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Earpiece passive noise attenuating

Abstract

An earpiece with structure for positioning and retaining the earpiece and with structure for sealing against the entrance to the ear canal to provide passive noise attenuation. The positioning and retaining structure engages features of the lateral surface of the ear. The structure for sealing against the entrance to the ear canal includes a conical structure.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
588099	12/1896	Blount et al.	N/A	N/A
931768	12/1908	Kirpatrick	N/A	N/A
1564474	12/1924	Fensky	N/A	N/A
1614987	12/1926	Bernhard et al.	N/A	N/A
1668890	12/1927	Curran et al.	N/A	N/A
1688910	12/1927	Winship	N/A	N/A
1753817	12/1929	Aber	N/A	N/A
1893143	12/1932	Koch	N/A	N/A
1893474	12/1932	Lieber	N/A	N/A
1969559	12/1933	Kelly	N/A	N/A
2437490	12/1947	Watson et al.	N/A	N/A
2487038	12/1948	Baum	N/A	N/A
2492183	12/1948	Rosenblatt	N/A	N/A
2521414	12/1949	Schier	N/A	N/A
2535258	12/1949	Bland	N/A	N/A
2538339	12/1950	Thomas	N/A	N/A
2545731	12/1950	French	N/A	N/A
2595489	12/1951	Rutter et al.	N/A	N/A
2763334	12/1955	Starkey	N/A	N/A
2863005	12/1957	Knauert	N/A	N/A
2904640	12/1958	Dreher et al.	N/A	N/A
2908343	12/1958	Hummert	N/A	N/A
3053061	12/1961	French	N/A	N/A
3157245	12/1963	Bernstein	N/A	N/A
3258533	12/1965	Bredon	N/A	N/A
D221442	12/1970	Feingold	N/A	N/A
4010820	12/1976	Johnson	N/A	N/A

4055233	12/1976	Huntress	N/A	N/A
4091067	12/1977	Kramer et al.	N/A	N/A
4219018	12/1979	Draper	N/A	N/A
D266590	12/1981	Bennett	N/A	N/A
4353364	12/1981	Woods	N/A	N/A
4403120	12/1982	Yoshimi	N/A	N/A
D274814	12/1983	Tang	N/A	N/A
4540063	12/1984	Ochi et al.	N/A	N/A
4646872	12/1986	Kamon et al.	N/A	N/A
4720857	12/1987	Burris et al.	N/A	N/A
4736435	12/1987	Yokoyama et al.	N/A	N/A
4878560	12/1988	Scott	N/A	N/A
4896679	12/1989	St. Pierre	N/A	N/A
D316550	12/1990	Sogabe	N/A	N/A
D318670	12/1990	Taniguchi	N/A	N/A
5048090	12/1990	Geers	N/A	N/A
5055233	12/1990	Borland et al.	N/A	N/A
D326655	12/1991	Iribe	N/A	N/A
5142587	12/1991	Kobayashi	N/A	N/A
5222151	12/1992	Nagayoshi et al.	N/A	N/A
5298692	12/1993	Ikeda et al.	N/A	N/A
5548643	12/1995	Dalgleish et al.	N/A	N/A
5625171	12/1996	Marshall	N/A	N/A
5654530	12/1996	Sauer et al.	N/A	N/A
5659156	12/1996	Mauney et al.	N/A	N/A
5668354	12/1996	Falco	N/A	N/A
D388093	12/1996	Frengley	N/A	N/A
5712453	12/1997	Bungardt et al.	N/A	N/A
5727566	12/1997	Leight	N/A	N/A
5881161	12/1998	Liu	N/A	N/A
5953435	12/1998	Mullin et al.	N/A	N/A
5957136	12/1998	Magidson et al.	N/A	N/A
D430139	12/1999	Peters et al.	N/A	N/A
D430547	12/1999	Yoon	N/A	N/A
D430860	12/1999	Yoon	N/A	N/A
6122388	12/1999	Feldman	N/A	N/A
6129175	12/1999	Tutor et al.	N/A	N/A
6241041	12/2000	Leight	N/A	N/A
6449374	12/2001	Skulley et al.	N/A	N/A
D469755	12/2002	Hlas et al.	N/A	N/A
D470122	12/2002	Hlas et al.	N/A	N/A
D470123	12/2002	Hlas et al.	N/A	N/A
D470128	12/2002	Hlas et al.	N/A	N/A
D470129	12/2002	Hlas et al.	N/A	N/A
D471537	12/2002	Ham	N/A	N/A
D471890	12/2002	Clarkson	N/A	N/A
D473204	12/2002	Tanio	N/A	N/A
D478991	12/2002	Dyer et al.	N/A	N/A
6621905	12/2002	Chun	N/A	N/A
6688421	12/2003	Dyer et al.	N/A	N/A

