. § 1.492 has been changed. The Office amended 37 C.F.R. § 1.25(b), effective November 7, 2000, so that an authorization to charge fees under 37 C.F.R. § 1.16 in an international application entering the national stage under 35 U.S.C. § 371 is now accepted by the Office as an authorization to charge fees under 37 C.F.R. § 1.492.*

☒ Please charge, in the manner authorized above, the following additional fees that may be required by this paper and during the entire pendency of this application:

☒ 37 C.F.R. §§ 1.492(a)(2), 1.492(a)(3), or 1.492(a)(5) (filing fees)

☒ 37 C.F.R. § 1.492(b) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing, or on later presentation, must only be paid, or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☒ 37 C.F.R. § 1.17 (application processing fees)

☒ 37 C.F.R. § 1.17(a)(1)–(5) (extension fees pursuant to § 1.136(a)).

WARNING: *While 37 C.F.R. § 1.17(a), (b), (c) and (d) deal with extension of time under § 1.136(a), this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 C.F.R. § 1.136(a) is to no avail unless a request or petition for extension is filed." (Emphasis added). Notice of November 5, 1985 (1060 O.G. 27).*

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b)).

NOTE: Section 1.311(b) provides that an authorization to charge the issue fee (§ 1.18) to a deposit account may be filed in an individual application ***only after the mailing of the notice of allowance.*** *Accordingly, general authorizations to pay fees and specific authorizations to pay the issue fee that are filed prior to the mailing of a notice of allowance will generally not be treated as requesting payment of the issue fee and will not be given effect to act as a reply to the notice of allowance. Applicant, when paying the issue fee, should submit a new authorization to charge fees, such as by completing box 6b on the current PTOL-85B form. Where no reply to the notice of allowance is received, the application will stand abandoned notwithstanding the presence of general authorizations to pay fees or a specific authorization to pay the issue fee that were submitted prior to mailing of the notice of allowance. Where an attempt is made to pay the issue fee but an incorrect amount is submitted, § 1.311(b)(1), or where the Office's issue fee transmittal form (currently PTOL-85(B)) is completed by applicant and submitted, § 1.311(b)(2), in reply to a notice of allowance, an exception will be made. Such submissions will operate as a request to charge the issue fee to any deposit account identified in a previously filed (i.e., submitted prior to the mailing of the notice of allowance) authorization to charge fees, and will be allowed to act as payment of the correct issue fee. § 1.311(b). See also the change to § 1.26(b). Notice of September 8, 2000, Fed. Reg. 54603-54683, at 54646 and 54647.*

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

☒ 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or an English translation of an international application later than 20 months from the earliest claimed priority date)

WARNING: *It is suggested that you always check this last authorization.*

Mark Kn

SIGNATURE OF PRACTITIONER

Reg. No.: 42,747

Mark G. Knedeisen
(type or print name of practitioner)

Tel. No.: (412) 355-6342

K&L Gates LLP
P.O. Address:
K&L Gates Center
210 Sixth Avenue
Pittsburgh, PA 15222

Customer No.: 26285

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
12/936,488	Michael J. Pelland	080188PCTUS

26285
K&L GATES LLP
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

INTERNATIONAL APPLICATION NO.	
PCT/US09/39754	
I.A. FILING DATE	PRIORITY DATE
04/07/2009	04/07/2008

CONFIRMATION NO. 3553
371 FORMALITIES LETTER

OC000000044168619

Date Mailed: 10/26/2010

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as a Designated Office (37 CFR 1.494):

- Indication of Small Entity Status
- Priority Document
- Copy of the International Application filed on 10/05/2010
- Copy of the International Search Report filed on 10/05/2010
- Preliminary Amendments filed on 10/05/2010
- Information Disclosure Statements filed on 10/05/2010
- U.S. Basic National Fees filed on 10/05/2010
- Priority Documents filed on 10/05/2010
- Specification filed on 10/05/2010
- Claims filed on 10/05/2010
- Abstracts filed on 10/05/2010
- Drawings filed on 10/05/2010

The applicant needs to satisfy supplemental fees problems indicated below.

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.
- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.492(h) of $65 for a small entity in compliance with 37 CFR 1.27, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fees required for this application is $**65** for a Small Entity:
- $**65** Surcharge.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE OR BY 32 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

FORM PCT/DO/EO/905 (371 Formalities Notice)

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

PAULETTE R KIDWELL

Telephone: (571) 272-0398

DECLARATION

INVENTORSHIP IDENTIFICATION

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

TITLE OF INVENTION

SPECIFICATION IDENTIFICATION

The specification of which was filed on October 5, 2010, as Serial No. 12/936,488 and was described and claimed in PCT International Application No. PCT/US2009/039754 filed on April 7, 2009.

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56.

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S) UNDER 35 U.S.C. § 119(e)

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

Provisional Application Number	Filing Date
61/123,265	April 7, 2008

CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S) UNDER 35 U.S.C. 120

(All Foreign Application(S), *If Any*, Filed More Than 12 Months
(6 Months For Design) Prior To This U.S. Application)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or 365(c) PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56, which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application.

U.S Parent Application No.	PCT Parent Application No.	Date Of Filing (Day, Month, Year)	Parent Patent No. *(If applicable)*
	PCT/US2009/039754	**07/April/2009**	

DECLARATION

I hereby declare that my presentation of this paper constitutes a certification under 37 C.F.R § 10.18, which provides, in part, that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and that further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful statements may jeopardize the validity of the application and any patent issuing therefrom.

SIGNATURE(S)

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DECLARATION

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SIGNATURE(S)

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DECLARATION

I hereby declare that my presentation of this paper constitutes a certification under 37 C.F.R § 10.18, which provides, in part, that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and that further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful statements may jeopardize the validity of the application and any patent issuing therefrom.

SIGNATURE(S)

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Michael	J.	Pelland
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☒ This declaration ends with this page.

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☒ This declaration ends with this page.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Pelland et al.	)	**Examiner:** TBD
	)	
Serial No.: 12/936,488	)	**Art Unit:** TBD
	)	
Filing Date: October 5, 2010	)	**Atty. Docket No.** 080188PCTUS

Title : WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Mail Stop: Amendment
Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicants, in accordance with their duty of disclosure pursuant to 37 C.F.R. § 1.56, hereby advise the United States Patent and Trademark Office of the references listed on the accompanying forms PTO/SB/08A and PTO/SB/08B. Copies of the non-U.S. patent documents, if any, are enclosed.

Applicants note that although the cited references may be relevant to the examination of the above-referenced application, under 37 C.F.R. § 1.97(h), the filing of this *Information Disclosure Statement* "shall not be construed to be an admission that the information cited in the statement is, or is considered to be, material to patentability as defined in § 1.56(b)." Applicants further note that the filing of this *Information Disclosure Statement* is not an admission that the references cited herein constitute prior art under 35 U.S.C. §§ 102-103 with respect to the captioned application.

Applicants submit that no additional fee is necessary for consideration of this *Information Disclosure Statement* under 37 C.F.R. § 1.97(b)(1). Nevertheless, the Office is hereby authorized to charge Account No. 11-1110 for any fees necessary for consideration of this *Information Disclosure Statement.*

Respectfully submitted,

Date: Dec. 20, 2010

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PI-2483697 v1

Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	12/936,488
	Filing Date	October 5, 2010
	First Named Inventor	Michael J. Pelland
	Art Unit	TBD
(use as many sheets as necessary)	Examiner Name	TBD
Sheet 1 of 2	Attorney Docket Number	080188PCTUS

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number: Number - Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2010/0246788 A1	09-30-2010	Menard et al.	
		5,784,685	07-21-1998	Stanford et al.	
		6,792,091 B2	09-14-2004	Lemchen et al.	
		6,937,712 B2	08-30-2005	Lemchen et al.	
		7,099,370 B2	08-29-2006	Takahashi	
		7,120,388 B2	10-10-2006	Hall	
		7,139,585 B2	11-21-2006	Hachimura et al.	
		7,599,679 B2	10-06-2009	Awiszus	
		7,764,775 B2	07-27-2010	Tarkoff et al.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Substitute for form 1449/PTO	*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	12/936,488
	Filing Date	October 5, 2010
	First Named Inventor	Michael J. Pelland
	Art Unit	TBD
(use as many sheets as necessary)	Examiner Name	TBD
Sheet 2 of 2	Attorney Docket Number	080188PCTUS

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]
		International Search Report for International Application No. PCT/US09/39754 mailed June 11, 2009, 2 pages.	
		International Preliminary Examination Report for International Application No. PCT/US09/39754 mailed October 28, 2010, 8 pages.	
		Written Opinion of the International Searching Authority for International Application No. PCT/US09/39754 mailed June 11, 2009, 5 pages.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached. This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SENDTO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
MARK G. KNEDEISEN
K&L GATES LLP
K&L GATES CENTER
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing (*day/month/year*) 28 OCT 2010

Applicant's or agent's file reference 080188PCT	**IMPORTANT NOTIFICATION**	
International application No. PCT/US09/39754	International filing date (*day/month/year*) 07 April 2009 (07.04.2009)	Priority date (*day/month/year*) 07 April 2008 (07.04.2008)
Applicant KOSS CORPORATION		

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/ US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No.	Authorized officer Charles Appiah Telephone No. 571-273-8300

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 080188PCT	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US09/39754	International filing date *(day/month/year)* 07 April 2009 (07.04.2009)	Priority date *(day/month/year)* 07 April 2008 (07.04.2008)
International Patent Classification (IPC) or national classification and IPC IPC: **H04R 1/02**(2006.01) USPC: 455/3.06,575.1		
Applicant KOSS CORPORATION		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of ___ sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03 December 2009 (03.12.2009)	21 October 2010 (21.10.2010)
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/ US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No.	Authorized officer Charles Appiah Telephone No. 571-273-8300

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US09/39754

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed.

☐ the description:
pages 22-28 as originally filed
pages None, filed with the demand
pages None, filed with the letter of ______.

☒ the claims:
pages 1-33, as originally filed
pages None, as amended (together with any statement) under Article 19
pages None, filed with the demand
pages None, filed with the letter of ______.

☒ the drawings
pages 1-16, as originally filed
pages None, filed with the demand
pages Nobe, filed with the letter of ______.

