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(54) **EYEWEAR WITH PRINTED CIRCUIT BOARD**

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(56) **References Cited**

U.S. PATENT DOCUMENTS

320,558 A 6/1885 Hull
669,949 A 3/1901 Underwood
(Continued)

FOREIGN PATENT DOCUMENTS

CA 2 487 391 12/2003
CN 88203065 11/1988
(Continued)

OTHER PUBLICATIONS

Notice of Allowance for U.S. Appl. No. 11/183,269, dated Dec. 10, 2010.

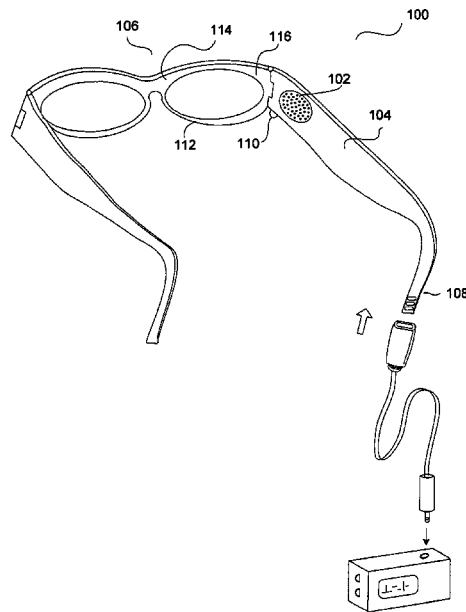
(Continued)

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(57) **ABSTRACT**

In one embodiment, an eyeglass frame includes a lens holder, a first temple with a first end close to the lens holder and a second end, a second temple, an electrical connector and a printed circuit board. The printed circuit board with at least one electrical component can be in the first temple. The connector can be close to the first end of the first temple, facing downward, and electrically connected to the at least one electrical component. In another embodiment, an eyeglass frame includes a first printed circuit board, with at least one electrical component. The first printed circuit board can be connected to an electrical component at the frame via a second printed circuit board.

42 Claims, 33 Drawing Sheets



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continuation of application No. 11/546,685, filed on Oct. 11, 2006, now Pat. No. 7,806,525, which is a continuation-in-part of application No. 11/183,256, filed on Jul. 15, 2005, now Pat. No. 7,500,747, which is a continuation-in-part of application No. 10/964,011, filed on Oct. 12, 2004, now Pat. No. 7,192,136.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

1,255,265 A 2/1918 Zachara
 1,917,745 A 7/1933 Weiss
 2,249,572 A 7/1941 Lieber
 2,638,532 A 5/1953 Brady
 2,794,085 A 5/1957 De Angelis
 2,818,511 A 12/1957 Ullery et al.
 2,830,132 A 4/1958 Borg
 2,874,230 A 2/1959 Carlson
 2,904,670 A 9/1959 Calmes
 3,060,308 A 10/1962 Fortuna
 3,597,054 A 8/1971 Winter
 3,710,115 A 1/1973 Jubb
 3,858,001 A 12/1974 Bonne
 3,883,701 A 5/1975 Delorenzo
 4,165,487 A 8/1979 Corderman
 4,254,451 A 3/1981 Cochran, Jr.
 4,283,127 A 8/1981 Rosenwinkel et al.
 4,322,585 A 3/1982 Liautaud
 4,348,664 A 9/1982 Boschetti et al.
 4,389,217 A 6/1983 Baughman et al.
 4,526,473 A 7/1985 Zahn, III
 4,535,244 A 8/1985 Burnham
 4,608,492 A 8/1986 Burnham
 4,683,587 A 7/1987 Silverman
 4,751,691 A 6/1988 Perera
 4,757,714 A 7/1988 Purdy et al.
 4,773,095 A 9/1988 Zwicker et al.
 4,806,011 A 2/1989 Bettinger
 4,822,160 A 4/1989 Tsai
 4,822,161 A 4/1989 Jimmy
 4,851,686 A 7/1989 Pearson
 4,856,086 A 8/1989 McCullough
 4,859,047 A 8/1989 Badewitz
 4,882,769 A 11/1989 Gallimore
 4,904,078 A 2/1990 Gorike
 4,942,629 A 7/1990 Stadlmann
 4,962,469 A 10/1990 Ono et al.
 4,967,268 A 10/1990 Lipton et al.
 4,985,632 A 1/1991 Bianco et al.

5,008,548 A 4/1991 Gat
 5,015,086 A 5/1991 Okaue et al.
 5,020,150 A 5/1991 Shannon
 5,026,151 A 6/1991 Waltuck et al.
 5,036,311 A 7/1991 Moran et al.
 5,050,150 A 9/1991 Ikeda
 5,064,410 A 11/1991 Frenkel et al.
 5,093,576 A 3/1992 Edmond et al.
 5,106,179 A 4/1992 Kamaya et al.
 5,148,023 A 9/1992 Hayashi et al.
 5,151,600 A 9/1992 Black
 5,161,250 A 11/1992 Ianna et al.
 5,172,256 A 12/1992 Sethofer et al.
 5,264,877 A 11/1993 Hussey
 5,306,917 A 4/1994 Black et al.
 5,353,378 A 10/1994 Hoffman et al.
 5,359,370 A 10/1994 Mugnier
 5,359,444 A 10/1994 Piosenka et al.
 5,367,345 A 11/1994 da Silva
 5,379,464 A 1/1995 Schleger et al.
 5,382,986 A 1/1995 Black et al.
 5,394,005 A 2/1995 Brown et al.
 5,452,026 A 9/1995 Marcy, III
 5,452,480 A 9/1995 Ryden
 5,455,637 A 10/1995 Kallman et al.
 5,455,640 A 10/1995 Gertsikov
 5,457,751 A 10/1995 Such
 5,463,428 A 10/1995 Lipton et al.
 5,500,532 A 3/1996 Kozicki
 D369,167 S 4/1996 Hanson et al.
 5,510,961 A 4/1996 Peng
 5,513,384 A 4/1996 Brennan et al.
 5,533,130 A 7/1996 Staton
 5,541,641 A 7/1996 Shimada
 5,581,090 A 12/1996 Goudjil
 5,585,871 A 12/1996 Linden
 5,589,398 A 12/1996 Krause et al.
 5,590,417 A 12/1996 Rydbeck
 5,606,743 A 2/1997 Vogt et al.
 5,608,808 A 3/1997 da Silva
 5,634,201 A 5/1997 Mooring
 5,671,035 A 9/1997 Barnes
 5,686,727 A 11/1997 Reenstra et al.
 5,694,475 A 12/1997 Boyden
 5,715,323 A 2/1998 Walker
 5,737,436 A 4/1998 Boyden et al.
 5,818,381 A 10/1998 Williams
 5,835,185 A * 11/1998 Kallman G02C 5/00
 351/113
 5,900,720 A 5/1999 Kallman et al.
 5,903,395 A 5/1999 Rallison et al.
 5,941,837 A 8/1999 Amano et al.
 5,946,071 A 8/1999 Feldman
 5,949,516 A 9/1999 McCurdy
 5,966,746 A 10/1999 Reedy et al.
 5,980,037 A 11/1999 Conway
 5,988,812 A 11/1999 Wingate
 5,991,085 A 11/1999 Rallison et al.
 5,992,996 A 11/1999 Sawyer
 5,995,592 A 11/1999 Shirai et al.
 6,010,216 A * 1/2000 Jesiek 351/158
 6,013,919 A 1/2000 Schneider et al.
 6,028,627 A 2/2000 Helmsderfer
 6,046,455 A 4/2000 Ribi et al.
 6,060,321 A 5/2000 Hovorka
 6,061,580 A 5/2000 Altschul et al.
 6,091,546 A 7/2000 Spitzer
 6,091,832 A 7/2000 Shurman et al.
 6,115,177 A 9/2000 Vossler
 6,132,681 A 10/2000 Faran et al.
 6,145,983 A 11/2000 Schiffer
 6,154,552 A 11/2000 Koroljow et al.
 6,176,576 B1 1/2001 Green et al.
 6,225,897 B1 5/2001 Doyle et al.
 6,231,181 B1 5/2001 Swab
 6,236,969 B1 5/2001 Ruppert et al.
 6,243,578 B1 6/2001 Koike
 6,259,367 B1 7/2001 Klein
 6,270,466 B1 8/2001 Weinstein et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