6690807	12/2003	Meyer	N/A	N/A
6795718	12/2003	Bae	N/A	N/A
6810987	12/2003	Dekalb	N/A	N/A
6819762	12/2003	Jones et al.	N/A	N/A
6820717	12/2003	Fleming et al.	N/A	N/A
6829362	12/2003	Kadziela et al.	N/A	N/A
6868284	12/2004	Bae	N/A	N/A
6879697	12/2004	Tøpholm	N/A	N/A
D505132	12/2004	Linville et al.	N/A	N/A
6914997	12/2004	Macdonald et al.	N/A	N/A
6944307	12/2004	Berg	N/A	N/A
D510574	12/2004	Okada	N/A	N/A
6961440	12/2004	Schlaegel	N/A	N/A
D519109	12/2005	Perszyk et al.	N/A	N/A
7043038	12/2005	Bachler et al.	N/A	N/A
7050599	12/2005	Baskerville	N/A	N/A
7068803	12/2005	Kuhlmann et al.	N/A	N/A
D525962	12/2005	Elson	N/A	N/A
D538271	12/2006	Kim et al.	N/A	N/A
7194102	12/2006	Harvery	N/A	N/A
7233676	12/2006	Bayer	N/A	N/A
D554756	12/2006	Sjursen et al.	N/A	N/A
D558735	12/2007	Carr et al.	N/A	N/A
7340075	12/2007	Bayer	N/A	N/A
D566099	12/2007	Komiyama	N/A	N/A
D566691	12/2007	Andre et al.	N/A	N/A
D568302	12/2007	Oh	N/A	N/A
D569841	12/2007	Chung et al.	N/A	N/A
7394910	12/2007	Smith et al.	N/A	N/A
D575277	12/2007	Gaarde et al.	N/A	N/A
D575772	12/2007	Schultz et al.	N/A	N/A
7412068	12/2007	Bayer	N/A	N/A
D578507	12/2007	Ando	N/A	N/A
D578508	12/2007	Wang	N/A	N/A
D579006	12/2007	Kim et al.	N/A	N/A
D582389	12/2007	Bose et al.	N/A	N/A
D582397	12/2007	Christopher	N/A	N/A
D582398	12/2007	Nam et al.	N/A	N/A
D582889	12/2007	Bose et al.	N/A	N/A
D584284	12/2008	Carr et al.	N/A	N/A
D584294	12/2008	Nam et al.	N/A	N/A
D585881	12/2008	Nam et al.	N/A	N/A
D588099	12/2008	Yuyama	N/A	N/A
D589945	12/2008	Esses	N/A	N/A
7536008	12/2008	Howes et al.	N/A	N/A
D596164	12/2008	Henning	N/A	N/A
D601134	12/2008	Elabidi et al.	N/A	N/A
D602476	12/2008	Lee et al.	N/A	N/A
D605170	12/2008	Keinanen	N/A	N/A
D605628	12/2008	Ando	N/A	N/A

D607875	12/2009	Pedersen	N/A	N/A
D618219	12/2009	Burgett et al.	N/A	N/A
D618221	12/2009	Fahrendorff et al.	N/A	N/A
7756284	12/2009	Sjursen et al.	N/A	N/A
D620927	12/2009	Li	N/A	N/A
D621817	12/2009	Brickstad	N/A	N/A
D622265	12/2009	Rye	N/A	N/A
D622704	12/2009	Fahrendorff et al.	N/A	N/A
7778410	12/2009	Liu et al.	N/A	N/A
D628188	12/2009	Koch	N/A	N/A
7831058	12/2009	Chen	N/A	N/A
D628990	12/2009	Pedersen	N/A	N/A
7856111	12/2009	Balke et al.	N/A	N/A
D633481	12/2010	Chen	N/A	N/A
D634305	12/2010	Hoggarth	N/A	N/A
D634306	12/2010	Pedersen	N/A	N/A
7899200	12/2010	Karamuk et al.	N/A	N/A
7916888	12/2010	Sapiejewski et al.	N/A	N/A
7949127	12/2010	Pedersen et al.	N/A	N/A
D640670	12/2010	Rye	N/A	N/A
7965855	12/2010	Ham	N/A	N/A
D641008	12/2010	Lee et al.	N/A	N/A
D641747	12/2010	Gisborne	N/A	N/A
7986803	12/2010	Dekalb	N/A	N/A
D645458	12/2010	Silvestri et al.	N/A	N/A
8059845	12/2010	Bryant	N/A	N/A
8073180	12/2010	Bruckhoff	N/A	N/A
8111854	12/2011	Peng	N/A	N/A
8121325	12/2011	Atamaniuk et al.	N/A	N/A
8130942	12/2011	Howes et al.	N/A	N/A
8175315	12/2011	Tanaka et al.	N/A	N/A
8249287	12/2011	Silvestri et al.	N/A	N/A
8270648	12/2011	Murozaki	N/A	N/A
8331593	12/2011	Slemming et al.	N/A	N/A
8355522	12/2012	Annunziato et al.	N/A	N/A
8401218	12/2012	Son et al.	N/A	N/A
8548186	12/2012	Alwicker et al.	N/A	N/A
8553923	12/2012	Tiscareno et al.	N/A	N/A
8594351	12/2012	Harlow et al.	N/A	N/A
8625834	12/2013	Smith et al.	N/A	N/A
8630436	12/2013	Berg	N/A	N/A
8666102	12/2013	Bruckhoff et al.	N/A	N/A
8792663	12/2013	Cano et al.	N/A	N/A
8879769	12/2013	Smith et al.	N/A	N/A
9020181	12/2014	Matsuo et al.	N/A	N/A
9036852	12/2014	Silvestri et al.	N/A	N/A
9398364	12/2015	Monahan et al.	N/A	N/A
10334344	12/2018	Monahan et al.	N/A	N/A
11218792	12/2021	Monahan et al.	N/A	N/A
11234065	12/2021	Monahan et al.	N/A	N/A