☒ the sequence listing part of the description:
pages None, as originally filed
pages None, filed with the demand
pages None, filed with the letter of ______.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination(under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages ____

☐ the claims, Nos. ____

☐ the drawings, sheets/fig ____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*
*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

Form PCT/IPEA/409 (Box I) (July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US09/39754

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims 1-33	YES
	Claims NONE	NO
Inventive Step (IS)	Claims 1-33	YES
	Claims NONE	NO
Industrial Applicability (IA)	Claims 1-33	YES
	Claims NONE	NO

2. CITATIONS AND EXPLANATIONS
Please See Continuation Sheet

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US09/39754

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Claims 1-33 meet novelty under PCT Article 33(2) .

Claim 1 An earphone comprising:
a body, wherein the body comprises:
at least one acoustic transducer for converting an analog electrical signal to sound; an antenna; and a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for out-putting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:
receive digital audio wirelessly from a data source via an ad hoe wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network;
transmit data via the ad hoe wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoe wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; and
when the data source is not in wireless communication range with the earphone via the ad hoe wireless network, transition automatically to receive digital audio via an infrastructure wireless network.

2. The earphone of claim 1, wherein the data source comprises a digital audio player. 3. The earphone of claim 1, wherein the transceiver circuit comprises: a wireless communication module; a processor unit in commaunication with the wireless communication module; a non-volatile memory unit in communication with the processor unit; and a volatile memory unit in communication with the processor unit.

4 The earphone of claim 3, wherein the wireless communication module comprises a Wi-Fi communication module.
5.The earphone of claim 1, wherein the infrastructure wireless network comprises a WLAN.

6 The earphone of claim 1, wherein the transceiver ch'cuit is for receiving digital audio from the data source via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoe wireless network.

7. The earphone of claim 6, wherein the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoe wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

8.The earphone of claim I, wherein the ftrmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoe wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

9.The earphone of claim 1, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoe wireless network.
10. The earphone of claim 9, wherein the earphone is for receiving streaming digital audio from the host server via the infrastructure wireless network.
11. The earphone of claim 9, wherein the earphone is for receiving a ftrst network address for a first streaming digital audio content server from the host server via the infrastructure wireless network.

12. The earphone of claim 11, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

13. The earphone of claim 12, wherein the user control comprises a button.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US09/39754

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

14. A system comprising: a data source for wirelessly transmitting streaming digital audio; and a wireless earphone that comprises: at least one acoustic transducer for converting an analog electrical signal to sound; an antenna; and a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:
receive the streaming digital audio wirelessly from the data source via an ad hoe wireless network when the data source is in wireless communication range with the earphone via the ad hoe wireless network;
transmit data via the ad hoe wireless network to the data source regarding one or more irastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastruc~rc wireless networks; and
when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive streaming digital audio via an infrastructure wireless network.

15. The system of claim 14, wherein the data source comprises a digital audio player.

16. The system of claim 14, further comprising a host server that is in communication with the wireless earphone via the infrastructure wireless network.

17. The system of claim 16, wherein the firmware of the transceiver circuit of the wireless earphone, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to the host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

18. The system of claim 16, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

19. The system of claim 16, wherein the host server is for transmitting a ftrst network address for a fLrst streaming digital audio content server to the earphone via the in~astructure wireless network.

20. The system of claim 19, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

21. The earphone of claim 20, wherein the user control comprises a button.

22. The system of claim 17, further comprising a web page for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone.

23. The system of claim 14, wherein the infrastruc~tre wireless network comprises a WLAN. 24. The system of claim 14, wherein the ftrmware, when executed by the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoe wireless network and when the pre-set infrastructure wireless network is in range, of both the earphone and the data source.

25. The system of claim 14, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoe wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

26. The system of claim 25, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

27. The system of claim 25, wherein the host sever is for transmitting a first network address fora first streaming digital audio content server to the earphone via the infrastructure wireless network.

28. The system of claim 27, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US09/39754

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

29. The earphone of claim 28, wherein the user control comprises a button. 30. A method comprising: receiving, by a wireless earphone, via an ad hoe wireless network, digital audio from a data source when the data source is in wireless communication with the earphone via the ad hoe wireless network; transmitting data via the ad hoe wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoe wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; converting, by the wireless earphone, the digital audio to sound; and when the data source is not in wireless communication with the earphone, transitioning automatically, by the earphone, to receive digital audio via an infrastructure wireless network.

31. The method of claim 30, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from the data source via an infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoe wireless network.

32. The method of claim 30, wherein transitioning automatically by the earphone to receive digital audio via an irffxastructure wireless network comprises transitioning automatically to receive digital audio from a host sever via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoe wireless network

33. The method of claim 30, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises: receiving, by the wireless earphone via the infastructure wireless network, from a host server connected to the infrastructure wireless network, a network address for a streaming digital audio content server; and connecting, by the wireless earphone, to the streaming digital audio content server using the network address received from the host server.

V. 2. Citations and Explanations:

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
MARK G. KNEDEISEN
K&L GATES LLP
K&L GATES CENTER
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing
(*day/month/year*)

Applicant's or agent's file reference		**IMPORTANT NOTIFICATION**
080188PCT		
International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US09/39754	07 April 2009 (07.04.2009)	07 April 2008 (07.04.2008)

Applicant

KOSS CORPORATION

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US	Authorized officer
Mail Stop PCT, Attn: IPEA/ US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450	Charles Appiah CAppiah
Facsimile No.	Telephone No. 571-273-8300

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 080188PCT	FOR FURTHER ACTION — see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US 09/39754	International filing date (*day/month/year*) 07 April 2009 (07.04.2009)	(Earliest) Priority Date (*day/month/year*) 07 April 2008 (07.04.2008)
Applicant Koss Corporation		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report

1. **Basis of the report**
   a. With regard to the **language**, the international search was carried out on the basis of:
      ☒ the international application in the language in which it was filed.
      ☐ a translation of the international application into ____________ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.*6bis*(a)).
   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.
2. ☐ **Certain claims were found unsearchable** (see Box No. II).
3. ☐ **Unity of invention is lacking** (see Box No. III).
4. With regard to the **title**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established by this Authority to read as follows:
5. With regard to the **abstract**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. With regard to the **drawings**,
   a. the figure of the **drawings** to be published with the abstract is Figure No. 2D
      ☒ as suggested by the applicant.
      ☐ as selected by this Authority, because the applicant failed to suggest a figure.
      ☐ as selected by this Authority, because this figure better characterizes the invention.
   b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 09/39754

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04R 1/02 (2009.01)
USPC - 381/330
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC: 381/330

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 381/309, 330; 340/505; 709/250 (see terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(PGPB,USPT,USOC,EPAB,JPAB); GOOGLE SCHOLAR
Search terms: ad hoc wireless network, infrastructure wireless network, earphone, headset, digital audio, antenna, transceiver, server, streaming, web page

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/0116316 A1 (Goldberg) 24 May 2007 (24.05.2007), entire document, especially; para [0095]-[0194], [0222], [0262]-[0277], [0303]-[0328], [0350]-[0352], Fig. 1, 13, 12, 29	1 - 47
A	US 2008/0062939 A1 (Horn et al.) 13 March 2008 (13.03.2008), entire document	1 - 47
A	US 2005/0198233 A1 (Manchester et al.) 08 September 2005 (08.09.2005), entire document	1 - 47

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 June 2009 (02.06.2009)	11 JUN 2009

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2007)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
Mark G. Knedeisen
K&L GATES LLP
HENRY W. OLIVER BUILDING
535 SMITHFIELD STREET
PITTSBURGH, PA 15222-2312

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing (*day/month/year*) 11 JUN 2009

Applicant's or agent's file reference		FOR FURTHER ACTION
080188PCT		See paragraph 2 below
International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US 09/39754	07 April 2009 (07.04.2009)	07 April 2008 (07.04.2008)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H04R 1/02 (2009.01)
USPC - 381/330

Applicant Koss Corporation

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	05 June 2009 (05.06.2009)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 09/39754

Box No. I **Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of:
   - [x] the international application in the language in which it was filed.
   - [ ] a translation of the international application into ____________ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. [ ] This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
   a. type of material
      - [ ] a sequence listing
      - [ ] table(s) related to the sequence listing

   b. format of material
      - [ ] on paper
      - [ ] in electronic form

   c. time of filing/furnishing
      - [ ] contained in the international application as filed
      - [ ] filed together with the international application in electronic form
      - [ ] furnished subsequently to this Authority for the purposes of search

4. [ ] In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Form PCT/ISA/237 (Box No. I) (April 2007)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 09/39754

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	None.	YES
	Claims	1 - 47	NO
Inventive step (IS)	Claims	None.	YES
	Claims	1 - 47	NO
Industrial applicability (IA)	Claims	1 - 47	YES
	Claims	None.	NO

2. Citations and explanations:

Claims 1 - 47 lack novelty under PCT Article 33(2) as being anticipated by US 2007/0116316 A1 (Goldberg).

As per claim 1, Goldberg discloses an earphone (901, fig. 12c, being a wireless earphone, para [0161]-[0162]) comprising: a body (enclosure, para [0110]), wherein the body comprises: at least one acoustic transducer (sound transducers 260, fig. 1, para [0099] and [0122]) for converting an analog electrical signal to sound (para [0137]); an antenna (antennae supported by portable devices, para [0142]); and a transceiver circuit (transmitter/receiver 110, fig. 1, para [0178]) in communication with the at least one acoustic transducer (para [0134]) and the antenna (para [0142]), wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna (para [0142]), and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer (para [0134]), and wherein the wireless transceiver circuit comprises firmware (instructions that implement a variety of protocols, para [0141] and [0165]), which when executed by the transceiver circuit, causes the transceiver circuit to: receive digital audio wirelessly from a data source (e.g., audio player 130, fig. 1 and 12c, para [0096] and [0155]) via an ad hoc wireless network (peer-to-peer communications, para [0165]) when the data source is in wireless communication range with the earphone via the ad hoc wireless network (within a predetermined distance, para [0165]); and when the data source is not in wireless communication range with the earphone via the ad hoc wireless network (outside of the range, para [0194] and [0269]), transition automatically to receive digital audio via an infrastructure wireless network (fixed infrastructure, para [0165]).

As per claim 15, Goldberg discloses a data source (e.g., audio player 130, fig. 1 and 12c, para [0096] and [0155]) for wirelessly transmitting streaming digital audio (audio data streaming 1954, para [0165]); and a wireless earphone (earphone 901, fig. 12c, being a wireless earphone, para [0161]-[0162]) that comprises: at least one acoustic transducer (sound transducers 260, fig. 1, para [0099] and [0122]) for converting an analog electrical signal to sound (para [0137]); an antenna (antennae supported by portable devices, para [0142]); and a transceiver circuit (transmitter/receiver 110, fig. 1, para [0178]) in communication with the at least one acoustic transducer (para [0134]) and the antenna (para [0142]), wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna (para [0142]), and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer (para [0134]), and wherein the wireless transceiver circuit comprises firmware (instructions that implement a variety of protocols, para [0141] and [0165]), which when executed by the transceiver circuit, causes the transceiver circuit to: receive the streaming digital audio wirelessly from the data source via an ad hoc wireless network (peer-to-peer communications, para [0165]) when the data source is in wireless communication range with the earphone via the ad hoc wireless network (within a predetermined distance, para [0165]); and when the data source is not in wireless communication range with the earphone via the ad hoc wireless network (outside of the range, para [0194] and [0269]), transition automatically to receive streaming digital audio via an infrastructure wireless network (fixed infrastructure, para [0165]).