				7,922,321 B2	4/2011	Howell et al.	
				7,976,159 B2	7/2011	Jacobs et al.	
				8,109,629 B2	2/2012	Howell et al.	
				8,142,015 B2	3/2012	Paolino	
6,292,213 B1	9/2001	Jones		8,174,569 B2	5/2012	Tanijiri et al.	
6,292,685 B1	9/2001	Pompei		8,337,013 B2	12/2012	Howell et al.	
6,301,367 B1	10/2001	Boyden et al.		8,430,507 B2	4/2013	Howell et al.	
6,307,526 B1	10/2001	Mann		8,434,863 B2	5/2013	Howell et al.	
6,343,858 B1	2/2002	Zelman		8,465,151 B2	6/2013	Howell et al.	
6,349,001 B1	2/2002	Spitzer		8,485,661 B2	7/2013	Yoo et al.	
6,349,422 B1	2/2002	Schleger et al.		8,500,271 B2	8/2013	Howell et al.	
6,409,335 B1	6/2002	Lipawsky		8,770,742 B2	7/2014	Howell et al.	
6,409,338 B1	6/2002	Jewell		8,905,542 B2	12/2014	Howell et al.	
6,426,719 B1	7/2002	Nagareda et al.		9,033,493 B2	5/2015	Howell et al.	
6,431,705 B1	8/2002	Linden		9,244,292 B2	1/2016	Swab et al.	
6,474,816 B2	11/2002	Butler et al.		9,405,135 B2	8/2016	Sweis et al.	
6,478,736 B1	11/2002	Mault		9,488,520 B2	11/2016	Howell et al.	
6,506,142 B2	1/2003	Itoh et al.		9,547,184 B2	1/2017	Howell et al.	
6,511,175 B2	1/2003	Hay et al.		9,690,121 B2	6/2017	Howell et al.	
6,513,532 B2	2/2003	Mault et al.		10,042,186 B2	8/2018	Chao et al.	
6,517,203 B1	2/2003	Blum et al.		10,060,790 B2	8/2018	Howell et al.	
6,539,336 B1	3/2003	Vock et al.		10,061,144 B2	8/2018	Howell et al.	
6,542,081 B2	4/2003	Torch		2001/0005230 A1	6/2001	Ishikawa	
6,546,101 B1	4/2003	Murray et al.		2001/0028309 A1	10/2001	Torch	
6,554,763 B1	4/2003	Amano et al.		2001/0050754 A1	12/2001	Hay et al.	
6,582,075 B1	6/2003	Swab et al.		2002/0017997 A1	2/2002	Felkowitz	
6,619,799 B1	9/2003	Blum et al.		2002/0021407 A1	2/2002	Elliott	
6,629,076 B1	9/2003	Haken		2002/0081982 A1	6/2002	Schwartz et al.	
6,729,726 B2	5/2004	Miller et al.		2002/0084990 A1	7/2002	Peterson, III	
6,736,759 B1	5/2004	Stubbs et al.		2002/0089639 A1	7/2002	Starner et al.	
6,764,194 B1	7/2004	Cooper		2002/0090103 A1	7/2002	Calisto, Jr.	
6,769,767 B2	8/2004	Swab et al.		2002/0098877 A1	7/2002	Glezerman	
6,788,309 B1	9/2004	Swan et al.		2002/0101568 A1	8/2002	Eberl et al.	
6,792,401 B1	9/2004	Nigro et al.		2002/0109600 A1	8/2002	Mault et al.	
6,824,265 B1	11/2004	Harper		2002/0140899 A1	10/2002	Blum et al.	
6,871,951 B2	3/2005	Blum et al.		2002/0159023 A1*	10/2002	Swab	351/158
6,879,930 B2	4/2005	Sinclair et al.		2002/0197961 A1	12/2002	Warren	
6,912,386 B1	6/2005	Himberg et al.		2003/0018274 A1	1/2003	Takahashi et al.	
6,929,365 B2	8/2005	Swab et al.		2003/0022690 A1	1/2003	Beyda et al.	
6,932,090 B1	8/2005	Reschke et al.		2003/0032449 A1	2/2003	Giobbi	
6,947,219 B1	9/2005	Ou		2003/0062046 A1	4/2003	Wiesmann et al.	
7,004,582 B2	2/2006	Jannard et al.		2003/0065257 A1	4/2003	Mault et al.	
7,013,009 B2	3/2006	Warren		2003/0067585 A1	4/2003	Miller et al.	
7,030,902 B2	4/2006	Jacobs		2003/0068057 A1	4/2003	Miller et al.	
7,031,667 B2	4/2006	Horiguchi		2003/0083591 A1	5/2003	Edwards et al.	
7,033,025 B2	4/2006	Winterbotham		2003/0214630 A1	11/2003	Winterbotham	
7,059,717 B2	6/2006	Bloch		2003/0226978 A1	12/2003	Ribi et al.	
7,073,905 B2	7/2006	Da Pra'		2004/0000733 A1	1/2004	Swab et al.	
7,079,876 B2	7/2006	Levy		2004/0029582 A1	2/2004	Swab et al.	
7,123,215 B2	10/2006	Nakada		2004/0059212 A1*	3/2004	Abreu	A61B 5/01 600/373
7,192,136 B2	3/2007	Howell et al.					
7,255,437 B2	8/2007	Howell et al.		2004/0063378 A1	4/2004	Nelson	
7,265,358 B2	9/2007	Fontaine		2004/0096078 A1	5/2004	Lin	
7,274,292 B2	9/2007	Velhal et al.		2004/0100384 A1	5/2004	Chen et al.	
7,289,767 B2	10/2007	Lai		2004/0128737 A1	7/2004	Gesten	
7,312,699 B2	12/2007	Chornenky		2004/0150986 A1	8/2004	Chang	
7,331,666 B2	2/2008	Swab et al.		2004/0156012 A1	8/2004	Jannard et al.	
7,376,238 B1	5/2008	Rivas et al.		2004/0157649 A1	8/2004	Jannard et al.	
7,380,936 B2	6/2008	Howell et al.		2004/0160571 A1	8/2004	Jannard	
7,401,918 B2	7/2008	Howell et al.		2004/0160572 A1	8/2004	Jannard	
7,405,801 B2	7/2008	Jacobs		2004/0160573 A1	8/2004	Jannard et al.	
7,429,965 B2	9/2008	Weiner		2004/0197002 A1	10/2004	Atsumi et al.	
7,438,409 B2	10/2008	Jordan		2004/0227219 A1	11/2004	Su	
7,438,410 B1	10/2008	Howell et al.		2005/0067580 A1	3/2005	Fontaine	
7,445,332 B2	11/2008	Jannard et al.		2005/0078274 A1	4/2005	Howell et al.	
7,481,531 B2	1/2009	Howell et al.		2005/0088365 A1	4/2005	Yamazaki et al.	
7,500,746 B1	3/2009	Howell et al.		2005/0201585 A1	9/2005	Jannard et al.	
7,500,747 B2	3/2009	Howell et al.		2005/0213026 A1	9/2005	Da Pra'	
7,512,414 B2	3/2009	Jannard et al.		2005/0230596 A1	10/2005	Howell et al.	
7,527,374 B2	5/2009	Chou		2005/0238194 A1	10/2005	Chornenky	
7,543,934 B2	6/2009	Howell et al.		2005/0239502 A1	10/2005	Swab et al.	
7,581,833 B2	9/2009	Howell et al.		2005/0248717 A1	11/2005	Howell et al.	
7,621,634 B2	11/2009	Howell et al.		2005/0248718 A1	11/2005	Howell et al.	
7,648,236 B1	1/2010	Dobson		2005/0248719 A1	11/2005	Howell et al.	
7,677,723 B2	3/2010	Howell et al.		2005/0264752 A1	12/2005	Howell et al.	
7,760,898 B2	7/2010	Howell et al.		2006/0001827 A1	1/2006	Howell et al.	
7,771,046 B2	8/2010	Howell et al.		2006/0003803 A1	1/2006	Thomas et al.	
7,792,552 B2	9/2010	Thomas et al.		2006/0023158 A1	2/2006	Howell et al.	
7,806,525 B2	10/2010	Howell et al.		2006/0034478 A1	2/2006	Davenport	