11889254	12/2023	Monahan et al.	N/A	N/A
2001/0043707	12/2000	Leedom	N/A	N/A
2002/0096391	12/2001	Smith et al.	N/A	N/A
2002/0131585	12/2001	Jones et al.	N/A	N/A
2002/0172386	12/2001	Bayer	N/A	N/A
2003/0091210	12/2002	Baskerville	N/A	N/A
2003/0174853	12/2002	Howes et al.	N/A	N/A
2003/0231783	12/2002	Kah	N/A	N/A
2004/0045558	12/2003	Taylor et al.	N/A	N/A
2004/0096077	12/2003	Csensich et al.	N/A	N/A
2004/0163653	12/2003	Fleming	N/A	N/A
2005/0008180	12/2004	Smith et al.	N/A	N/A
2005/0244026	12/2004	Nielsen et al.	N/A	N/A
2006/0042640	12/2005	Haussmann	128/864	A61F 11/08
2006/0067556	12/2005	Bailey et al.	N/A	N/A
2006/0177080	12/2005	Smith	N/A	N/A
2006/0188122	12/2005	Smith	N/A	N/A
2006/0215864	12/2005	Espersen et al.	N/A	N/A
2007/0116309	12/2006	Smith	N/A	N/A
2007/0183615	12/2006	Wurfel	N/A	N/A
2007/0189570	12/2006	Matsuo et al.	N/A	N/A
2007/0254725	12/2006	Smith	N/A	N/A
2007/0280496	12/2006	Karamuk et al.	N/A	N/A
2007/0280497	12/2006	Isberg et al.	N/A	N/A
2008/0002835	12/2007	Sapiejewski et al.	N/A	N/A
2008/0013774	12/2007	Hosaka et al.	N/A	N/A
2008/0037817	12/2007	Ewert et al.	N/A	N/A
2008/0085030	12/2007	Smith	N/A	N/A
2008/0090622	12/2007	Kim et al.	N/A	N/A
2008/0144877	12/2007	Ham et al.	N/A	N/A
2008/0159577	12/2007	Smith	N/A	N/A
2008/0181441	12/2007	Smith	N/A	N/A
2008/0181444	12/2007	Bryant	N/A	N/A
2008/0247561	12/2007	Smith	N/A	N/A
2008/0253605	12/2007	Smith	N/A	N/A
2009/0041284	12/2008	Tanaka et al.	N/A	N/A
2009/0052702	12/2008	Murphy et al.	N/A	N/A
2009/0092269	12/2008	Nielsen et al.	N/A	N/A
2009/0095566	12/2008	Leong et al.	N/A	N/A
2009/0101433	12/2008	Stiehl et al.	N/A	N/A
2009/0123010	12/2008	Cano et al.	N/A	N/A
2009/0141921	12/2008	Perkins et al.	N/A	N/A
2009/0141923	12/2008	Smith	N/A	N/A
2009/0180654	12/2008	Nielsen et al.	N/A	N/A
2009/0202094	12/2008	Ammitzboll et al.	N/A	N/A
2009/0202097	12/2008	Tiscareno et al.	N/A	N/A
2009/0202098	12/2008	Chan et al.	N/A	N/A
2009/0214065	12/2008	Dahl	381/328	H04R 1/1083
2009/0226025	12/2008	Howes et al.	N/A	N/A

2009/0323993	12/2008	Slemming et al.	N/A	N/A
2010/0027824	12/2009	Atamaniuk et al.	N/A	N/A
2010/0098285	12/2009	Kusuda et al.	N/A	N/A
2010/0278364	12/2009	Berg	N/A	N/A
2011/0002498	12/2010	Wong et al.	N/A	N/A
2011/0123059	12/2010	Hu	N/A	N/A
2011/0176699	12/2010	Lin	N/A	N/A
2011/0176700	12/2010	Hashimoto	N/A	N/A
2011/0182454	12/2010	Larsen et al.	N/A	N/A
2011/0255729	12/2010	Tan et al.	N/A	N/A
2011/0261988	12/2010	Kromann et al.	N/A	N/A
2012/0063622	12/2011	Bruckhoff et al.	N/A	N/A
2012/0128192	12/2011	Burgett et al.	N/A	N/A
2012/0140967	12/2011	Aubert	N/A	N/A
2012/0217087	12/2011	Ambrose et al.	N/A	N/A
2012/0237068	12/2011	Fretz	381/330	H04R 25/656
2014/0241563	12/2013	Monahan et al.	N/A	N/A
2014/0270315	12/2013	Burgett et al.	N/A	N/A
2015/0117695	12/2014	Barrentine et al.	N/A	N/A
2015/0118961	12/2014	Petit et al.	N/A	N/A
2015/0121347	12/2014	Petit et al.	N/A	N/A
2015/0215693	12/2014	Sandanger	N/A	N/A
2019/0223747	12/2018	Chou	N/A	N/A
2022/0201378	12/2021	Monahan et al.	N/A	N/A

FOREIGN PATENT DOCUMENTS

Patent No.	**Application Date**	**Country**	**CPC**
2689100	12/2007	CA	N/A
2740006	12/2009	CA	N/A
1173810	12/1997	CN	N/A
2459840	12/2000	CN	N/A
101094760	12/2006	CN	N/A
101297593	12/2007	CN	N/A
102132587	12/2010	CN	N/A
102742296	12/2011	CN	N/A
101523928	12/2011	CN	N/A
101188873	12/2012	CN	N/A
351644	12/1921	DE	N/A
8328154	12/1983	DE	N/A
29718483	12/1998	DE	N/A
202011002165	12/2010	DE	N/A
368125	12/1989	EP	N/A
421681	12/1990	EP	N/A
786241	12/1996	EP	N/A
1355508	12/2002	EP	N/A
1377113	12/2003	EP	N/A
1448014	12/2003	EP	N/A
1594340	12/2004	EP	N/A
1429580	12/2005	EP	N/A