As per claims 32, Goldberg discloses a system comprising: a host server (broadcast unit 710, fig. 13, para [0262], e.g., Internet device 1706, fig. 29, being a computer hosting a database, para [0352]); a first streaming digital audio content server (streaming socket, para [0314]) that is connected to the host server via a data network (para [0311]); and a wireless earphone (earphone 901, fig. 12c, being a wireless earphone, para [0161]-[0162]) that is in communication with the host server via a wireless network (para [0350]), wherein the host server is programmed to transmit to the earphone a first network address for the first streaming digital audio content server (one of the socket addresses, para [0272]-[0273]).

- - - - - - Please See Supplemental Box - - - - - -

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 09/39754

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Box V. 2. Citations and Explanations:

As per claim 37, Goldberg discloses a headset (headphones 1020, fig. 13e, para [0222]) comprising: a first earphone (left speaker 1022) that comprises one or more acoustic transducers for converting a first analog electrical signal to sound (para [0222]); and a second earphone (right speaker, not labeled in fig. 13e), connected to the first earphone (fig. 13e), wherein the second earphone comprises one or more acoustic transducers for converting a second analog electrical signal to sound (para [0222]), and wherein the first earphone comprises: a first antenna (antennae supported by portable devices, para [0142]); and a first transceiver circuit (transmitter/receiver 110, fig. 1, para [0178]) in communication with the one or more acoustic transducers of the first earphone (para [0134]) and in communication with the first antenna (para [0142]), wherein the first transceiver circuit is for receiving and transmitting wireless signals via the first antenna (para [0142]), and wherein the first transceiver circuit is for outputting the first analog electrical signal to the one or more acoustic transducers of the first earphone (para [0134]), and wherein the first transceiver circuit comprises firmware (instructions that implement a variety of protocols, para [0141] and [0165]), which when executed by the first transceiver circuit, causes the first transceiver circuit to: receive digital audio wirelessly from a data source (e.g., audio player 130, fig. 1 and 12c, para [0096] and [0155]) via an ad hoc wireless network (peer-to-peer communications, para [0165]) when the data source is in wireless communication range with the first earphone via the ad hoc wireless network (within a predetermined distance, para [0165]); and when the data source is not in wireless communication range with the first earphone via the ad hoc wireless network (outside of the range, para [0194] and [0269]), transition automatically to receive digital audio via an infrastructure wireless network (fixed infrastructure, para [0165]).

As per claim 43, Goldberg discloses a method (para [0165] and [0172]) comprising: receiving, by a wireless earphone (earphone 901, fig. 12c, being a wireless earphone, para [0161]-[0162]), via an ad hoc wireless network (peer-to-peer communications, para [0165]), digital audio from a data source (e.g., audio player 130, fig. 1 and 12c, para [0096] and [0155]) when the data source is in wireless communication with the earphone via the ad hoc wireless network (within a predetermined distance, para [0165]); converting, by the wireless earphone, the digital audio to sound; and when the data source is not in wireless communication with the earphone (outside of the range, para [0194] and [0269]), transitioning automatically, by the earphone, to receive digital audio via an infrastructure wireless network (fixed infrastructure, para [0165]).

As per claims 2 and 16, Goldberg further discloses that the data source comprises a digital audio player (e.g., portable MP3 player, para [0102]).

As per claim 3, Goldberg further discloses that the transceiver circuit comprises: a wireless communication module (wireless communications hardware, para [0179]); a processor unit in communication with the wireless communication module (microprocessor, para [0115]); a non-volatile memory unit in communication with the processor unit (means to store the digital software, para [0115]); and a volatile memory unit in communication with the processor unit (inherent feature with the microprocessor, para [0115]).

As per claim 4, Goldberg further discloses that the wireless communication module comprises a Wi-Fi communication module (para [0179]).

As per claims 5 and 24, Goldberg further discloses that the infrastructure wireless network comprises a WLAN (e.g., HiperLAN, para [0141], a wireless LAN standard).

As per claim 6 and 44, Goldberg further discloses that the transceiver circuit is for receiving digital audio from the data source via the infrastructure wireless network (audio data streaming, para [0165]) when the data source is not in wireless communication range with the earphone via the ad hoc wireless network (outside of the range, para [0194] and [0269]).

As per claims 7 and 25, Goldberg further discloses that the infrastructure wireless network is a pre-set infrastructure wireless network (fixed infrastructure, para [0165]) that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source (e.g., through access points, para [0165]).

As per claims 8, 26 and 45, Goldberg further discloses that the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network (mode switch 1950 made by the user, either manually, or automatically--for example, that the user chooses between different functions, para [0165]).

As per claims 9 and 27, Goldberg further discloses that the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server (broadcast unit 710, fig. 13, para [0262], e.g., Internet device 1706, fig. 29, being a computer hosting a database, para [0352]) via a second infrastructure wireless network (alternatively through computers or computer networks to which the unit 100 can be connected, para [0311]) when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network (outside of the range, para [0194] and [0269]) and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network (e.g., turned off, para [0269]).

As per claims 10, 17, 18 and 46, Goldberg further discloses that the firmware of the transceiver circuit of the wireless earphone, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server (broadcast unit 710, fig. 13, para [0262], e.g., Internet device 1706, fig. 29, being a computer hosting a database, para [0352]) via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network (outside of the range, [0194] and [0269]).

------ Please See Next Supplemental Box ------

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 09/39754

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Box V. 2. Citations and Explanations:

As per claims 11, 19 and 28, Goldberg further discloses that the earphone (para [0162] and [0222]) is for receiving streaming digital audio (para [0166] and [0322]) from the host server (para [0262] and [0352]) via the infrastructure wireless network (para [0165]).

As per claims 12, 20 and 29, Goldberg further discloses that the earphone is for receiving a first network address (one of socket addresses, para [0185]-[0186] and [0273]) for a first streaming digital audio content server (streaming socket, para [0314]) from the host server via the infrastructure wireless network (para [0165]).

As per claim 33, Goldberg further discloses that the wireless earphone comprises: at least one acoustic transducer (sound transducers 260, fig. 1, para [0099] and [0122]) for converting an analog electrical signal to sound (para [0137]); an antenna (antennae supported by portable devices, para [0142]); and a transceiver circuit (transmitter/receiver 110, fig. 1, para [0178]) in communication with the at least one acoustic transducer (para [0134]) and the antenna (para [0142]), wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna (para [0142]), and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer (para [0134]), and wherein the wireless transceiver circuit comprises firmware that is executed by the transceiver circuit (instructions that implement a variety of protocols, para [0141] and [0165]).

As per claims 23 and 34, Goldberg further discloses that the host server hosts a web page (web sites, para [0277]) for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone (Audio personalization, para [0276]).

As per claim 35, Goldberg further discloses that the one or more settings comprise the first streaming digital audio content server and a second streaming digital audio content server (another streaming socket, para [0314]).

As per claims 13, 21, 30 and 36, Goldberg further discloses that the earphone comprises a user control (mode switch 1950, para [0165]) that, when activated, causes the earphone to submit an electronic request (sending control requests, para [0176]) via the infrastructure wireless network to the host server for a second network address (another of socket addresses, para [0185]-[0186] and [0273]) for a second streaming digital audio content server (another streaming socket, para [0314]).

As per claims 14, 22 and 31, Goldberg further discloses that the user control comprises a button (para [0173]).

As per claim 38, Goldberg further discloses a head band (fig. 13e), wherein the first and second earphones are connected to the headband (fig. 13e).

As per claim 39, Goldberg further discloses a microphone having an output connected to the first transceiver circuit (para [0174]).

As per claim 40, Goldberg further discloses that the first transceiver circuit is for outputting the second analog electrical signal to the one or more acoustic transducers of the second earphone (para [0222]).

As per claim 41, Goldberg further discloses that the second earphone comprises: a second antenna (antennae supported by portable devices, para [0142]); and a second transceiver circuit (transmitter/receiver 110, fig. 1, para [0178]) in communication with the one or more acoustic transducers of the second earphone (para [0134]) and in communication with the second antenna (para [0142]), wherein the second transceiver circuit is for receiving and transmitting wireless signals via the second antenna (para [0142]), and wherein the second transceiver circuit is for outputting the second analog electrical signal to the one or more acoustic transducers of the second earphone (para [0134]), and wherein the second transceiver circuit comprises firmware (instructions that implement a variety of protocols, para [0141] and [0165]), which when executed by the second transceiver circuit, causes the second transceiver circuit to: receive digital audio (e.g., audio player 130, fig. 1 and 12c, para [0096] and [0155]) wirelessly from the data source via the ad hoc wireless network (peer-to-peer communications, para [0165]) when the data source is in wireless communication range with the second earphone via the ad hoc wireless network (within a predetermined distance, para [0165]); and when the data source is not in wireless communication range with the second earphone via the ad hoc wireless network (outside of the range, para [0194] and [0269]), transition automatically to receive digital audio via the infrastructure wireless network (fixed infrastructure, para [0165]).

As per claim 42, Goldberg further discloses that the first earphone comprises a first data port and the second earphone comprises a second data port (carrying port number, para [0222]), and wherein the headset further comprises an adapter (e.g., cable 146, fig. 12c, para [0161] and [0328]) connected to the first data port of the first earphone and to the second data port of the second earphone (as wired headphones, para [0104]), and wherein the adapter comprises an output plug connector (the portion of the cable 146 connected to an output audio port 142, para [0161]) for connecting to a remote device (e.g., modular audio unit 132, fig. 12a and 12c, para [0328]).

As per claim 47, Goldberg further discloses that transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises: receiving, by the wireless earphone via the infrastructure wireless network, from a host server (broadcast unit 710, fig. 13, para [0262], e.g., Internet device 1706, fig. 29, being a computer hosting a database, para [0352]) connected to the infrastructure wireless network (para [0165]), a network address (one of socket addresses, para [0185]-[0186] and [0273]) for a streaming digital audio content server (streaming socket, para [0314]); and connecting, by the wireless earphone, to the streaming digital audio content server using the network address received from the host server (para [0222]).