(56)

References Cited

U.S. PATENT DOCUMENTS

2006/0107822 A1 5/2006 Bowen
 2006/0132382 A1 6/2006 Jannard
 2007/0030442 A1 2/2007 Howell et al.
 2007/0035830 A1 2/2007 Matveev et al.
 2007/0046887 A1 3/2007 Howell et al.
 2007/0055888 A1 3/2007 Miller et al.
 2007/0098192 A1 5/2007 Sipkema
 2007/0109491 A1 5/2007 Howell et al.
 2007/0186330 A1 8/2007 Howell et al.
 2007/0200927 A1 8/2007 Krenik
 2007/0208531 A1 9/2007 Darley et al.
 2007/0270663 A1 11/2007 Ng et al.
 2007/0271065 A1 11/2007 Gupta et al.
 2007/0271116 A1 11/2007 Wysocki et al.
 2007/0271387 A1 11/2007 Lydon et al.
 2007/0279584 A1 12/2007 Howell et al.
 2008/0062338 A1 3/2008 Herzog et al.
 2008/0068559 A1 3/2008 Howell et al.
 2008/0144854 A1 6/2008 Abreu
 2008/0151175 A1 6/2008 Gross
 2008/0151179 A1 6/2008 Howell et al.
 2008/0158506 A1 7/2008 Fuziak
 2008/0218684 A1 9/2008 Howell et al.
 2008/0262392 A1 10/2008 Ananny et al.
 2008/0278678 A1 11/2008 Howell et al.
 2009/0059159 A1 3/2009 Howell et al.
 2009/0073375 A1 3/2009 Nakada
 2009/0141233 A1 6/2009 Howell et al.
 2009/0147215 A1 6/2009 Howell et al.
 2009/0156128 A1 6/2009 Franson et al.
 2009/0251660 A1 10/2009 Figler et al.
 2009/0251661 A1 10/2009 Fuziak, Jr.
 2009/0296044 A1 12/2009 Howell et al.
 2010/0061579 A1 3/2010 Rickards et al.
 2010/0079356 A1 4/2010 Hoellwarth
 2010/0110368 A1 5/2010 Chaum
 2010/0245754 A1 9/2010 Matsumoto et al.
 2010/0296045 A1 11/2010 Agnoli et al.
 2010/0309426 A1 12/2010 Howell et al.
 2011/0102734 A1 5/2011 Howell et al.
 2011/0164122 A1 7/2011 Hardacker
 2011/0187990 A1 8/2011 Howell et al.
 2011/0241976 A1 10/2011 Boger et al.
 2011/0273365 A1 11/2011 West et al.
 2012/0033061 A1 2/2012 Ko et al.
 2012/0050668 A1 3/2012 Howell et al.
 2012/0133885 A1 5/2012 Howell et al.
 2013/0072828 A1 3/2013 Sweis et al.
 2013/0201440 A1 8/2013 Howell et al.
 2013/0308089 A1 11/2013 Howell et al.
 2014/0132913 A1 5/2014 Sweis et al.
 2014/0176902 A1 6/2014 Sweis et al.
 2014/0198293 A1 7/2014 Sweis et al.
 2014/0268008 A1 9/2014 Howell et al.
 2014/0268017 A1 9/2014 Sweis et al.
 2014/0361185 A1 12/2014 Howell et al.
 2015/0085245 A1 3/2015 Howell et al.
 2015/0230988 A1 8/2015 Chao et al.
 2015/0253590 A1 9/2015 Howell et al.
 2016/0246075 A9 8/2016 Howell et al.
 2016/0302992 A1 10/2016 Sweis et al.
 2017/0074721 A1 3/2017 Howell et al.
 2017/0090219 A1 3/2017 Howell et al.
 2017/0131575 A1 5/2017 Howell et al.
 2017/0146829 A1 5/2017 Howell et al.
 2018/0314079 A1 11/2018 Chao et al.
 2018/0335650 A1 11/2018 Howell et al.
 2018/0348050 A1 12/2018 Howell et al.

FOREIGN PATENT DOCUMENTS

CN 89214222.7 3/1990
 CN 90208199.3 11/1990
 DE 10123226 A1 11/2002
 EP 1134491 A2 9/2001

FR 2530039 A1 1/1984
 GB 1467982 3/1977
 JP 58-113912 7/1983
 JP 58-113914 7/1983
 JP 02-181722 7/1990
 JP 09-017204 1/1997
 JP 10-161072 6/1998
 JP 2000-039595 2/2000
 JP 2002 341059 A 11/2002
 JP 2005-151292 6/2005
 TW 484711 6/2001
 WO WO 97/12205 A1 4/1997
 WO WO 99/50706 A1 10/1999
 WO WO 01/06298 A1 1/2001
 WO WO 02/06881 A2 1/2002
 WO WO 03/069394 A1 8/2003
 WO 2003/100503 A2 12/2003
 WO WO 03/100368 A1 12/2003
 WO WO 2004/012477 A2 2/2004
 WO WO 2004/025554 A1 3/2004

OTHER PUBLICATIONS

Office Action for U.S. Appl. No. 11/183,269, dated May 25, 2010.
 Final Office Action for U.S. Appl. No. 11/183,269, dated Feb. 17, 2010.
 Office Action for U.S. Appl. No. 11/183,269, dated Jun. 23, 2009.
 Office Action for U.S. Appl. No. 11/183,269, dated Dec. 4, 2008.
 Final Office Action for U.S. Appl. No. 11/183,269, dated Jun. 5, 2008.
 Office Action for U.S. Appl. No. 11/183,269, dated Oct. 18, 2007.
 Restriction Requirement for U.S. Appl. No. 11/183,269, dated Jun. 25, 2007.
 Office Action for U.S. Appl. No. 13/085,402, dated Apr. 19, 2012.
 Notice of Allowance for U.S. Appl. No. 13/085,402, dated Aug. 2, 2012.
 Notice of Allowance for U.S. Appl. No. 13/085,402, dated Nov. 13, 2012.
 Notice of Allowance for U.S. Appl. No. 13/085,402, dated Feb. 20, 2013.
 Notice of Allowance for U.S. Appl. No. 11/580,222, dated Apr. 20, 2009.
 Office Action for U.S. Appl. No. 11/580,222, dated Jan. 28, 2009.
 Office Action for U.S. Appl. No. 11/580,222, dated Sep. 12, 2008.
 Restriction Requirement for U.S. Appl. No. 11/580,222, dated Jun. 18, 2008.
 Notice of Allowance for U.S. Appl. No. 12/462,286, dated Nov. 22, 2011.
 Notice of Allowance for U.S. Appl. No. 12/462,286, dated Jun. 24, 2011.
 Office Action for U.S. Appl. No. 12/462,286, dated Jan. 13, 2011.
 Restriction Requirement for U.S. Appl. No. 12/462,286, dated Sep. 17, 2010.
 U.S. Appl. No. 12/462,286, filed Jul. 31, 2009.
 U.S. Appl. No. 12/806,312, filed Aug. 10, 2010.
 Office Action for U.S. Appl. No. 12/806,312, dated Apr. 20, 2012.
 Office Action for U.S. Appl. No. 12/806,312, dated Sep. 25, 2012.
 Notice of Allowance for U.S. Appl. No. 12/806,312, dated Dec. 14, 2012.
 Notice of Allowance for U.S. Appl. No. 11/183,256, dated Jan. 13, 2009.
 Office Action for U.S. Appl. No. 11/183,256, dated Sep. 12, 2008.
 Notice of Allowance for U.S. Appl. No. 11/183,256, dated Jul. 8, 2008.
 Office Action for U.S. Appl. No. 11/183,256, dated Jan. 25, 2008.
 Restriction Requirement for U.S. Appl. No. 11/183,256, dated Oct. 17, 2007.
 Restriction Requirement for U.S. Appl. No. 11/183,256, dated Jun. 28, 2007.
 Notice of Allowance for U.S. Appl. No. 11/546,685, dated Feb. 17, 2010.
 Notice of Allowance for U.S. Appl. No. 11/546,685, dated Sep. 18, 2009.
 Office Action for U.S. Appl. No. 11/546,685, dated Mar. 5, 2009.