1874080	12/2007	EP	N/A
2071867	12/2016	EP	N/A
2437802	12/1979	FR	N/A
239478	12/1925	GB	N/A
365962	12/1931	GE	N/A
074473	12/1926	JP	N/A
S584754	12/1982	JP	N/A
S58-104077	12/1982	JP	N/A
S60-40187	12/1984	JP	N/A
63-079500	12/1987	JP	N/A
H-457991	12/1991	JP	N/A
H11-275693	12/1998	JP	N/A
2000-115876	12/1999	JP	N/A
2001-333484	12/2000	JP	N/A
2002-058086	12/2001	JP	N/A
2005-073144	12/2004	JP	N/A
2005-184579	12/2004	JP	N/A
2008-017473	12/2007	JP	N/A
2008-092356	12/2007	JP	N/A
4088841	12/2007	JP	N/A
2009-542056	12/2008	JP	N/A
3159710	12/2009	JP	N/A
2011-524703	12/2010	JP	N/A
WO 1993025053	12/1992	WO	N/A
WO 1996037052	12/1995	WO	N/A
WO 1999031935	12/1998	WO	N/A
WO 1999039544	12/1998	WO	N/A
WO 2001050813	12/2000	WO	N/A
WO 2001050993	12/2000	WO	N/A
WO 2003075608	12/2002	WO	N/A
WO 2004068896	12/2003	WO	N/A
WO 2006007541	12/2005	WO	N/A
WO 2006104981	12/2005	WO	N/A
WO 2007014950	12/2006	WO	N/A
WO 2007028659	12/2006	WO	N/A
WO 2008041396	12/2007	WO	N/A
WO 2008083148	12/2007	WO	N/A
WO 2008086286	12/2007	WO	N/A
WO 2009018825	12/2008	WO	N/A
WO 2009030229	12/2008	WO	N/A
WO 2009077145	12/2008	WO	N/A
WO 2009086555	12/2008	WO	N/A
WO 2009115618	12/2008	WO	N/A
WO 2009153221	12/2008	WO	N/A
WO 2010031775	12/2009	WO	N/A
WO 2010040350	12/2009	WO	N/A
WO 2010040351	12/2009	WO	N/A
WO 2010040370	12/2009	WO	N/A
WO 2010131426	12/2009	WO	N/A
WO 2011007448	12/2010	WO	N/A

WO 2012024226	12/2011	WO	N/A

OTHER PUBLICATIONS

[No. Author Listed], “Manual: Bose IE2 Audio Headphones,” Bose Corporation, 2010, 7 pages. cited by applicant

Abel et al., “An investigation of the attenuation provided by the Surefire EP3 Sonic Defender earplug, ” Defense R&D Canada, May 2008, 36 pages. cited by applicant

ABT Electronics [online], “ABT Electronics: Bose IE2 and MIE2 In Ear Headphone Review,” Aug. 25, 2010, retrieved on Apr. 29, 2024, retrieved from URL<https://www.youtube.com/watch?v=C9UHl_eS4Gc>, 28 pages [video submission]. cited by applicant

Bauer et al., “Stakeholders forum on hearing enhancement,” RESNA Conference, Reno Nevada, 2001. cited by applicant

Bose.com [online], “SoundSport® In-Ear Headphones—Apple Devices,” available on or before Aug. 15, 2020, retrieved on Jul. 3, 2024, retrieved from URL<https://www.bose.cn/zh_cn/products/headphones/earphones/soundsport-in-ear-headphones-appledevices.html#v=soundsport_ie_headphones_ii_apple_charcoal>, 11 pages (with Machine Translation). cited by applicant

Bose.com [online], “SoundSport® In-Ear Headphones—Samsung and Android™ Devices,” available on or before Sep. 8, 2020, retrieved on Jul. 3, 2024, retrieved from URL<https://www.bose.cn/zh_cn/products/headphones/earphones/soundsport-in-ear-headphones-samsungdevices.html#v=soundsport_ie_headphones_ii_samsung_charcoal>, 12 pages (with Machine Translation). cited by applicant

Chinese Office Action for Appln. No. 2012800375228, mailed Nov. 5, 2015. cited by applicant

Chinese Office Action in Chinese Appln. No. 2016105673488, mailed Aug. 30, 2019, 2 pages (English translation only). cited by applicant

Cnet.com [online], “Bose debuts new in-ear headphones,” Aug. 16, 2010, retrieved on Apr. 29, 2024, retrieved from URL<https://www.cnet.com/culture/bose-debuts-new-in-ear-headphones/>, 4 pages. cited by applicant

Cyberindian.net [online], “Bose IE2, MIE2 and MIE2i in-ear Headphones Launched; Featuring StayHear Tips,” Aug. 25, 2010, retrieved on Jan. 15, 2018, retrieved form URL<http://www.cyberindian.net/2010/08/25/bose-ie2-mie2-and-mie2i-in-e>, 2 pages. cited by applicant

EP Extended European Search Report in European Appln. No. 21154253.5, mailed Jun. 17, 2021, 10 pages. cited by applicant

EPO Communication in EP Appln. No. 12741458.9, mailed Jun. 24, 2019, 6 pages. cited by applicant

European Search Report, EP 17 16 8500, mailed Aug. 14, 2017, 8 pages. cited by applicant

Exhibit 1—Preliminary Identification of Exemplary Prior Art to U.S. Pat. No. 8,311,253, 6 pages. cited by applicant

Extended European Search Report in EP Appln. No. 18212433.9-1210, mailed Mar. 22, 2019, 7 pages. cited by applicant

Extended European Search Report in EP Appln. No. 18212436.2-1210, mailed Mar. 20, 2019, 7 pages. cited by applicant

Extended European Search Report in EP Appln. No. 18212439.6, mailed Mar. 20, 2019, 7 pages. cited by applicant

First Chinese Office Action for Chinese Patent Appln. No. 201410423949.2, mailed Mar. 2, 2017, 7 pages. cited by applicant

First Office Action CN Appln. No. 201710358826.9, mailed Oct. 24, 2018, 10 pages (with English Translation). cited by applicant

International Search Report and the Written Opinion of the International Searching Authority for