Claims 1 - 47 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Pelland, M., et al.	) **Examiner:**	TBD
Serial No.:	12/936,488	) **Art Unit:**	TBD
Filing Date:	April 7, 2009	) **Atty. Docket No.**	080188PCTUS

Title: WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

APPLICATION DATA SHEET

I. Applicant Information

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Residence: DeForest, WI 53532 (US)
Citizenship: US

II. Correspondence Information

Correspondence should be directed to the practitioners associated with Customer No. **26285.**

III. Application Information

A. Title: WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

B. Total Number of Drawing Sheets: 16

C. Suggested Drawing Figure For Publication: Figure 6

D. Attorney Docket No. 080188PCTUS

E. Type of application: Utility

IV. Representative Information

The practitioners associated with Customer No. **26285.**

V. Domestic Priority Information

This application claims priority to PCT application no. PCT/US2009/039754, having an international filing date of April 7, 2009, which PCT application claims priority to U.S. provisional application Serial No. 61/123,265, filed April 7, 2008.

VI. Foreign Priority Information

Not Applicable.

VII. Assignee Information

Koss Corporation
4129 N. Port Washington Ave.
Milwaukee, WI 53212 (US)

Respectfully submitted,

Date: December 20, 2010

Mark Knedeisen

Mark G. Knedeisen
Reg. No. 42,747

K&L GATES LLP
K&L Gates Center
210 Sixth Avenue
Pittsburgh, Pennsylvania 15222

Ph. (412) 355-6342
Fax (412) 355-6501

Electronic Patent Application Fee Transmittal

Application Number:	12936488
Filing Date:	
Title of Invention:	WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS
First Named Inventor/Applicant Name:	Michael J. Pelland
Filer:	Mark G. Knedeisen/Amanda Kernan
Attorney Docket Number:	080188PCTUS

Filed as Small Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Oath/decl > 30 mo. from priority date	2617	1	65	65
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
	Total in USD ($)			**65**

Electronic Acknowledgement Receipt

EFS ID:	9074348
Application Number:	12936488
International Application Number:	
Confirmation Number:	3553
Title of Invention:	WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS
First Named Inventor/Applicant Name:	Michael J. Pelland
Customer Number:	26285
Filer:	Mark G. Knedeisen/Amanda Kernan
Filer Authorized By:	Mark G. Knedeisen
Attorney Docket Number:	080188PCTUS
Receipt Date:	20-DEC-2010
Filing Date:	
Time Stamp:	16:01:48
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$65
RAM confirmation Number	2915
Deposit Account	111110
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	12-20-2010-Completion_of_Filing_Requirements.pdf	714876 [illegible]	no	6
Warnings:					
Information:					
2	Applicant Response to Pre-Exam Formalities Notice	Notice-of-missing-requirements.pdf	67087 [illegible]	no	2
Warnings:					
Information:					
3	Oath or Declaration filed	12-20-2010_Declaration.pdf	631693 [illegible]	no	6
Warnings:					
Information:					
4		12-20-2010_Supplemental_IDS.pdf	318357 [illegible]	yes	3

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Information Disclosure Statement (IDS) Filed (SB/08)	2	3

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
Warnings:					
Information:					
5	NPL Documents	NPL-IPER.pdf	393231 [illegible]	no	8
Warnings:					
Information:					
6	NPL Documents	NPL-ISR.pdf	96847 [illegible]	no	2
Warnings:					
Information:					
7	NPL Documents	NPL-Written-opinion.pdf	348452 [illegible]	no	5
Warnings:					
Information:					

8	Application Data Sheet	12-20-2010-ADS.pdf	23890 [illegible]	no	3
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
9	Fee Worksheet (PTO-875)	fee-info.pdf	30248 [illegible]	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2624681		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/936,488	12/20/2010		728	080188PCTUS	33	2

CONFIRMATION NO. 3553

26285
K&L GATES LLP
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

FILING RECEIPT

OC000000045594529

Date Mailed: 01/24/2011

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Michael J. Pelland, Princeton, WI;
Michael J. Koss, River Hills, WI;
Michael Sagan, Marshall, WI;
Steven R. Reckamp, Crystal Lake, IL;
Gregory J. Hallingstad, Madison, WI;
Jeffrey K. Bovee, Lake Geneva, WI;
Morgan J. Lowery, DeForest, WI;

Assignment For Published Patent Application

Koss Corporation, Milwaukee, WI

Power of Attorney: The patent practitioners associated with Customer Number 26285

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/US09/39754 04/07/2009
which claims benefit of 61/123,265 04/07/2008

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 01/20/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/936,488**

Projected Publication Date: 05/05/2011

Non-Publication Request: No

Early Publication Request: No

** SMALL ENTITY **
Title

WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

Preliminary Class

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
12/936,488	Michael J. Pelland	080188PCTUS

26285
K&L GATES LLP
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

INTERNATIONAL APPLICATION NO.	
PCT/US09/39754	
I.A. FILING DATE	PRIORITY DATE
04/07/2009	04/07/2008

CONFIRMATION NO. 3553
371 ACCEPTANCE LETTER

OC000000045594530

Date Mailed: 01/24/2011

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is ACCEPTED for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

12/20/2010	12/20/2010
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF COMPLETION OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1), (c)(2) and (c)(4) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

The following items have been received:

- Indication of Small Entity Status
- Copy of the International Application filed on 10/05/2010
- Copy of the International Search Report filed on 10/05/2010
- Preliminary Amendments filed on 10/05/2010
- Information Disclosure Statements filed on 10/05/2010
- Oath or Declaration filed on 12/20/2010
- U.S. Basic National Fees filed on 10/05/2010
- Priority Documents filed on 10/05/2010
- Specification filed on 10/05/2010
- Claims filed on 10/05/2010
- Abstracts filed on 10/05/2010
- Drawings filed on 10/05/2010

FORM PCT/DO/EO/903 (371 Acceptance Notice)

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

PAULETTE R KIDWELL

Telephone: (571) 272-0398

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/936,488

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	165		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	50		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	110		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	33 minus 20 =	* 13	x 26 =	338	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	x 110 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2			TOTAL	663		TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

Doc Code: PPH.PCT.652
Document Description: Petition to make special under PCT-Patent Pros Hwy

PTO/SB/20PCT-US (09-10)
Approved for use through 01/31/2012. OMB 0651-0058
U.S. Patent and Trademark Office; U. S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

REQUEST FOR PARTICIPATION IN THE PATENT COOPERATION TREATY - PATENT PROSECUTION HIGHWAY (PCT-PPH) PILOT PROGRAM IN A U.S. APPLICATION WHERE THE USPTO WAS THE ISA OR IPEA

Application No:	12/936,488	Filing date:	12/20/2010
First Named Inventor:	Michael J. Pelland		

Title of the Invention: WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

THIS REQUEST FOR PARTICIPATION IN THE PCT-PPH PILOT PROGRAM ALONG WITH THE REQUIRED DOCUMENTS MUST BE SUBMITTED VIA EFS-WEB. INFORMATION REGARDING EFS-WEB IS AVAILABLE AT HTTP://WWW.USPTO.GOV/EBC/EFS_HELP.HTML

APPLICANT HEREBY REQUESTS PARTICIPATION IN THE PCT-PPH PROGRAM AND PETITIONS TO MAKE THE ABOVE-IDENTIFIED APPLICATION SPECIAL UNDER THE PCT-PPH PROGRAM.

The above-identified application is (1) a national stage entry of the corresponding PCT application, or (2) a national stage entry of another PCT application which claims priority to the corresponding PCT application, or (3) a national application that claims domestic/ foreign priority to the corresponding PCT application, or (4) a national application which forms the basis for the priority claim in the corresponding PCT application, or (5) a continuing application of a U.S. application that satisfies one of (1) to (4) above, or (6) a U.S. application that claims domestic benefit to a U.S. provisional application which forms the basis for the priority claim in the corresponding PCT application.

The corresponding PCT application number(s) is/are: PCT/US09/39754

The international date of the corresponding PCT application(s) is/are:

April 7, 2009

I. List of Required Documents:

a. **A copy of the latest international work product (WO/ISA, WO/IPEA, or IPER) in the above–identified corresponding PCT application(s)**
- [x] Is attached
- [ ] Is not attached because the document is already in the U.S. application.

b. **A copy of all claims which were indicated as having novelty, inventive step and industrial applicability in the above-identified corresponding PCT application(s).**
- [ ] Is attached.
- [x] Is not attached because the document is already in the U.S. application.

c. **English translations of the documents in a. and b. above are attached (if the documents are not in the English language). A statement that the English translation is accurate is attached for the document in b. above.**

PTO/SB/20PCT-US (09-10)
Approved for use through 01/31/2012. OMB 0651-0058
U.S.Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

REQUEST FOR PARTICIPATION IN THE PCT-PPH PILOT PROGRAM IN A U.S. APPLICATION WHERE THE USPTO WAS THE ISA OR IPEA
(continued)

Application No.:	12/936,488
First Named Inventor:	Michael J. Pelland

d. **(1) An information disclosure statement listing the documents cited in the international work products (ISR, WO/ISA, WO/IPEA, IPER) of the corresponding PCT application.**

☐ Is attached

■ Has already been filed in the above-identified U.S. application on October 5, 2010

(2) Copies of all documents (except) for U.S. patents or U.S. patent application publications)

☐ Are attached.

■ Have already been filed in the above-identified U.S. application on October 5, 2010

II. Claims Correspondence Table:

Claims in US Application	Patentable Claims in the corresponding PCT Application	Explanation regarding the correspondence
48 - 80	1-33	Claims Correspond on a direct 1-to-1 basis

III. All the claims in the US application sufficiently correspond to the patentable claims in the corresponding PCT application.

Signature /Mark G. Knedeisen/	Date 02/15/2011
Name (Print/Typed) Mark Knedeisen	Registration Number 42,747

PATENT
Docket No. 080188PCT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE AS INTERNATIONAL SEARCHING AUTHORITY

Applicant: KOSS CORPORATION	:	
International Application No. PCT/US2009/039754	:	WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS
International Filing Date 07 April 2009	:	

REPLY TO THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

K&L Gates, LLP
Pittsburgh, Pennsylvania 15222
September 11, 2009

VIA ELECTRONIC FILING

Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
USA

Attn: Authorized Officer Lee W. Young

Dear Sir or Madam:

In response to the Written Opinion of the International Searching Authority ("Written Opinion"), which was mailed 11 June 2009 in connection with the above-identified international patent application ("Subject Application"), Applicant submits the following amendments and remarks under Article 34 of the Patent Cooperation Treaty.