(56)

References Cited

OTHER PUBLICATIONS

- Restriction Requirement for U.S. Appl. No. 11/546,685, dated Jan. 27, 2009.
- U.S. Appl. No. 12/803,732, filed Jul. 1, 2010.
- Notice of Allowance for U.S. Appl. No. 12/803,732, dated Sep. 1, 2011.
- Notice of Allowance for U.S. Appl. No. 12/803,732, dated Nov. 15, 2011.
- Notice of Allowance for U.S. Appl. No. 12/803,732, dated Jan. 30, 2012.
- Notice of Allowance for U.S. Appl. No. 12/803,732, dated Apr. 17, 2012.
- Notice of Allowance for U.S. Appl. No. 12/803,732, dated Oct. 19, 2012.
- "±5g Dual Axis Micromachined Accelerometer", Freescale Semiconductor, Inc., Motorola Semiconductor Technical Data, MMA6260Q, Jun. 2004, pp. 1-7.
- "APA Announces Shipment of the SunUV™ Personal UV Monitor", Press Release, Nov. 7, 2003, pp. 1-3.
- "Camera Specs Take Candid Snaps", BBC News, Sep. 18, 2003, pp. 1-3.
- "Cardo Wireless Attaching Clips and Wearing Headset", Cardo Systems, Inc., <http://www.cardowireless.com/clips.php>, downloaded Nov. 27, 2004, pp. 1-3.
- "Environmental Health Criteria 14: Ultraviolet Radiation", International Programme on Chemical Safety, World Health Organization Geneva, 1979 <http://www.ichem.org>, pp. 1-102.
- "Exclusive Media Event Marks Debut of Oakley Thump: World's First Digital Audio Eyewear", Oakley Investor Relations, Press Release, Nov. 15, 2004, pp. 1-2.
- "Eyetop", Product-Features, eyetop eyewear, eyetop belt worn, <http://www.eyetop.net/products/eyetop/features.asp>, downloaded Nov. 6, 2003, pp. 1-2.
- "Heart Rate Monitors", <http://www.healthgoods.com>, downloaded Dec. 4, 2004.
- "How is the UV Index Calculated", SunWise Program, U.S. Environmental Protection Agency, <http://www.epa.gov/sunwise/uvcalc.html>, downloaded Oct. 14, 2004, pp. 1-2.
- "Industrial UV Measurements", APA Optics, Inc., <http://www.apaoptics.com/uv/>, downloaded Jul. 12, 2004, p. 1.
- "Motorola and Oakley Introduce First Bluetooth Sunglasses-Cutting Edge RAZRWire Line Offers Consumers On-The-Go Connections", Motorola Mediacenter—Press Release, Feb. 14, 2005, pp. 1-2.
- "Oakley Thump: Sunglasses Meet MP3 Player", with image, <http://news.designtechnica.com/article4665.html>, Jul. 13, 2004.
- "Personal UV monitor," Optics.org, <http://optics.org/articles/news/6/6/7/1> (downloaded Dec. 20, 2003), Jun. 9, 2000, pp. 1-2.
- "SafeSun Personal Ultraviolet Light Meter", <http://healthchecksyste.ms.com/safesun.htm>, downloaded Jul. 12, 2004, pp. 1-4.
- "SafeSun Personal UV Meter", Introduction, Optix Tech Inc., <http://www.safesun.com>, downloaded Feb. 5, 2004, pp. 1-2.
- SafeSun Personal UV Meter, features, Optix Tech Inc., <http://www.safesun.com/features.html>, downloaded May 1, 2004, pp. 1-2.
- "Sharper Image—The FM Pedometer", e-Corporate Gifts.com, <http://www.e-corporategifts.com/sr353.html>, downloaded Jan. 22, 2005, pp. 1-2.
- "Sun UV™ Personal UV Monitor", APA Optics, Inc., <http://www.apaoptics.com/sunuv/uvfacts.html>, downloaded Dec. 20, 2003, pp. 1-3.
- "Ultraviolet Light and Sunglasses", Oberon's Frequently Asked Questions, <http://www.oberoncompany.com/OBEnglish/FAQUV.html>, downloaded Feb. 5, 2004, pp. 1-2.
- "Ultraviolet Light Sensor", Barrett & Associates Engineering, http://www.barrettengineering.com/project_uv.htm, downloaded Feb. 5, 2004, pp. 1-3.
- "Ultraviolet Radiation (UVR)", Forum North, Ontario Ministry of Labour, <http://www3.mb.sympatico.ca/~eric/ULTRAVIOLET%20RADIATION.htm>, downloaded Feb. 5, 2004, pp. 1-6.
- "What Are Gripples?", Gripping Eyewear, Inc., <http://www.grippingeyewear.com/whatare.html>, downloaded Nov. 2, 2005.
- "With Racing Heart", Skaloud et al., GPS World, Oct. 1, 2001, <http://www.gpsworld.com/gpsworld/content/printContentPopup.jsp?id=1805>, pp. 1-5.
- Abrisa Product Information: Cold Mirrors, Abrisa, Jun. 2001, p. 1.
- Abrisa Product Information: Commercial Hot Mirror, Abrisa, Jun. 2001, p. 1.
- Alps Spectacle, Air Conduction Glass, Bone Conduction Glass, <http://www.alps-inter.com/spec.htm>, downloaded Dec. 10, 2003, pp. 1-2.
- Altimeter and Compass Watches, <http://store.yahoo.com/snowshack/altimeter-watches.html>, downloaded May 3, 2004, pp. 1-2.
- Bone Conduction Headgear HG16 Series, "Voiceducer," <http://www.temco-j.co.jp/html/English/HG16.html>, downloaded Dec. 10, 2003, pp. 1-3.
- Carnoy, David, "The Ultimate MP3 Player for Athletes? Could be.," CNET Reviews, May 14, 2004, pp. 1-4.
- Clifford, Michelle A., "Accelerometers Jump into the Consumer Goods Market", Sensors Online, <http://www.sensorsmag.com>, Aug. 2004.
- Comfees.com, Adjustable Sports Band Style No. 1243, <http://shop.store.yahoo.com/comfees/adsporbanssty.html>, downloaded Apr. 18, 2003, pp. 1-2.
- Cool Last Minute Gift Ideas!, UltimateFatBurner Reviews and Articles, <http://www.ultimatefatburner.com/gift-ideas.html>, downloaded May 10, 2005, pp. 1-3.
- Dickie et al. "Eye Contact Sensing Glasses for Attention-Sensitive Wearable Video Blogging," Human Media Lab, Queen's University, Kingston, ON K7L 3N6, Canada, est. Apr. 2004, pp. 1-2.
- Dixen, Brian, "ear-catching", Supertesten, Mobil, Apr. 2003 (estimated), pp. 37-41.
- Global Solar UV Index, A Practical Guide, World Health Organization, 2002, pp. 1-28.
- Grobart, Sam, "Digit-Sizing Your Computer Data", News Article, Sep. 2004, p. 1.
- Life Monitor V1.1, Rhusoft Technologies Inc., <http://www.rhusoft.com/lifemonitor/>, Mar. 1, 2003, pp. 1-6.
- Manes, Stephen, "Xtreme Cam", Forbes Magazine, Sep. 5, 2005, p. 96.
- Mio, PhysiCal, <http://www.gophysical.com/>, downloaded Jan. 27, 2004, 5 pages.
- Monitoring Athletes Performance—2002 Winter Olympic News from KSL, Jan. 23, 2002, <http://2002.ksl.com/news-3885i>, pp. 1-3.
- Niwa, "UV Index Information", <http://www.niwa.cri.nz/services/uvozone/uvi-info>, downloaded Jul. 15, 2004, pp. 1-2.
- NuVision 60GX Steroscopic Wireless Glasses, Product Information, NuVision by MacNaughton, c. 1997, MacNaughton, Inc., pp. 1-2.
- Pärkkä, Juha, et al., "A Wireless Wellness Monitor for Personal Weight Management", VTT Information Technology, Tampere, Finland, Nov. 2000, p. 1.
- Pedometer, Model HJ-112, Omron Instruction Manual, Omron Healthcare, Inc., 2003, pp. 1-27.
- PNY Announces Executive Attaché USB 2.0 Flash Drive and Pen Series, Press Release, PNY Technologies, Las Vegas, Jan. 8, 2004, pp. 1-2.
- PNY Technologies, "Executive Attaché" <http://www.pny.com/products/flash/execattache.asp> downloaded Nov. 16, 2005.
- Polar WM41 and 42 weight management monitor, http://www.simplysports/polar/weight_management/wm41-42.htm, downloaded Jan. 28, 2004, pp. 1-3.
- Questions Answers, Pedometer.com, <http://www.pedometer.com>, downloaded May 5, 2005.
- RazrWire, copyright Motorola, Inc., Jul. 2005, 1 page.
- SafeSun Personal UV Meter, Scientific Data, Optix Tech Inc., <http://www.safesun.com/scientific.html>, downloaded May 1, 2004, pp. 1-3.
- SafeSun Sensor, User's Manual, Optix Tech Inc., Jun. 1998, 2 pages.
- SafeSun, Personal UV Meter, "Technical Specifications", Optix Tech Inc., <http://www.safesun.com/technical.html>, downloaded Jul. 12, 2004, pp. 1-2.