PCT/US2012/047975 mailed Mar. 18, 2013. cited by applicant
International Search Report and Written Opinion International Appln. No. PCT/US2011/048233, mailed on Oct. 27, 2011. cited by applicant
Jabra C100, C150 manual, www.jabra.com, available on or before Jul. 22, 2014. cited by applicant
Jabra ear gels, photographs taken by applicant to document product that was on sale, available on or before Jul. 22, 2014. cited by applicant
Japanese Office Action for Japanese Patent Appln. No. 2013-524913, mailed Dec. 2, 2013. cited by applicant
Japanese Office Action for Japanese Patent Appln. No. 2014-165091, mailed May 7, 2015. cited by applicant
Japanese Office Action for Japanese Patent Appln. No. 2014-522941, mailed Jan. 26, 2015. cited by applicant
Japanese Office Action for Japanese Patent Appln. No. 2015-154126, mailed Jul. 4, 2016. cited by applicant
Jawbone Prime manual, available on or before Jul. 22, 2014. cited by applicant
Notice of Reasons for Rejection JP Appln. No. 2017-074264, mailed Apr. 16, 2018, 9 pages (with English Translation). cited by applicant
Notification of Second Office Action CN Appln. No. 2014104239492, Aug. 29, 2017, 18 pages (English Translation). cited by applicant
Notification of Third Office Action CN Appln. No. 2014104239492, Jan. 24, 2018, 13 pages (English Translation). cited by applicant
Office Action in corresponding EP Appln. No. 17 168 500.1 mailed Jun. 8, 2018, 6 pages. cited by applicant
Office Action in corresponding EP Appln. No. 17 168 520.9 mailed Jun. 7, 2018, 6 pages. cited by applicant
Office Action in Japanese Appln. No. 2018-218137, mailed on Sep. 24, 2019, 8 pages (with Machine Translation). cited by applicant
Petition for Inter Partes Review, *Freebit AS*, Petitioner, v. *Bose Corporation*, Patent Owner, U.S. Pat. No. 9,036,853. cited by applicant
Petition for Inter Partes Review, *Freebit AS*, Petitioner, v. *Bose Corporation*, Patent Owner, U.S. Pat. No. 8,254,621. cited by applicant
Petition for Inter Partes Review, *Freebit AS*, Petitioner, v. *Bose Corporation*, U.S. Pat. No. 8,311,253. cited by applicant
Sempre-audio.at [online], “Bose IE2 Audio Headphone & Bose MIE2 Mobile Headset,” Aug. 22, 2019, retrieved on Jan. 15, 2018, retrieved from URL<https://plus.google.com/u/0/114694607938693346725?rel=author>, 6 pages. cited by applicant
Surefire EarPro EP3 Sonic Defenders manual, www.surefire.com/hearingprotection, available on or before Jul. 22, 2014. cited by applicant
Techgoodies [online], “Auriculares BOSE IE2 in-ear con tecnología TriPort™ y Stay Hear™, ” Feb. 28, 2011, retrieved on Apr. 29, 2024, retrieved from URL<https://www.youtube.com/watch?v=LaQG1GQoQtk>, 19 pages [video submission]. cited by applicant
EPO Communication in EP Appln. No. 21154253.5, mailed Feb. 14, 2025, 3 pages. cited by applicant

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of and claims priority to U.S. patent application Ser. No. 17/549,318, filed on Dec. 13, 2021, which is a continuation and claims priority to U.S. patent application Ser. No. 16/450,197, filed on Jun. 24, 2019 (now U.S. Pat. No. 11,234,065), which is a continuation and claims priority to U.S. patent application Ser. No. 16/265,685, filed on Feb. 1, 2019 (now U.S. Pat. No. 11,218,792), which is a continuation of and claims priority to U.S. patent application Ser. No. 15/137,632 filed Apr. 25, 2016 (now U.S. Pat. No. 10,334,344), which is a continuation of and claims priority to U.S. patent application Ser. No. 14/272,845, filed May 8, 2014 (now U.S. Pat. No. 9,398,364), which is a continuation of and claims priority to U.S. patent application Ser. No. 13/193,288 filed Jul. 28, 2011 (now U.S. Pat. No. 8,737,669), the entire contents of which are incorporated herein by reference.

BACKGROUND
(1) This specification describes a structure for providing passive noise attenuation by an in-ear earpiece and for positioning and retaining the earpiece in the ear.
SUMMARY
(2) In one aspect, an in-ear earpiece includes an acoustic driver; an acoustic passage to conduct sound waves radiated by the acoustic driver to an ear canal of a user; a positioning and retaining structure to engage features of the lateral surface of an ear of the user to position the earpiece and to hold the earpiece in place without any structure external to the earpiece; and a substantially conical structure configured so that the smaller end of the conical structure is smaller than the entrance to an ear canal of a user and so that the larger end of the conical structure is larger than the entrance to the ear canal of the user, formed of material that conforms to the entrance to the ear canal to seal the ear canal. The material may have a hardness of 30 Shore A or less. The material may have a modulus of 2 gf/mm or less. The material may be silicone rubber. The material may be a thermoplastic elastomer. The material may be a thermoplastic polyurethane. The positioning and retaining structure may include a first leg and a second leg attached to each other at an attachment end to form a tip and attached to a body of the earpiece at the other end. The positioning and retaining structure may provide at least three modes for preventing clockwise rotation of the earpiece past a rotational position. The modes may include an extremity of the tip contacting the base of the helix; the extremity of the tip becoming wedged under the anti-helix in the cymba concha region; and the inner leg contacting the base of the helix. The positioning and retaining structure may include an inner leg and an outer leg. The inner leg and the outer leg may be attached at an attachment end to the body and attached at a joined end to each other. With the earpiece in its intended position, the outer leg may be urged against the anti-helix at the rear of the concha, the body engages the ear canal; and at least one of the tip is under the anti-helix; or a portion of at least one of the body and the outer leg are under the anti-tragus. The positioning and retaining structure may include an inner leg and an outer leg attached at attachment end to each other and at a second end to an earpiece body. The inner leg and outer leg may be arranged to provide at least three modes for preventing clockwise rotation of the earpieces. The modes may include the tip contacts the base of the helix; the tip becomes wedged under the anti-helix; and the inner leg contacts the base of the helix. The inner leg and the outer leg may be further arranged so that with the earpiece in its intended position, the outer leg is urged against the anti-helix at the rear of the concha, the body engages the ear canal; and at least one of the tip is under the anti-helix; or a portion of at least one of the body and the outer leg are under the anti-tragus. The substantially conical structure may include an opening therethrough to conduct sound waves from the acoustic driver to the ear canal. The opening may be substantially elliptical in cross-section. The substantially conical structure

may taper substantially linearly from the large end to the small end. The substantially conical structure may have a substantially uniform thickness. The material of the positioning and retaining structure of the user may have a different hardness than the substantially conical structure. The material of the structure to conduct sound waves radiated by the acoustic driver to an ear canal of a user may have a different hardness than the material of the positioning and retaining structure of the user and than the material of the substantially conical structure.