Replacement Sheets 22-28, containing the claims (which replace pages 22-28 of the Subject Application as filed), are attached for consideration in connection with this reply. Also attached is a copy of the Annotated Replacement Sheets indicating the claim amendments made herein.

REMARKS

In the Written Opinion, the Authorized Officer indicated that original claims 1-47 did not meet the novelty and inventive step requirements of Article 33 of the Patent Cooperation Treaty due to the disclosure of U.S. Pub. No. 2007/0116316 A1 to Goldberg (hereinafter "Goldberg"). Applicant respectfully asserts that amended claims 1-33, as set forth in the attached claim sheets, meet the novelty and inventive step requirements for the reasons set forth below.

The independent claims (i.e., claims 1, 14, and 30) have been amended to recite generally that the transceiver circuit of the wireless earphone:

> transmit[s] data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks.

Goldberg does not disclose or suggest this feature of the claims. The Written Opinion states, with respect to original claims 8, 26, and 45, that "Goldberg further discloses that the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network." This statement is erroneous. Goldberg does not disclose that the earphone transmits data regarding the infrastructure wireless networks that it detects to the data source. Moreover, Goldberg certainly does not disclose that the data that is transmitted by the earphone to the data source about the infrastructure wireless networks are identification data and signal strength data for the infrastructure wireless networks.

As support for its factually incorrect assertion, the Written Opinion cites paragraph [0165] of Goldberg. Paragraph [0165] of Goldberg mentions how Goldberg's users can operate in two communication modes: peer-to-peer and fixed infrastructure. Paragraph [0165] of Goldberg further discloses that the transition between modes can be either manual or automatic. Contrary to the assertions in the Written Opinion, however, paragraph [0165] nowhere discloses that while the earphone and the data source are in an ad hoc communication mode, they exchange data regarding detected infrastructure wireless networks. Thus, the Written Opinion's assertions with respect the subject matter of original claims 8, 26, and 45 is factually incorrect.

New claim 22 recites a web page for the earphone through which a user is capable of configuring one or more settings for the wireless earphone. The Written Opinion stated that Goldberg disclosed this feature at paragraph [0277]. Paragraph [0277], however, does not disclose the subject matter of claim 22. Paragraph [0277] merely states that the unit 100 can download content from Internet web sites. About the only thing paragraph [0277] has in common with claim 22 is use of the phrase "web site." Paragraph [0277] simply does not disclose the subject matter of claim 22.

For these reasons and others, applicant submits that claims 1-33, as set forth in the attached claim sheets, satisfy the novelty and inventive step requirements of PCT Article 33.

CONCLUSION

In the present Reply, Applicant requests that pages 22-28 of the Subject Application be replaced with the enclosed Replacement Sheets 22-28. For the reasons set forth above, Applicant submits that the pending claims meet the novelty and inventive step requirements in view of the cited references and requests that the Authorized Officer issue a favorable International Preliminary Report on Patentability regarding the same.

Should the Authorized Officer have any questions or concerns regarding this Reply, the Authorized Officer is invited to contact the undersigned.

Respectfully submitted,

Date: September 11, 2009

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REPLACEMENT SHEET

CLAIMS

What is claimed is:

1. An earphone comprising:

a body, wherein the body comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:

receive digital audio wirelessly from a data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network;

transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; and

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive digital audio via an infrastructure wireless network.

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2. The earphone of claim 1, wherein the data source comprises a digital audio player.

3. The earphone of claim 1, wherein the transceiver circuit comprises:

a wireless communication module;

a processor unit in communication with the wireless communication module;

a non-volatile memory unit in communication with the processor unit; and

a volatile memory unit in communication with the processor unit.

4. The earphone of claim 3, wherein the wireless communication module comprises a Wi-Fi communication module.

5. The earphone of claim 1, wherein the infrastructure wireless network comprises a WLAN.

6. The earphone of claim 1, wherein the transceiver circuit is for receiving digital audio from the data source via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

7. The earphone of claim 6, wherein the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

8. The earphone of claim 1, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

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9. The earphone of claim 1, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

10. The earphone of claim 9, wherein the earphone is for receiving streaming digital audio from the host server via the infrastructure wireless network.

11. The earphone of claim 9, wherein the earphone is for receiving a first network address for a first streaming digital audio content server from the host server via the infrastructure wireless network.

12. The earphone of claim 11, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

13. The earphone of claim 12, wherein the user control comprises a button.

14. A system comprising:

a data source for wirelessly transmitting streaming digital audio; and

a wireless earphone that comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit

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comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:

receive the streaming digital audio wirelessly from the data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network;

transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; and

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive streaming digital audio via an infrastructure wireless network.

15. The system of claim 14, wherein the data source comprises a digital audio player.

16. The system of claim 14, further comprising a host server that is in communication with the wireless earphone via the infrastructure wireless network.

17. The system of claim 16, wherein the firmware of the transceiver circuit of the wireless earphone, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to the host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

18. The system of claim 16, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

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19. The system of claim 16, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network

20. The system of claim 19, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

21. The earphone of claim 20, wherein the user control comprises a button.

22. The system of claim 17, further comprising a web page for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone.

23. The system of claim 14, wherein the infrastructure wireless network comprises a WLAN.

24. The system of claim 14, wherein the firmware, when executed by the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

25. The system of claim 14, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

26. The system of claim 25, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

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27. The system of claim 25, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network

28. The system of claim 27, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

29. The earphone of claim 28, wherein the user control comprises a button.

30. A method comprising:

receiving, by a wireless earphone, via an ad hoc wireless network, digital audio from a data source when the data source is in wireless communication with the earphone via the ad hoc wireless network;

transmitting data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks;

converting, by the wireless earphone, the digital audio to sound; and

when the data source is not in wireless communication with the earphone, transitioning automatically, by the earphone, to receive digital audio via an infrastructure wireless network.

31. The method of claim 30, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to

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receive digital audio from the data source via an infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

32. The method of claim 30, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from a host sever via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network

33. The method of claim 30, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises:

receiving, by the wireless earphone via the infrastructure wireless network, from a host server connected to the infrastructure wireless network, a network address for a streaming digital audio content server; and

connecting, by the wireless earphone, to the streaming digital audio content server using the network address received from the host server.

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CLAIMS

What is claimed is:

1. An earphone comprising:

a body, wherein the body comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:

receive digital audio wirelessly from a data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network;

transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; and

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive digital audio via an infrastructure wireless network.

2. The earphone of claim 1, wherein the data source comprises a digital audio player.

3. The earphone of claim 1, wherein the transceiver circuit comprises:

a wireless communication module;

a processor unit in communication with the wireless communication module;

a non-volatile memory unit in communication with the processor unit; and

a volatile memory unit in communication with the processor unit.

4. The earphone of claim 3, wherein the wireless communication module comprises a Wi-Fi communication module.

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5. The earphone of claim 1, wherein the infrastructure wireless network comprises a WLAN.

6. The earphone of claim 1, wherein the transceiver circuit is for receiving digital audio from the data source via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

7. The earphone of claim 6, wherein the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

88. The earphone of claim ~~7,~~1, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to ~~transmit data via the ad hoc wireless network to the data source regarding one or more~~connect to a host server via a second infrastructure wireless ~~networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc~~network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

9. ~~The earphone of claim 8, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.10.~~—The earphone of claim 1, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

10. The earphone of claim 9, wherein the earphone is for receiving streaming digital audio from the host server via the infrastructure wireless network.

11. The earphone of claim ~~10,~~9, wherein the earphone is for receiving a first network address for a first streaming digital audio content server from the host server via the infrastructure wireless network.

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12. The earphone of claim ~~10,~~11, wherein the earphone ~~is for receiving a first~~comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a ~~first~~second streaming digital audio content server~~-from the host server via the infrastructure wireless network~~.

13. The earphone of claim 12, wherein the ~~earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server~~user control comprises a button.

14. ~~The earphone of claim 13, wherein the user control comprises a button.15.~~ A system comprising:

a data source for wirelessly transmitting streaming digital audio; and

a wireless earphone that comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:

receive the streaming digital audio wirelessly from the data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network;

transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; and

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when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive streaming digital audio via an infrastructure wireless network.

15. The system of claim 14, wherein the data source comprises a digital audio player.

16. The system of claim ~~15, wherein the data source comprises a digital audio player~~14, further comprising a host server that is in communication with the wireless earphone via the infrastructure wireless network.

17. The system of claim ~~15, further comprising a host server that is~~16, wherein the firmware of the transceiver circuit of the wireless earphone, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to the host server via the infrastructure wireless network when the data source is not in wireless communication range with the ~~wireless~~ earphone via the ~~infrastructure~~ad hoc wireless network.

18. The system of claim ~~17, wherein the firmware of the transceiver circuit of the wireless earphone, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to~~16, wherein the host server is for streaming digital audio to the earphone via the infrastructure ~~wireless network when the data source is not in wireless communication range with the earphone via the ad hoc~~ wireless network.

19. The system of claim ~~17,~~16, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network~~.~~

20. The system of claim ~~17, wherein~~19, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server~~-is~~ for ~~transmitting a first~~a second network address for a ~~first~~second streaming digital audio content server ~~to the earphone via the infrastructure wireless network~~.

21. The ~~system~~earphone of claim 20, wherein the ~~earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server~~user control comprises a button.

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22. The ~~earphone of claim 21, wherein the user control comprises a button~~system of claim 17, further comprising a web page for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone.

23. The system of claim ~~18, wherein the host server hosts a web page for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone~~14, wherein the infrastructure wireless network comprises a WLAN.

24. The system of claim ~~15,~~14, wherein the firmware, when executed by the infrastructure wireless network ~~comprises~~is a ~~WLAN.25. The system of claim 15, wherein the firmware, when executed by the infrastructure wireless network is a~~ pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

25. The system of claim 14, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and ~~when~~(2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network~~ is in range of both the earphone and the data source~~.

26. The system of claim 25, wherein the ~~firmware, when executed by the transceiver circuit, causes the transceiver circuit of~~host server is for streaming digital audio to the earphone ~~to transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc~~via the infrastructure wireless network.

27. The system of claim ~~26,~~25, wherein the ~~firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication~~host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the~~ pre-set~~ infrastructure wireless network~~.~~

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28. The system of claim 27, wherein the ~~host server is for streaming digital audio to~~earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

29. The ~~system of claim 27, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network~~

~~30. The system of claim 29, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.31. The earphone of claim 30,~~earphone of claim 28, wherein the user control comprises a button.