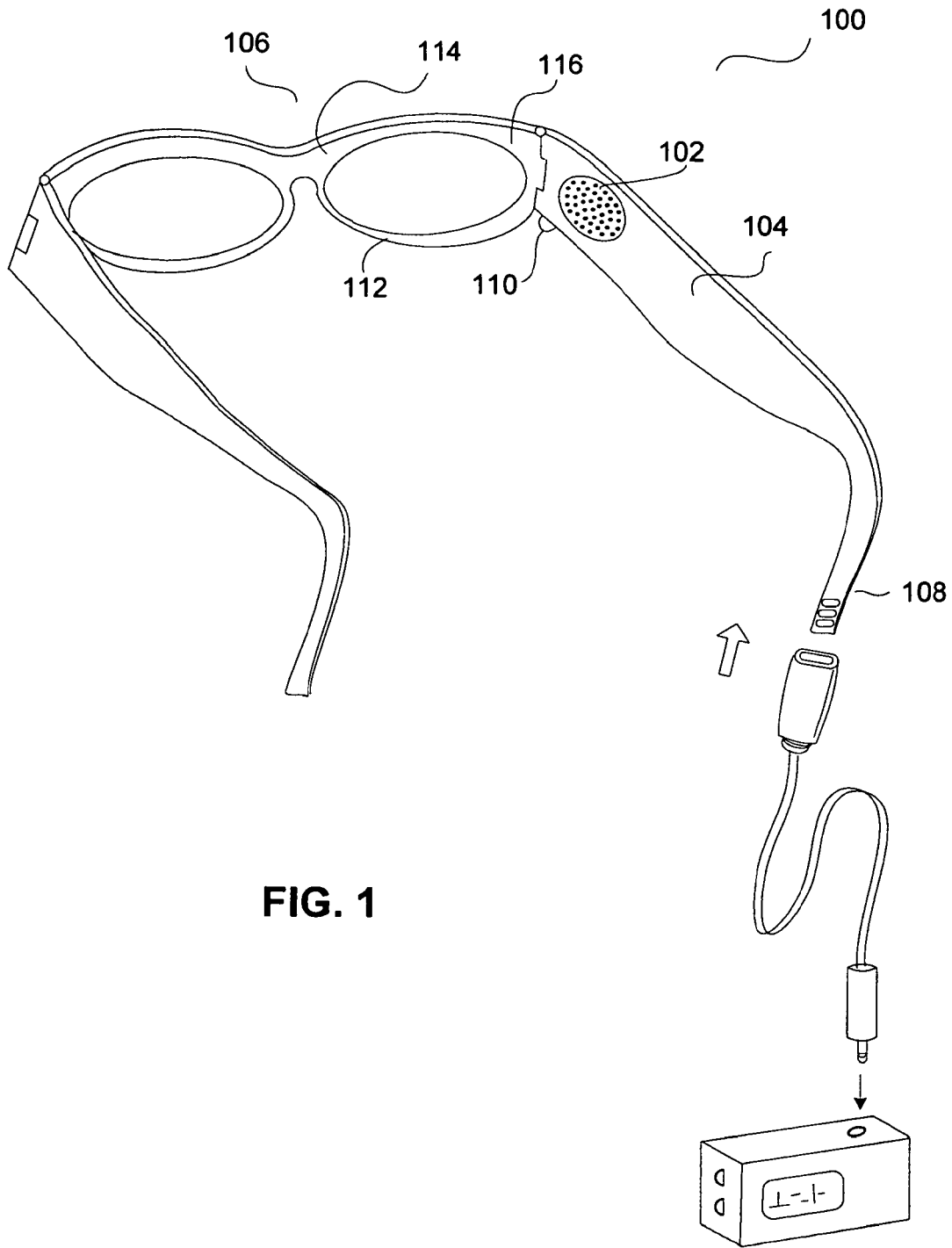
(56)