(3) In another aspect, an eartip for an in-ear earpiece includes positioning and retaining structure to engage features of the lateral surface of an ear to position the earpiece and to hold the earpiece in place without any structure external to the earpiece and a substantially conical structure configured so that the smaller end of the conical structure is smaller than the entrance to an ear canal of a user and so that the larger end of the conical structure is larger than the entrance to the ear canal of the user, formed of material that conforms to the entrance to the ear canal to seal the ear canal. The positioning and retaining structure and the substantially conical structure may include the same material. The positioning and retaining structure and the substantially conical structure may be a unitary structure.

(4) Other features, objects, and advantages will become apparent from the following detailed description, when read in connection with the following drawing, in which:

Description

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

(1) FIG. **1**A is a view of the lateral surface of the human ear;

(2) FIGS. **1**B and **1**C are exemplary cross-sections of the human ear;

(3) FIG. **2** is an isometric view of an earpiece;

(4) FIG. **3** is a lateral view of an earpiece and a human ear;

(5) FIG. **4** shows cross-sections of two exemplary human ears;

(6) FIGS. **5**A-**5**D are views of an earpiece;

(7) FIG. **6** shows cross-sections of two exemplary human ears;

(8) FIGS. **7**A-**7**C are views of a portion of the earpiece of FIGS. **2** and **5**A-**5**D; and

(9) FIGS. **8**A and **8**B are cross-sections of the earpiece portions of FIGS. **7**A-**7**C.

DETAILED DESCRIPTION

(10) This specification describes an in-ear earpiece that is designed to fit in the right ear. An earpiece that is designed to fit in the left ear is a mirror image of the earpiece described below, and operates according to the same principles, and is not described herein.

(11) FIG. **1**A shows the lateral surface of a human right ear, with some features identified. There are many different ear sizes and geometries. Some ears have additional features that are not shown in FIG. **1**A. Some ears lack some of the features that are shown in FIG. **1**A. Some features may be more or less prominent than are shown in FIG. **1**A. FIGS. **1**B and **1**C show two exemplary cross-sections of the human ear, with some features identified. The ear canal is an irregularly shaped cylinder with a variable cross sectional area and a centerline that is not straight. Among the features identified is the entrance to the ear canal and the main portion of the ear canal. In this specification the entrance to the ear canal refers to the portion of the ear canal near the concha where the walls of the ear canal are substantially non parallel to the centerline of the ear canal. The precise structure of the human ear varies widely from individual to individual. For example, in the cross section of FIG. **1**B, there is a relatively sharp transition from ear canal walls that are non-parallel to a centerline **30**-**1**B of the ear canal to walls that are substantially parallel to a centerline of the ear canal, so the entrance **32**-**1**B to the ear canal in relatively short. In the cross-second of FIG. **1**C, there is a more gradual transition from walls that are non-parallel to a centerline of the ear canal to walls that are substantially parallel to a centerline **30**-**1**C of the ear canal, so the entrance **32**-**1**C to

the ear canal is relatively long.
(12) FIG. **2** shows an earpiece **10**. The earpiece **10** may include a stem **52** for positioning cabling and the like, an acoustic driver module **14**, and a tip **60** (more clearly identified in FIGS. **5**A-**5**D). Some earpieces may lack the stem **52** but may include electronics modules (not shown) for wireless communicating with external devices. Other earpieces may lack the stem and the acoustic driver module and may function as passive earplugs. The tip **60** includes a positioning and retaining structure **20**, which in this example includes an outer leg **22** and an inner leg **24**. The tip also includes a sealing structure **48**.
(13) In operation, the earpiece **10** is placed in the ear and is oriented and held in place by positioning and retaining structure **20** and other portions of the earpiece. The tip **60** includes a passageway to conduct sound waves radiated by an acoustic driver in the acoustic driver module **14** to the ear canal. Extending from the tip **60** is the positioning and retaining structure **20** that holds the earpiece in position, without significant contribution from the portions of the eartip that engage the ear canal and without any structure external to the eartip. The positioning and retaining structure **20** includes at least an outer leg **22** and an inner leg **24** that are joined to other portions of the eartip at one end and are joined to each other at the other end. The outer leg is curved to generally follow the curve of the anti-helix and/or the cymba concha at the rear of the concha. In general, the compliance/stiffness of the entire positioning and retaining structure is more important than the compliance/stiffness of the material from which the positioning and retaining structure is made or the compliance/stiffness of the any one component of the positioning and retaining structure. The outer leg **22** and inner leg **24** may lie in a plane.
(14) Referring now to FIG. **3**, the earpiece tip is placed in the ear and pushed gently inward and preferably rotated counter-clockwise as indicated by arrow **43**. Pushing the body into the ear causes the outer leg **22** to seat in position underneath the anti-helix, and causes the outlet section of the tip **48** (for convenience, not shown in this view) to enter the ear canal by a small amount, depending on the dimensions and geometry of the entrance to the ear canal.
(15) The body is then rotated clockwise as indicated by arrow **41** until a condition occurs so that the body cannot be further rotated. The conditions could include: the extremity **35** of the tip may contact the base of the helix; inner leg **24** may contact the base of the helix; or the extremity **35** may become wedged behind the anti-helix in the cymba concha region. Though the positioning and retaining structure provides all three conditions (hereinafter referred to as “modes)”, not all three conditions will happen for all users, but at least one of the modes will occur for most users. Which condition(s) occur(s) is dependent on the size and geometry of the user's ears.
(16) Rotating the earpiece clockwise also causes the extremity and outer leg to engage the cymba concha region and seat beneath the anti-helix. When the body and positioning and retaining structure **20** are in place, the positioning and retaining structure and/or body contact the ear of most people in at least two, and in many people more, of several ways: a length **40** of the outer leg **22** contacts the anti-helix at the rear of the concha; the extremity **35** of the positioning and retaining structure **20** is underneath the anti-helix; portions of the outer leg **22** or tip **60** (of previous figures) or both are underneath the anti-tragus; and the tip **60** contacts at the entrance to the ear canal under the tragus. The two or more points of contact hold the earpiece in position, providing greater stability. The distributing of the force, and the compliance of the portions of the body and the outer leg that contact the ear lessens pressure on the ear, providing a more comfortable fit.
(17) It is desirable to place the earpiece in the ear so that it is oriented properly, so that it is stable (that is, stays in the ear), so that it is comfortable, and, for some applications so that it provides significant passive attenuation of ambient noise. One way of providing stability and proper orientation is described above and is described more completely in U.S. patent application Ser. No. 12/860,531, incorporated herein by reference in its entirety.
(18) One apparatus for providing significant passive attenuation is a structure (for example a “Christmas tree” structure, as described in U.S. Pat. App. 2004/0163653, a “mushroom” structure,