~~32. A system comprising:~~

~~a host server;~~

~~a first streaming digital audio content server that is connected to the host server via a data network; and~~

~~a wireless earphone that is in communication with the host server via a wireless network, wherein the host server is programmed to transmit to the earphone a first network address for the first streaming digital audio content server.~~

~~33. The system of claim 32, wherein the wireless earphone comprises:~~

~~at least one acoustic transducer for converting an analog electrical signal to sound;~~

~~an antenna; and~~

~~a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware that is executed by the transceiver circuit.~~

~~34. The system of claim 33, wherein the host server hosts a web page for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone.~~

~~35. The system of claim 34, wherein the one or more settings comprise the first streaming digital audio content server and a second streaming digital audio content server.~~

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~~36. The system of claim 35, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the wireless network to the host server for a second network address for the second streaming digital audio content server.~~

~~37. A headset comprising:~~

~~a first earphone that comprises one or more acoustic transducers for converting a first analog electrical signal to sound; and~~

~~a second earphone, connected to the first earphone, wherein the second earphone comprises one or more acoustic transducers for converting a second analog electrical signal to sound, and~~

~~wherein the first earphone comprises:~~

~~a first antenna; and~~

~~a first transceiver circuit in communication with the one or more acoustic transducers of the first earphone and in communication with the first antenna, wherein the first transceiver circuit is for receiving and transmitting wireless signals via the first antenna, and wherein the first transceiver circuit is for outputting the first analog electrical signal to the one or more acoustic transducers of the first earphone, and wherein the first transceiver circuit comprises firmware, which when executed by the first transceiver circuit, causes the first transceiver circuit to:~~

~~receive digital audio wirelessly from a data source via an ad hoc wireless network when the data source is in wireless communication range with the first earphone via the ad hoc wireless network; and~~

~~when the data source is not in wireless communication range with the first earphone via the ad hoc wireless network, transition automatically to receive digital audio via an infrastructure wireless network.~~

~~38. The headset of claim 37, further comprising a head band, wherein the first and second earphones are connected to the headband.~~

~~39. The headset of claim 37, further comprising a microphone having an output connected to the first transceiver circuit.~~

~~40. The headset of claim 37, wherein the first transceiver circuit is for outputting the second analog electrical signal to the one or more acoustic transducers of the second earphone.~~

~~41. The headset of claim 37, wherein the second earphone comprises:~~

~~a second antenna; and~~

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~~a second transceiver circuit in communication with the one or more acoustic transducers of the second earphone and in communication with the second antenna, wherein the second transceiver circuit is for receiving and transmitting wireless signals via the second antenna, and wherein the second transceiver circuit is for outputting the second analog electrical signal to the one or more acoustic transducers of the second earphone, and wherein the second transceiver circuit comprises firmware, which when executed by the second transceiver circuit, causes the second transceiver circuit to:~~

~~receive digital audio wirelessly from the data source via the ad hoc wireless network when the data source is in wireless communication range with the second earphone via the ad hoc wireless network; and~~

~~when the data source is not in wireless communication range with the second earphone via the ad hoc wireless network, transition automatically to receive digital audio via the infrastructure wireless network.~~

~~42. The headset of claim 37, wherein the first earphone comprises a first data port and the second earphone comprises a second data port, and wherein the headset further comprises an adapter connected to the first data port of the first earphone and to the second data port of the second earphone, and wherein the adapter comprises an output plug connector for connecting to a remote device.~~

~~43.~~30. A method comprising:

receiving, by a wireless earphone, via an ad hoc wireless network, digital audio from a data source when the data source is in wireless communication with the earphone via the ad hoc wireless network;

transmitting data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks;

converting, by the wireless earphone, the digital audio to sound; and

when the data source is not in wireless communication with the earphone, transitioning automatically, by the earphone, to receive digital audio via an infrastructure wireless network.

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~~44.~~31. The method of claim ~~43,~~30, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from the data source via an infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

~~45. The method of claim 43, further comprising, receiving by the wireless earphone from the data source via the ad hoc wireless network data regarding one or more infrastructure wireless networks detected by data source when the earphone and the data source are communicating via the ad hoc wireless network.~~

~~46.~~32. The method of claim ~~43,~~30, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from a host sever via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network

~~47.~~33. The method of claim ~~43,~~30, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises:

receiving, by the wireless earphone via the infrastructure wireless network, from a host server connected to the infrastructure wireless network, a network address for a streaming digital audio content server; and

connecting, by the wireless earphone, to the streaming digital audio content server using the network address received from the host server.

Electronic Acknowledgement Receipt	
EFS ID:	9444540
Application Number:	12936488
International Application Number:	
Confirmation Number:	3553
Title of Invention:	WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS
First Named Inventor/Applicant Name:	Michael J. Pelland
Customer Number:	26285
Filer:	Mark G. Knedeisen/Theresa Ulinski
Filer Authorized By:	Mark G. Knedeisen
Attorney Docket Number:	080188PCTUS
Receipt Date:	15-FEB-2011
Filing Date:	20-DEC-2010
Time Stamp:	10:30:29
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Request_for_Participaition_in_the_PCT-PPH_Pilot_Program_filed_02-15-2011.pdf	6305443 [illegible]	yes	21

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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26285 e 02/22/2011

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Paper No.

Application No.:	**12/936,488** *12936488*	**Date Mailed:**	**02/22/2011**
First Named Inventor:	Pelland, Michael, J.	Examiner:	
Attorney Docket No.:	080188PCTUS	Art Unit:	2614
Confirmation No.:	3553	Filing Date:	12/20/2010

Please find attached an Office communication concerning this application or proceeding.

Commissioner for Patents

PTO-90c (Rev.08-06)

# Notice of Non-Compliant Amendment (37 CFR 1.121)	Application No. 12/936,488	Applicant(s) PELLAND ET AL.	
		Art Unit 3998	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

The amendment document filed on *10/05/10* is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121 or 1.4. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

☐ 1. Amendments to the specification:
- ☐ A. Amended paragraph(s) do not include markings.
- ☐ B. New paragraph(s) should not be underlined.
- ☐ C. Other ____.

☐ 2. Abstract:
- ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
- ☐ B. Other ____.

☐ 3. Amendments to the drawings:
- ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
- ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
- ☐ C. Other ____.

☒ 4. Amendments to the claims:
- ☐ A. A complete listing of all of the claims is not present.
- ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
- ☒ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
- ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
- ☐ E. Other: ____.

☐ 5. Other (e.g., the amendment is unsigned or not signed in accordance with 37 CFR 1.4): For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714.

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment or an amendment filed after allowance, or a drawing submission (only) If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted.

2. Applicant is given **one month**, or thirty (30) days, whichever is longer, from the mail date of this notice to supply the correction, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a Quayle action. If any of above boxes 1 to 4 are checked, the correction required is only the corrected section of the non-compliant amendment in compliance with 37 CFR 1.121.

Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.
Failure to timely respond to this notice will result in:
Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or
Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

Legal Instruments Examiner (LIE), if applicable /ROSALIND BALL/ Telephone No: (571)272-3566

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Pelland et el.	)	**Examiner:** TBD
Serial No.:	12/936,488	)	**Art Unit:** 2614
Filing Date:	Dec. 20, 2010	)	**Atty. Docket No.** 080188PCTUS

Title: WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

RESPONSE TO NOTICE OF NON-COMPLIANT AMENDMENT

K&L Gates LLP
Pittsburgh, PA 15222
March 14, 2011

VIA ELECTRONIC FILING

Mail Stop Amendment
Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Notice of Non-Compliant Amendment (hereinafter "the Notice") mailed February 22, 2011 in connection with the above-referenced application, applicants respond as follows, wherein

A Listing of the Claims begins on page 2; and

Remarks begin on page 9.

Listing of the Claims

The following is a listing of the claims.

1-47. (Canceled)

48. (New) An earphone comprising:

a body, wherein the body comprises:

at least one acoustic transducer for converting an analog electrical signal to sound;

an antenna; and

a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:

receive digital audio wirelessly from a data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network;

transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; and

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive digital audio via an infrastructure wireless network.

49. (New) The earphone of claim 48, wherein the data source comprises a digital audio player.

50. (New) The earphone of claim 48, wherein the transceiver circuit comprises:

a wireless communication module;
a processor unit in communication with the wireless communication module;
a non-volatile memory unit in communication with the processor unit; and
a volatile memory unit in communication with the processor unit.

51. (New) The earphone of claim 50, wherein the wireless communication module comprises a Wi-Fi communication module.

52. (New) The earphone of claim 48, wherein the infrastructure wireless network comprises a WLAN.

53. (New) The earphone of claim 48, wherein the transceiver circuit is for receiving digital audio from the data source via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

54. (New) The earphone of claim 53, wherein the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

55. (New) The earphone of claim 48, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

56. (New) The earphone of claim 48, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via

the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

57. (New) The earphone of claim 56, wherein the earphone is for receiving streaming digital audio from the host server via the infrastructure wireless network.

58. (New) The earphone of claim 56, wherein the earphone is for receiving a first network address for a first streaming digital audio content server from the host server via the infrastructure wireless network.

59. (New) The earphone of claim 58, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

60. (New) The earphone of claim 59, wherein the user control comprises a button.

61. (New) A system comprising:
a data source for wirelessly transmitting streaming digital audio; and
a wireless earphone that comprises:
at least one acoustic transducer for converting an analog electrical signal to sound;
an antenna; and
a transceiver circuit in communication with the at least one acoustic transducer and the antenna, wherein the transceiver circuit is for receiving and transmitting wireless signals via the antenna, and wherein the transceiver circuit is for outputting the analog electrical signal to the at least one acoustic transducer, and wherein the wireless transceiver circuit comprises firmware, which when executed by the transceiver circuit, causes the transceiver circuit to:
receive the streaming digital audio wirelessly from the data source via an ad hoc wireless network when the data source is in wireless communication range with the earphone via the ad hoc wireless network;

transmit data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks; and

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network, transition automatically to receive streaming digital audio via an infrastructure wireless network.

62. (New) The system of claim 61, wherein the data source comprises a digital audio player.

63. (New) The system of claim 61, further comprising a host server that is in communication with the wireless earphone via the infrastructure wireless network.

64. (New) The system of claim 63, wherein the firmware of the transceiver circuit of the wireless earphone, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to the host server via the infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

65. (New) The system of claim 63, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

66. (New) The system of claim 63, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network

67. (New) The system of claim 66, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure

wireless network to the host server for a second network address for a second streaming digital audio content server.