References Cited

OTHER PUBLICATIONS

- SafeSun, Personal UV Meter, Experiments, Optix Tech Inc., <http://www.safesun.com/experiments.html>, downloaded Feb. 5, 2004, pp. 1-2.
- Shades of Fun, Blinking Light Glasses, <http://www.shadesoffun.com/Nov/Novpgs-14.html>, downloaded Jul. 9, 2005, pp. 1-4.
- SportLine Fitness Pedometer—Model 360, UltimateFatBurner Superstore, http://www.ultimatefatburner-store.com/ac_004.html, downloaded May 10, 2005, pp. 1-2.
- Steele, Bonnie G. et al., “Bodies in motion: Monitoring daily activity and exercise with motion sensors in people with chronic pulmonary disease”, VA Research & Development, Journal of Rehabilitation Research & Development, vol. 40, No. 5, Sep./Oct. 2003, Supplement 2, pp. 45-58.
- Stevens, Kathy, “Should I Use a Pedometer When I Walk?”, Healthon/WebMD, Apr. 14, 2000.
- Sundgot, Jørgen “2nd-gen Motorola Bluetooth headset”, InfoSync World, Mar. 1, 2003, <http://www.infosync.no/news/2002/n/2841.html>, pp. 1-2.
- SunSensors, Segan Industries, Inc., <http://www.segan-ind.com/sunsensor.htm>, downloaded Feb. 5, 2004, pp. 1-3.
- SunUV™, Personal UV Monitor User’s Guide, APA Optics, Inc., 2003 pp. 1-52.
- SunUV™, Personal UV Monitor, APA Optics, Inc., <http://www.apaoptics.com/sunuv/models.html>, downloaded Dec. 20, 2003.
- Talking Pedometer, Sportline, Inc., Jun. 2001 (*Possibly earlier*), 1 page.
- The unofficial ELSA 3D Revelator page, Dec. 30, 1999, pp. 1-15.
- Top Silicon PIN Photodiode, PD93-21C, Technical Data Sheet, Everlight Electronics Co., Ltd., 2004, pp. 1-9.
- UV Light Meter, UVA and UVB measurement, UV-340, Instruction Manual, Lutron, Jun. 2003 (estimated), pp. 1-5.
- UV-Smart, UVA/B Monitor, Model EC-960-PW, Instruction Manual, Tanita Corporation of America, Inc., downloaded Nov. 16, 2001.
- Vitaminder Personal Carb Counter, <http://www.auravita.com/products/AURA/ORBU11420.asp>. Downloaded Nov. 15, 2005, pp. 1-4.
- Yamada et al. “Development of an eye-movement analyser possessing functions for wireless transmission and autocalibration.” Med. Biol. Eng. Comput., No. 28, v.4, Jul. 28, 1990, <http://link.springer.com/article/10.1007%2FBF02446149?LI=true>, pp. 1-2.
- Notice of Allowance for U.S. Appl. No. 13/085,402, dated Jun. 14, 2013.
- Office Action for U.S. Appl. No. 13/955,336, dated Dec. 5, 2013.
- Notice of Allowance for U.S. Appl. No. 13/955,336, dated Apr. 28, 2014.
- Notice of Allowance for U.S. Appl. No. 13/955,336, dated Aug. 18, 2014.
- Notice of Allowance for U.S. Appl. No. 13/955,336, dated Oct. 7, 2014.
- Office Action for U.S. Appl. No. 14/557,409, dated Jun. 11, 2015.
- Notice of Allowance for U.S. Appl. No. 14/557,409, dated Jan. 14, 2016.
- Notice of Allowance for U.S. Appl. No. 14/557,409, dated Apr. 28, 2016.
- Notice of Allowance for U.S. Appl. No. 14/557,409, dated Aug. 8, 2016.
- Notice of Allowance for U.S. Appl. No. 14/557,409, dated Nov. 4, 2016.
- Corrected Notice of Allowance for U.S. Appl. No. 14/557,409, dated Dec. 12, 2016.
- Office Action for U.S. Appl. No. 13/367,346, dated May 15, 2013.
- Notice of Allowance for U.S. Appl. No. 13/367,346, dated Oct. 10, 2013.
- Office Action for U.S. Appl. No. 13/367,346, dated Jan. 28, 2014.
- Notice of Allowance for U.S. Appl. No. 13/367,346, dated Aug. 15, 2014.
- Notice of Allowance for U.S. Appl. No. 13/367,346, dated Mar. 19, 2015.
- Office Action for U.S. Appl. No. 14/715,501, dated Sep. 23, 2015.
- Office Action for U.S. Appl. No. 14/715,501, dated Mar. 25, 2016.
- Office Action for U.S. Appl. No. 14/715,501, dated Oct. 17, 2016.
- Notice of Allowance for U.S. Appl. No. 12/806,312, dated Mar. 29, 2013.
- U.S. Appl. No. 13/831,512, filed Mar. 14, 2013.
- Office Action for U.S. Appl. No. 13/831,512, dated Jun. 4, 2013.
- Office Action for U.S. Appl. No. 13/831,512, dated Feb. 24, 2014.
- Office Action for U.S. Appl. No. 13/831,512, dated Jul. 2, 2014.
- Office Action for U.S. Appl. No. 13/831,512, dated Jan. 21, 2015.
- Office Action for U.S. Appl. No. 13/831,512, dated May 29, 2015.
- Office Action for U.S. Appl. No. 13/831,512, dated Feb. 24, 2016.
- Notice of Allowance for U.S. Appl. No. 13/831,512, dated Aug. 1, 2016.
- Notice of Allowance for U.S. Appl. No. 13/831,512, dated Oct. 25, 2016.
- Notice of Allowance for U.S. Appl. No. 12/803,732, dated Feb. 13, 2013.
- Office Action for U.S. Appl. No. 13/291,020, dated Jun. 4, 2012.
- Office Action for U.S. Appl. No. 15/375,423, dated Mar. 27, 2017.
- Notice of Allowance for U.S. Appl. No. 13/955,336, dated Nov. 3, 2014.
- Notice of Allowance for U.S. Appl. No. 13/831,512, dated Jan. 30, 2017.
- Notice of Allowance for U.S. Appl. No. 13/831,512, dated Feb. 21, 2017.
- Notice of Allowance for U.S. Appl. No. 12/803,732, dated Jul. 5, 2012.
- Office Action for U.S. Appl. No. 13/291,020, dated Apr. 23, 2012.
- Notice of Allowance for U.S. Appl. No. 13/291,020, dated Aug. 2, 2012.
- Notice of Allowance for U.S. Appl. No. 13/291,020, dated Nov. 2, 2012.
- Notice of Allowance for U.S. Appl. No. 13/291,020, dated Feb. 11, 2013.
- U.S. Appl. No. 13/831,419, filed Mar. 14, 2013.
- Office Action for U.S. Appl. No. 13/831,419, dated Apr. 27, 2015.
- Office Action for U.S. Appl. No. 13/831,419, dated Aug. 12, 2015.
- Notice of Allowance for U.S. Appl. No. 13/831,419, dated Jan. 28, 2016.
- Office Action for U.S. Appl. No. 13/831,419, dated Apr. 28, 2016.
- Office Action for U.S. Appl. No. 13/831,419, dated Nov. 17, 2016.
- Office Action for U.S. Appl. No. 13/831,419, dated Feb. 1, 2017.
- Notice of Allowance for U.S. Appl. No. 13/831,419, dated Jun. 6, 2017.
- Corrected Notice of Allowance for U.S. Appl. No. 13/831,445, dated Jan. 23, 2017.
- Notice of Allowance for U.S. Appl. No. 15/375,423, dated Jul. 5, 2017.
- Notice of Allowance for U.S. Appl. No. 15/375,423, dated Oct. 31, 2017.
- Notice of Allowance for U.S. Appl. No. 15/375,423, dated Mar. 23, 2018.
- Office Action for U.S. Appl. No. 14/715,501, dated Jul. 20, 2017.
- Office Action for U.S. Appl. No. 14/715,501, dated Jan. 8, 2018.
- Notice of Allowance for U.S. Appl. No. 14/715,501, dated May 9, 2018.
- Office Action for U.S. Appl. No. 15/396,428, dated Feb. 16, 2018.
- Office Action for U.S. Appl. No. 15/409,723, dated Apr. 23, 2018.
- Office Action for U.S. Appl. No. 13/831,419, dated Oct. 20, 2017.
- Notice of Allowance for U.S. Appl. No. 15/375,423, dated Jul. 13, 2018.
- Notice of Allowance for U.S. Appl. No. 14/715,501, dated Sep. 11, 2018.
- Office Action for U.S. Appl. No. 15/396,428, dated Jun. 21, 2018.
- Office Action for U.S. Appl. No. 13/831,419, dated Jun. 8, 2018.
- Office Action for U.S. Appl. No. 15/409,723, dated Oct. 31, 2018.