as described by U.S. Pat. No. 5,957,136, or disk shaped flanges, such as described in U.S. Pat. No. 6,129,175, or similar structures) that fit in the main portion of the ear canal and seals to the ear canal itself by exerting radial pressure on the walls of the main portion of the ear canal, as indicated by arrows **70**, **72**, and **74** of FIG. **4**. The radial pressure may result from, or be supplemented by, inward clamping pressure. This apparatus may have some undesirable side effects, such as poor sealing, discomfort, or even pain, because the geometry and size of ear canals vary widely from individual to individual and because the apparatus may intrude farther into the ear canal than desired in some individuals. The main portion of the ear canal, particularly close to the middle ear, is very sensitive, so the farther the structure extends into the ear, the more uncomfortable it is likely to be. Another apparatus for providing significant passive attenuation is structure, apart from the earpiece itself, that provides inward clamping pressure that urges a conformable structure against the side of the head or the side of the ear. Examples include headbands of conventional headphones and yokes of stethoscopes, for example as described in U.S. Pat. No. 4,055,233. However, for in-the-ear earpieces, light weight and small size are desirable features, and headbands and yokes add weight and structure.

(19) The earpiece of FIG. **2** includes a tip that provides orientation, stability, and good sealing to the entrance to the ear canal and to ear structure outside the ear canal, without excessive radial pressure, and without inward clamping pressure provided by a source not included in the earpiece.

(20) FIGS. **5**A-**5**D shows several views of the tip **60**. Not all elements of the tip **60** are identified in all of the views. The tip **60** includes positioning and retaining structure **20**, a passageway **21**, and sealing structure **48**. The sealing structure **48** comprises a frusto-conical structure. The frusto-conical structure may have an elliptical or oval cross section (as viewed in FIG. **7**A below), with walls that taper (as viewed in FIGS. **7**B, **8**A and **8**B below) substantially linearly. In one implementation, the structure of the sealing structure and the material from which it is made cause the modulus, when measured in the direction of the arrow **34** of FIG. **5**B is in the range of 0.2 to 2 gf/mm. Examples of appropriate materials include silicones, TPUs (thermoplastic polyurethanes) and TPEs (thermoplastic elastomers).

(21) The smaller end **62** of the tip is dimensioned so that it fits inside the ear canal of most users by a small amount and so that the sealing structure **48** contacts the entrance to the ear canal but does not contact the inside of the ear canal. The larger end **64** of the tip is dimensioned so that it is larger than the entrance to the ear canal of most users.

(22) The positioning and retaining structure **20** and the sealing structure **48** may be a single piece, made of the same material, for example a very soft silicone rubber, with a hardness of 30 Shore A or less. The walls of the sealing structure **48** may be of a uniform thickness which may be very thin, for example, less than one mm at the thickest part of the wall and may taper to the base of the frusto-conical structure so that the walls deflect easily, thereby conforming easily to the contours of the ear and providing a good seal and good passive attenuation without exerting significant radial pressure on the ear canal. Since the different parts of the earpiece serve different functions, it may be desirable for different portions of the earpiece to be made of different materials, or materials with different hardnesses or moduli. For example, hardness (durometer) of the retaining structure **20** may be selected for comfort (for example 12 Shore A), the hardness of the tip **48** may be slightly higher (for example 20 Shore A) for better fit and seal, and the hardness of the part of the eartip that mechanically couples the eartip to the acoustic module **14** may be higher (for example 70 Shore A) for better retention and seal to the part of the eartip that mechanically couples the eartip to the acoustic module **14** and in some instances so that the passage through which sound waves travel has a more consistent shape and dimensions.