68. (New) The earphone of claim 67, wherein the user control comprises a button.

69. (New) The system of claim 64, further comprising a web page for the wireless earphone through which a user is capable of configuring one or more settings for the wireless earphone.

70. (New) The system of claim 61, wherein the infrastructure wireless network comprises a WLAN.

71. (New) The system of claim 61, wherein the firmware, when executed by the infrastructure wireless network is a pre-set infrastructure wireless network that the data source transitions to when the data source is not in wireless communication range with the earphone via the ad hoc wireless network and when the pre-set infrastructure wireless network is in range of both the earphone and the data source.

72. (New) The system of claim 61, wherein the firmware, when executed by the transceiver circuit, causes the transceiver circuit of the earphone to connect to a host server via a second infrastructure wireless network when (1) the data source is not in wireless communication range with the earphone via the ad hoc wireless network and (2) the data source and the earphone are not in wireless communication via the pre-set infrastructure wireless network.

73. (New) The system of claim 72, wherein the host server is for streaming digital audio to the earphone via the infrastructure wireless network.

74. (New) The system of claim 72, wherein the host server is for transmitting a first network address for a first streaming digital audio content server to the earphone via the infrastructure wireless network

75. (New) The system of claim 74, wherein the earphone comprises a user control that, when activated, causes the earphone to submit an electronic request via the infrastructure wireless network to the host server for a second network address for a second streaming digital audio content server.

76. (New) The earphone of claim 75, wherein the user control comprises a button.

77. (New) A method comprising:

receiving, by a wireless earphone, via an ad hoc wireless network, digital audio from a data source when the data source is in wireless communication with the earphone via the ad hoc wireless network;

transmitting data via the ad hoc wireless network to the data source regarding one or more infrastructure wireless networks detected by the transceiver circuit when the earphone and the data source are communicating via the ad hoc wireless network, wherein the data comprises identification data and signal strength data for the one or more infrastructure wireless networks;

converting, by the wireless earphone, the digital audio to sound; and

when the data source is not in wireless communication with the earphone, transitioning automatically, by the earphone, to receive digital audio via an infrastructure wireless network.

78. (New) The method of claim 77, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from the data source via an infrastructure wireless network when the data source is not in wireless communication range with the earphone via the ad hoc wireless network.

79. (New) The method of claim 77, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises transitioning automatically to receive digital audio from a host sever via the infrastructure wireless network

when the data source is not in wireless communication range with the earphone via the ad hoc wireless network

80. (New) The method of claim 77, wherein transitioning automatically by the earphone to receive digital audio via an infrastructure wireless network comprises:

receiving, by the wireless earphone via the infrastructure wireless network, from a host server connected to the infrastructure wireless network, a network address for a streaming digital audio content server; and

connecting, by the wireless earphone, to the streaming digital audio content server using the network address received from the host server.

REMARKS

The Notice indicates that the amendment filed October 5, 2010 is non-compliant under 37 CFR § 1.121 or § 1.4 because each claim has not been provided with a proper status identifier. In response, new claims 48-80 have been identified herein with the status identifier "New." The present claims have not been otherwise amended. Applicants submit that the present claim amendments satisfy 37 CFR § 1.121 and § 1.4.

Applicants filed a "Request for Participation in the Patent Cooperation Treaty – Patent Prosecution Highway (PCT-PPH) Pilot Program in a U.S. Application Where the USPTO was the ISA or IPEA" on February 15, 2011. Applicants respectfully request that the request be acted upon expeditiously.

A representative of the Office is invited to contact the undersigned with any questions regarding this application.

Respectfully submitted,

Date: March 14, 2011

Mark Knedeisen

Mark G. Knedeisen
Reg. No. 42,747

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Electronic Acknowledgement Receipt

EFS ID:	9652258
Application Number:	12936488
International Application Number:	
Confirmation Number:	3553
Title of Invention:	WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS
First Named Inventor/Applicant Name:	Michael J. Pelland
Customer Number:	26285
Filer:	Mark G. Knedeisen/Theresa Ulinski
Filer Authorized By:	Mark G. Knedeisen
Attorney Docket Number:	080188PCTUS
Receipt Date:	14-MAR-2011
Filing Date:	20-DEC-2010
Time Stamp:	16:39:26
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response_to_Notice_of_Non-Compliant_Amendment_filed_03-14-2011.pdf	2046562 [illegible]	yes	9

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Miscellaneous Incoming Letter	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	9

Warnings:

Information:

Total Files Size (in bytes):	2046562

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number	Filing Date	
12/936,488	12/20/2010	☐ To be Mailed

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT	03/14/2011	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 33	Minus	** 33	= 0	X $26 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $110 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/LAVINIA JOHNSON/

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number 12/936,488	Filing Date 12/20/2010	☐ To be Mailed

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY ☒ RATE ($)	FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT 03/14/2011	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 33	Minus	** 33	= 0	X $26 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $110 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/LAVINIA JOHNSON/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/936,488	12/20/2010	Michael J. Pelland	080188PCTUS	3553

26285 7590 04/07/2011

K&L GATES LLP
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

EXAMINER	

ART UNIT	PAPER NUMBER
2614	

MAIL DATE	DELIVERY MODE
04/07/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

K&L GATES LLP
210 SIXTH AVENUE
PITTSBURGH PA 15222-2613

In re Application of	:	
PELLAND, MICHAEL J. et al.	:	DECISION ON REQUEST TO
Application No. 12/936,488	:	PARTICIPATE IN PATENT
Filed: December 20, 2010	:	PROSECUTION HIGHWAY
Attorney Docket No. **3553**	:	PROGRAM AND PETITION
	:	TO MAKE SPECIAL UNDER
	:	37 CFR 1.102(a)

This is a decision on the renewed request to participate in the PCT Patent Prosecution Highway (PPH) pilot program and the petition under 37 CFR 1.102(a), filed February 15, 2011 to make the above-identified application special.

The request and petition are **GRANTED**.

A grantable request to participate in the PCT-PPH pilot program and petition to make special require:

(1) The U.S. application be (a) a national stage entry of the corresponding PCT application, or (b) a national stage entry of another PCT application which claims priority to the corresponding PCT application, or (c) a national stage application that claims domestic/foreign priority to the corresponding PCT application, (d) a national application which forms the basis for the priority claim in the corresponding PCT application, or (e) a continuation application of the U.S. application which satisfies one of the above (a) to (d) scenarios.
(2) A copy of the latest international work product (WO/ISA, WO/IPEA, or IPER) in the corresponding PCT application(s) which indicates at least one claim in the PCT application has novelty, inventive step, and industrial applicability.
(3) A copy of all claims which were indicated as having novelty, inventive step and industrial applicability in the corresponding PCT application(s).
(4) English translations of the documents in (2) and (3) (if the documents are not in the English language).
(5) All the claims in the U.S. application must sufficiently correspond or be amended to sufficiently correspond to the claims which were indicated as having novelty, inventive step, and industrial applicability in the corresponding PCT application(s).
(6) Examination of the U.S. application has not begun; and
(7) An information disclosure statement listing the documents cited in the international work products (ISR, WO/ISA, WO/IPEA, IPER) of the corresponding PCT application(s).

The request to participate in the PCT-PPH pilot program and petition comply with the above requirements. Accordingly, the above-identified application has been accorded "special" status.

Telephone inquiries concerning this decision should be directed to Daniel Swerdlow at 571-272-7531.

All other inquiries concerning the examination or status of the application should be directed to Patent Application Information Retrieval (PAIR) system.

The application is undergoing pre-examination processing. Once it is released for examination, the application will be forwarded to the examiner for action on the merits commensurate with this decision.

/ Daniel Swerdlow /

Daniel Swerdlow
Quality Assurance Specialist
Technology Center 2600
Communications

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/936,488	12/20/2010	Michael J. Pelland	080188PCTUS

CONFIRMATION NO. 3553

PUBLICATION NOTICE

26285
K&L GATES LLP
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

OC000000047513894

Title:WIRELESS EARPHONE THAT TRANSITIONS BETWEEN WIRELESS NETWORKS

Publication No.US-2011-0103609-A1
Publication Date:05/05/2011

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/936,488
Filing Date	December 20, 2010
First Named Inventor	Michael J. Pelland
Art Unit	2617
Examiner Name	Doan, Kiet M.
Attorney Docket Number	080188PCTUS

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number: Number - Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2007/0049198 A1	03-01-2007	Walsh et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document: Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
		WO 2007/139578 A1	12-06-2007	Sony Ericsson Mobile Communications AB		

Examiner Signature		Date Considered	

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PTO/SB/08b (07-09)
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Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	12/936,488
	Filing Date	December 20, 2010
	First Named Inventor	Michael J. Pelland
	Art Unit	2617
(use as many sheets as necessary)	Examiner Name	Doan, Kiet M.
Sheet 2 of 2	Attorney Docket Number	080188PCTUS

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]
		Supplementary European Search Report for European Application No. 09731146.8 mailed June 10, 2011, 7 pages.	

Examiner Signature		Date Considered	

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If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 December 2007 (06.12.2007)

PCT

(10) International Publication Number
WO 2007/139578 A1

(51) International Patent Classification:
H04L 29/12 (2006.01)

(21) International Application Number:
PCT/US2006/044877

(22) International Filing Date:
20 November 2006 (20.11.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/421,195 31 May 2006 (31.05.2006) US

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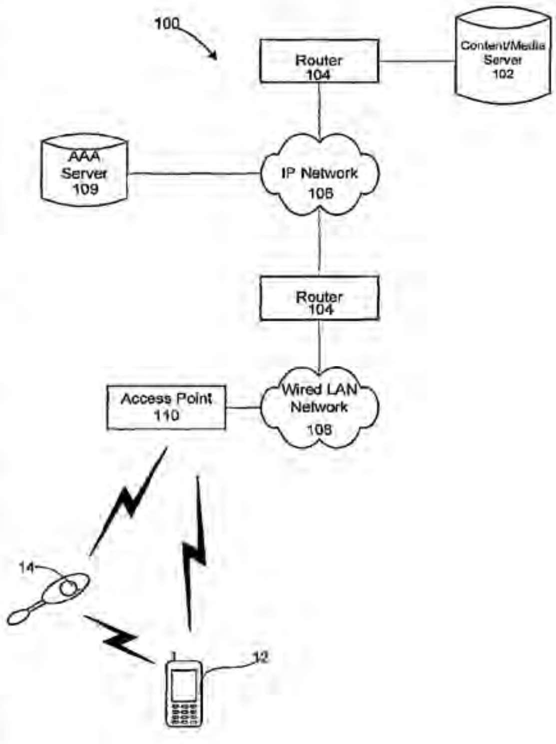
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,

[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR MOBILE TELEPHONE AS AUDIO GATEWAY



(57) Abstract: Disclosed is a system and method for using a mobile telephone (10) as an audio gateway. In one embodiment, a mobile telephone (12) requests: access to a wireless network (100), wherein the wireless network (100) includes at least one remote server (102) that contains multimedia content. The mobile telephone (12) assigns a subnet internet protocol (IP) address to a rendering device (14). After authenticating the user, the user selects at least one service and/or device associated with the wireless network (100). The streaming audio is then routed to the rendering device (14) based on the assigned subnet IP address.