* cited by examiner



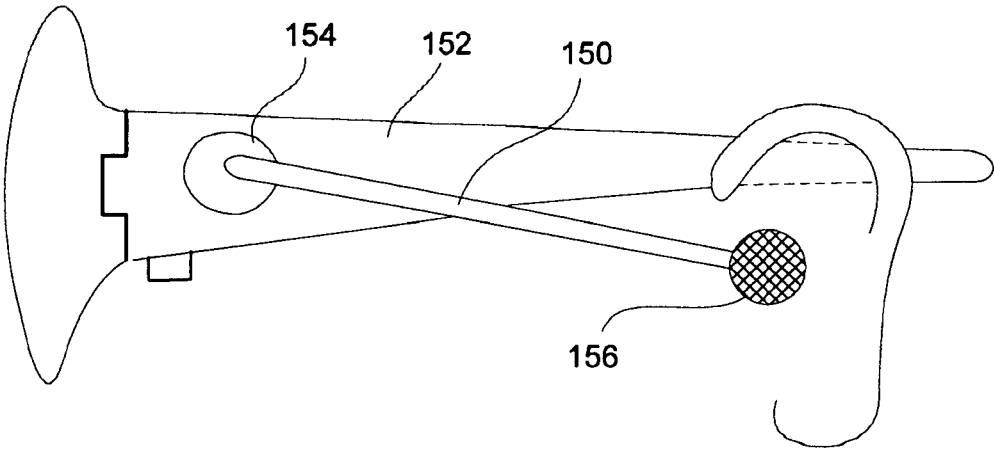


FIG. 2

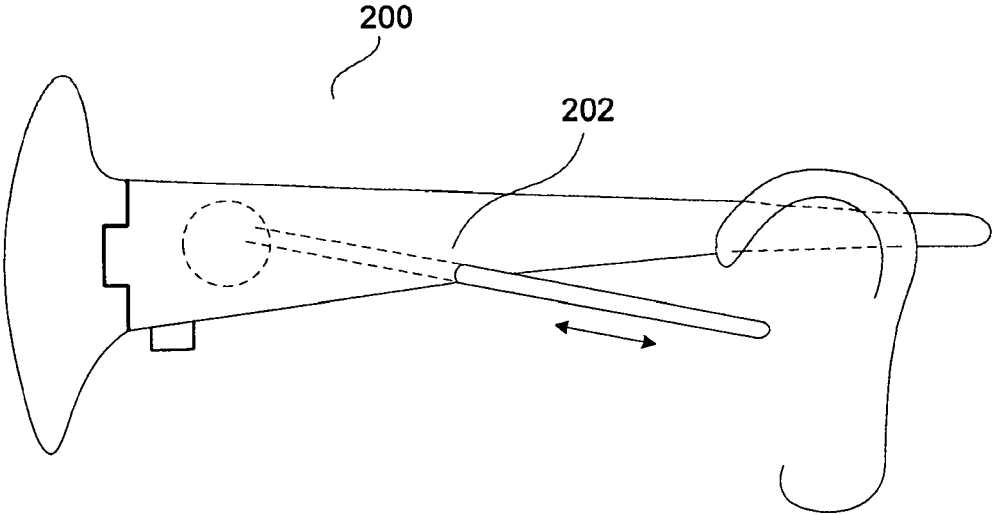


FIG. 3

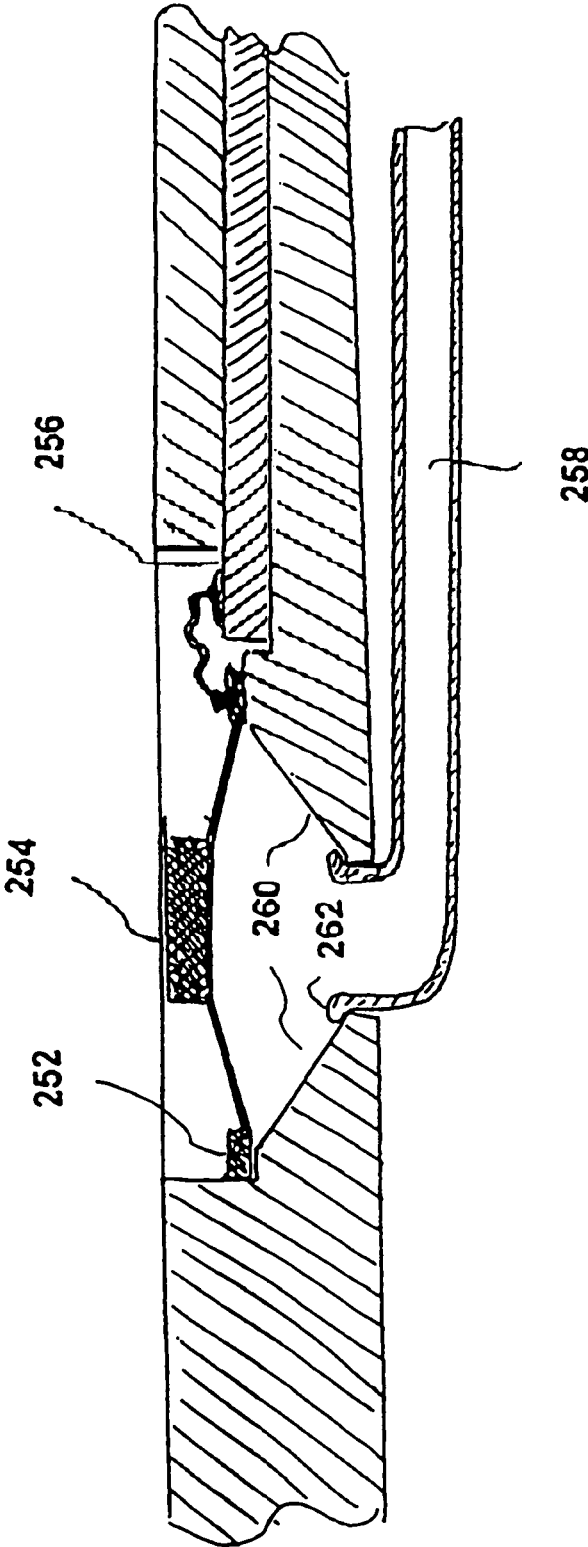