(23) An eartip according to FIGS. **5**A-**5**D seals to the entrance of the ear canal to provide passive attenuation and exerts little radial pressure against the main portion of the ear canal, or does not contact the main portion of the ear canal at all, as shown in FIG. **6**

(24) FIGS. **7**A-**7**C show external views and FIGS. **8**A and **8**B show cross-sectional views, of the tip

60, with dimensions from a typical embodiment. In the implementations of FIGS. **7**A-**7**C and **8**A and **8**B, the sealing structure **48** is elliptical, with a major axis of 7.69 mm and a minor axis of 5.83 mm at the smaller end, and a major axis of 16.1 mm and a minor axis of 14.2 mm at the larger end. A sealing structure with these dimensions fits into the ear canal of many users so that the smaller end protrudes into the ear canal by a small amount and does not contact the walls of the ear canal, so that the larger end does not fit in the ear canal, and so that the sealing structure **48** engages the entrance to the ear canal. Smaller or larger versions may be used for users with below- or above-averaged-sized ear, including children. Versions with similar overall size but different aspect ratios between major and minor axes may be provided for users with ear canal entrances that are more- or less-circular than average.

(25) Numerous uses of and departures from the specific apparatus and techniques disclosed herein may be made without departing from the inventive concepts. Consequently, the invention is to be construed as embracing each and every novel feature and novel combination of features disclosed herein and limited only by the spirit and scope of the appended claims.

Claims

1. An ear tip for an earpiece, comprising: a body configured to fit within the concha of a wearer's ear; an outlet extending towards the ear canal of the wearer's ear when the ear tip is placed in the wearer's ear; a sealing structure at an end of the outlet; and a retaining structure coupled to the body and having a first portion configured to engage the antihelix of the wearer's ear, and a second, different portion configured to engage the antitragus of the wearers ear; wherein, when the ear tip is placed in the wearer's ear, the retaining structure applies a pressure to the antihelix of the wearer's ear and the antitragus of the wearer's ear to orient the sealing structure so that the sealing structure is positioned at the entrance of the ear canal.

2. The ear tip of claim 1, wherein, when the ear tip is placed in the wearer's ear, the first portion of the retaining structure is positioned underneath at least part of the antihelix of the wearer's ear, or the second portion of the retaining structure is positioned underneath at least part of the antitragus of the wearer's ear.

3. The ear tip of claim 1, wherein clockwise rotation of the ear tip within the wearer's ear causes the retaining structure to engage at least one of the antihelix of the wearer's ear or the antitragus of the wearer's ear.

4. The ear tip of claim 1, wherein the first portion of the retaining structure is shaped to generally follow the antihelix of the wearer's ear, and wherein the second portion of the retaining structure is shaped to generally follow the antitragus of the wearer's ear.

5. The ear tip of claim 1, wherein, when the ear tip is placed in the wearer's ear, the sealing structure forms a substantial seal with the flesh of the entrance of the ear canal of the wearer's ear.

6. The ear tip of claim 1, wherein: the body comprises a generally planar surface that rests against at least a portion of the concha; the outlet extends from the body at a non-right angle relative to a generally planar surface of the body; and the sealing structure extends from the end of the outlet such that a central axis of the sealing structure is substantially the same non-right angle relative to the generally planar surface of the body of the outlet.

7. The ear tip of claim 1, wherein, when the ear tip is placed in the wearer's ear, the body prevents the outlet and the sealing structure from contacting the ear canal beyond the entrance.

8. The ear tip of claim 1, wherein the sealing structure seals the entrance to the ear canal by conforming to the entrance to the ear canal when pressed towards the ear canal.

9. The ear tip of claim 1, wherein: the sealing structure has a frusto-conical shape having a narrow end and a wide end; the sealing structure is joined to the outlet at the narrow end of the frusto-conical shape; and the wide end of the frusto-conical shape is larger than a typical ear canal is wide.

10. The ear tip of claim 9, wherein the sealing structure is shaped to taper substantially linearly from the wide end to the narrow end.
11. The ear tip of claim 1, wherein the sealing structure comprises a thin layer of material that at least partially surrounds the outlet.
12. The ear tip of claim 1, wherein: the body is coupled to an acoustic driver of the earpiece; and the outlet comprises an acoustic passage that (i) comprises an opening for receiving sound waves from the acoustic driver, and (ii) conducts the sound waves to the ear canal of the wearer's ear.
13. The ear tip of claim 1, wherein the retaining structure comprises a material having a lower hardness than a material of the outlet.
14. An earpiece, comprising: a body configured to fit within the concha of a wearer's ear; an outlet extending towards the ear canal of the wearer's ear when the earpiece is placed in the wearer's ear; a sealing structure extending from an end of the outlet; and a retaining structure coupled to the body and having a first portion configured to engage the antihelix of the wearer's ear, and a second, different portion configured to engage the antitragus of the wearers ear; wherein, when the earpiece is placed in the wearer's ear, the retaining structure applies a pressure to the antihelix of the wearer's ear and the antitragus of the wearer's ear to orient the sealing structure so that the sealing structure is positioned at the entrance of the ear canal.
15. The earpiece of claim 14, wherein, when the earpiece is placed in the wearer's ear, the first portion of the retaining structure is positioned underneath at least part of the antihelix of the wearer's ear, or the second portion of the retaining structure is positioned underneath at least part of the antitragus of the wearer's ear.
16. The earpiece of claim 14, wherein clockwise rotation of the earpiece within the wearer's ear causes the retaining structure to engage at least one of the antihelix of the wearer's ear or the antitragus of the wearer's ear.
17. The earpiece of claim 14, wherein the first portion of the retaining structure is shaped to generally follow the antihelix of the wearer's ear, and wherein the second portion of the retaining structure is shaped to generally follow the antitragus of the wearer's ear.
18. The earpiece of claim 17, wherein the sealing structure comprises a thin layer of material that at least partially surrounds the outlet.
19. The earpiece of claim 17, wherein the body prevents the outlet and sealing structure from contacting the ear canal beyond the entrance of the ear canal.
20. The earpiece of claim 14, wherein: the sealing structure has a frusto-conical shape having a narrow end and a wide end; the sealing structure is joined to the outlet at the narrow end of the frusto-conical shape; and the wide end of the frusto-conical shape is larger than a typical ear canal is wide.