WO 2007/139578 A1

ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

TITLE: SYSTEM AND METHOD FOR MOBILE TELEPHONE AS AUDIO GATEWAY

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a system and method for rendering multimedia content between a multimedia storage source and a mobile telephone and/or a rendering device (e.g., a headset).

DESCRIPTION OF THE RELATED ART

Mobile telephones have evolved from voice-only electronic devices to multi-functional electronic devices. For example, mobile telephones may now function as electronic organizers, digital cameras, audio applications (e.g., MP3 players), video applications (e.g., video players), video game terminals, etc. Moreover, mobile telephones are not only used for voice communications, but they also are used in a variety of other forms (e.g., in instant messaging applications, sharing photographs, gaining access to information on the Internet, etc).

As the mobile telephone has evolved, so too have accessories for mobile telephones. For example, the first mobile telephones required the user to hold the telephone next to the user's mouth and ear during use. Later, a wired ear bud and microphone were developed that connected to the mobile telephone were developed. The wired ear bud allows the user's hands to be free from holding the mobile telephone during use. Wireless headsets have also been developed that provide the user with both wireless and hands-free convenience.

A wireless interface commonly used in headsets and mobile telephones is referred to as "Bluetooth" technology. Bluetooth refers to a technical specification designed to standardize wireless transmission between a wide variety of electronic devices, such as personal computers, mobile telephones, headsets, printers, personal digital assistants ("PDAs"), etc. Bluetooth acts as a "virtual cable", whereby one electronic device can easily communicate with another electronic device.

Bluetooth operates using frequency-hopping spread spectrum, where data packets are spread across the 2.45-GHz Spectrum at a rate of 1,600 hops per second to lessen interference. For Bluetooth devices, the nominal link range is 10 meters and the gross data rate is up to 3 Mbps, although higher data rates have been proposed for future versions of the standard. Bluetooth can support both synchronous connection oriented ("SCO") links for voice and asynchronous connectionless ("ACL") links for packet data.

Wireless local area networks ("WLANs") are now ubiquitous in everyday life. Such WLAN's are commonly available in many public areas (so-called "hotspots" or "hotzones"), as well as in homes and office environments. WLANs are generally compliant with one or more IEEE standards (e.g., 802.11a, 802.11b, 802.11g, etc.) and are easily configured to provide for open access or to limit access by authorization and link-level security procedures.

End users generally access the WLAN through WLAN adapters that may be implemented as a removable or fully embedded component in a stationary, portable or fully mobile device. Examples of such implementations in a desktop computer include ISA or PCI cards, as well as an external or removable USB adapter. Typical implementations for laptop computers include removable PCMCIA cards or embedded PCI Express or USB adapters, while typical implementations for PDAs and mobile telephones include removable SD Cards or embedded with USB or SDIO interconnections. In addition, the physical WLAN adapter is typically augmented with software (a "driver") that allows the device's operating system to manage the adapter and to create a transparent connection to the wireless network that can be used by various applications to the benefit of the end user.

Conventional methods for facilitating communication between mobile telephones and mobile telephone accessories (e.g., headsets, hands-free kits, etc.) are generally capable of receiving signals received directly from the mobile telephone. In the case of wireless communication between the mobile telephone and the mobile telephone accessory, a Bluetooth compatible protocol is often times utilized. With the Bluetooth implementation, media may be received by the mobile telephone is generally provided in an IETF protocol (e.g. SIP, SDP, RTP, TCP, UDP, etc.). Once received by the mobile telephone, the streaming media is converted into a Bluetooth-specific protocol (e.g., advanced audio distribution profile A2DP) and then transmitted to the rendering device (e.g., a headset). Converting the streaming media to a Bluetooth-specific protocol limits the functionality of the mobile telephone in a variety of ways, for example, limits the functionality of the rendering device, limits the ability of the user to use the mobile telephone for multiple tasks, limits the battery life of the mobile telephone, etc.

SUMMARY

Often times, it is desirable for users of mobile telephones to utilize the full functionality of their mobile telephone accessories, as well as gain access to multimedia content. Thus, a strong need exists for a system and method for establishing a data path utilizing IETF-compliant protocols between endpoints (e.g., streaming source and rendering device) of a wireless network.

One aspect of the invention relates to a method for rendering multimedia content, the method comprising: requesting access to a wireless network by a mobile telephone, wherein the wireless network includes at least one remote server; assigning a subnet internet protocol (IP) address to a rendering device by the mobile telephone; selecting at least one service and/or device by an associated user associated with the wireless network; and routing streaming audio related to the selected service and/or device to the rendering device based on the assigned subnet IP address.

According to an aspect of the invention, the mobile telephone is configured to provide one or more operations on a received signal from the network utilizing a Dynamic Host Configuration Protocol.

According to an aspect of the invention, the mobile telephone is configured to provide one or more operations on a received signal from the network utilizing network address translation.

According to an aspect of the invention, the request for access is transmitted by a wireless local area adapter associated with the mobile telephone.

According to an aspect of the invention, wherein the mobile telephone is associated with the rendering device prior to requesting access to the wireless network.

According to an aspect of the invention, the rendering device is a wireless headset.

According to an aspect of the invention, the mobile telephone is authenticated with the network prior to providing an identification of services and/or devices available on the wireless network.

According to an aspect of the invention, the server is a media server.

Another aspect of the invention relates to a method for rendering multimedia, the method comprising: obtaining a unique address for a mobile telephone in a wireless local area network, wherein the local area network includes at least one wireless access point and one or more servers; assigning a subnet internet protocol (IP) address to a rendering device associated with the mobile telephone; requesting information from at least one of the servers on the network through the mobile telephone; receiving information responsive to the request for information by the mobile telephone; and directing streaming audio related to the requested information to the rendering device based on the assigned IP address.

According to an aspect of the invention, the unique address is an Internet Protocol address associated with the wireless local area network.

According to an aspect of the invention, the received information includes an identification of services and/or devices available on the network.

According to an aspect of the invention, the identification of services and/or devices include multimedia content stored on a media server.

According to an aspect of the invention, the multimedia content includes at least one audible component.

According to an aspect of the invention, the multimedia content also includes a video component for display on the mobile telephone.

According to an aspect of the invention, the mobile telephone is communicatively coupled to the local area network through an 802.11-compatible communication protocol.

According to an aspect of the invention, the headset is communicatively coupled to the wireless local area network through an 802.11-compatible communication protocol.

According to an aspect of the invention, transmitting control signals directly from the mobile telephone to the rendering device through a second wireless communication protocol.

According to an aspect of the invention, the second wireless communication protocol is Bluetooth.

Another aspect of the invention relates to a method for rendering multimedia content, the method comprising: requesting access to a wireless network by a mobile telephone; establishing a session on the wireless network; assigning a subnet internet protocol (IP) address to a peripheral device by the mobile telephone; providing an identification of services and/or devices to the mobile telephone from an associated server communicatively coupled to the wireless network; selecting at least one service and/or device by an associated user; and routing streaming audio related to the selected service and/or device to the peripheral device based on the assigned subnet IP address.

According to an aspect of the invention, the session is controlled by the mobile telephone.

Another aspect of the invention relates to a computer program stored on a machine readable medium, the program being suitable for use in a mobile telephone to assign a subnet internet protocol (IP) address to a headset, wherein: when the program is loaded in memory in the mobile telephone and executed causes the mobile telephone to route streaming audio received through a wireless local area network to headset based on the assigned IP address.

Other systems, devices, methods, features, and advantages of the present invention will be or become apparent to one having ordinary skill in the art upon examination of the following drawings and detailed description. It is intended that all such additional systems, methods, features, and advantages be included within this description, be within the scope of the present invention, and be protected by the accompanying claims.

It should be emphasized that the term "comprise/comprising" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof."

The term "electronic equipment" includes portable radio communication equipment. The term "portable radio communication equipment", which herein after is referred to as a mobile radio terminal includes all equipment such as mobile telephones, pagers, communicators, i.e., electronic organizers, personal digital assistants (PDA's), portable communication apparatus, smart phones or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other embodiments of the invention are hereinafter discussed with reference to the drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present invention. Likewise, elements and features depicted in one drawing may be combined with elements and features depicted in additional drawings. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

Figure 1 is an exemplary block diagram of a mobile telephone and headset in accordance with aspects of the present invention.

Figure 2 is an exemplary schematic diagram of a mobile telephone and headset in accordance with aspects of the present invention.

Figure 3 is an exemplary block diagram of a network in accordance with aspects of the present invention.

Figure 4 is an exemplary schematic diagram of a server in accordance with aspects of the present invention.

Figures 5A and 5B are exemplary protocol stacks associated with a mobile telephone and a rendering device in accordance with aspects of the present invention.

Figure 6 is an exemplary flow chart in accordance with aspects of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

The present invention is directed to a system and method for rendering multimedia content between one or more devices associated with a wireless local area network or a wide area network and a mobile telephone and/or mobile telephone accessory. The mobile telephone acts as a gateway or proxy for routing multimedia content (e.g., audio files, video files, etc.) stored on a remote server.

The invention is described primarily in the context of a mobile telephone. However, it will be appreciated that the invention is not intended to relate solely to mobile telephones and can relate to any type of electronic equipment. Other types of electronic equipment that may benefit from aspects of the present invention include playback devices having at least audio playback capability or video playback capability in addition to audio playback capability. Exemplary playback devices include MP3 players, CD players and DVD players.

Referring to Figure 1, an electronic equipment assembly 10 is shown in accordance with the present invention. The illustrated electronic equipment assembly 10 includes electronic equipment 12 and a wirelessly coupled electronic equipment accessory 14. The electronic equipment 12 in the exemplary embodiment is a mobile telephone and will be referred to as the mobile telephone 12. The mobile telephone 12 is shown as having a "brick" or "block" design type housing 16, but it will be appreciated that other type housings, such as a clamshell housing or a slide-type housing, may be utilized without departing from the scope of the invention.