FIG. 4

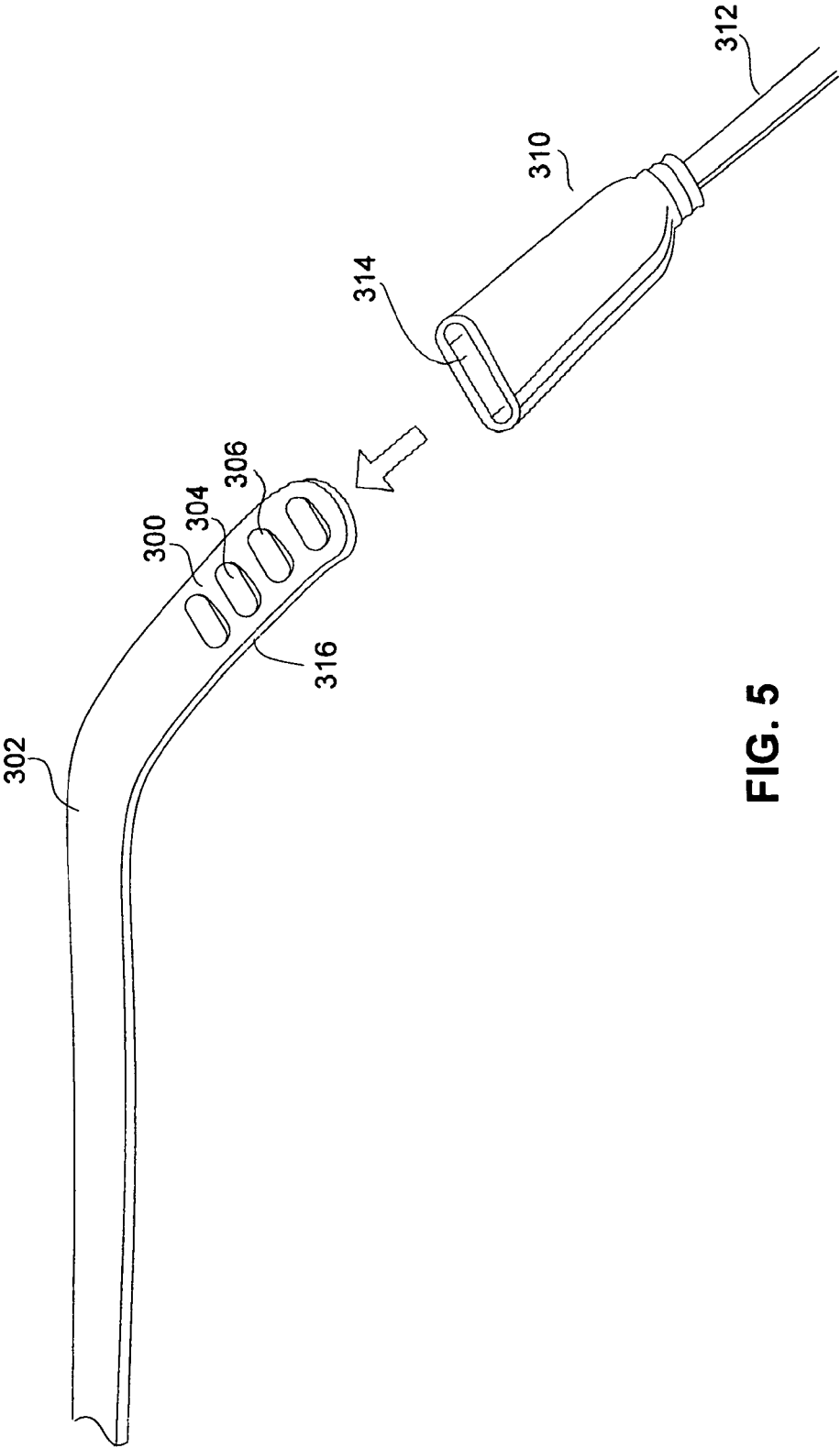


FIG. 5

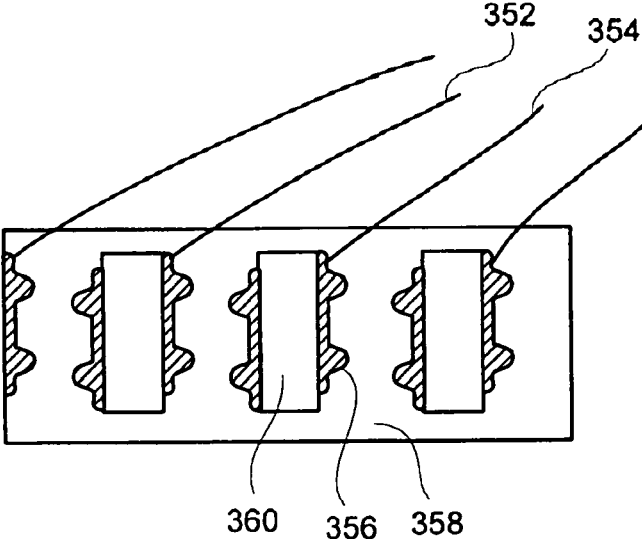


FIG. 6A

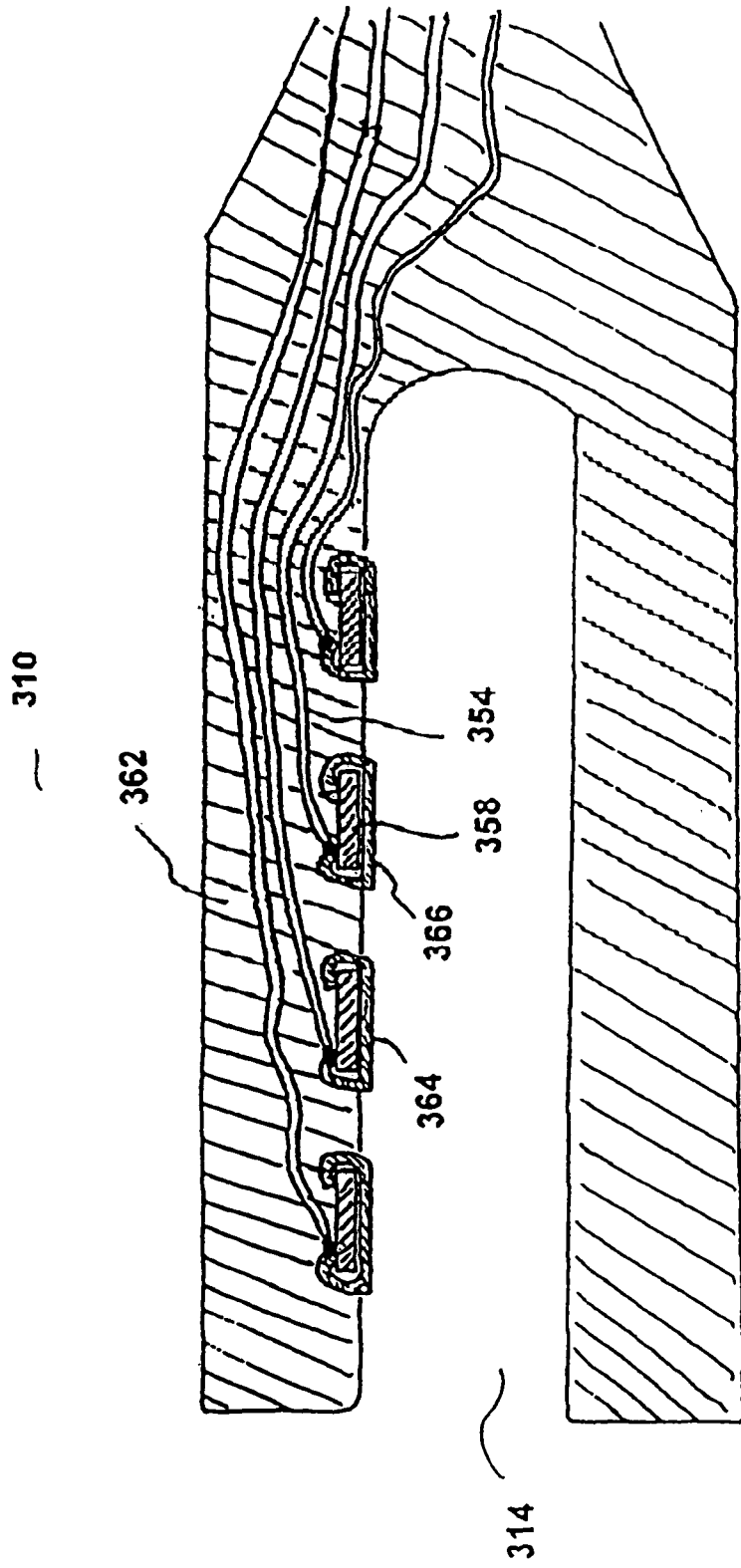


FIG. 6B

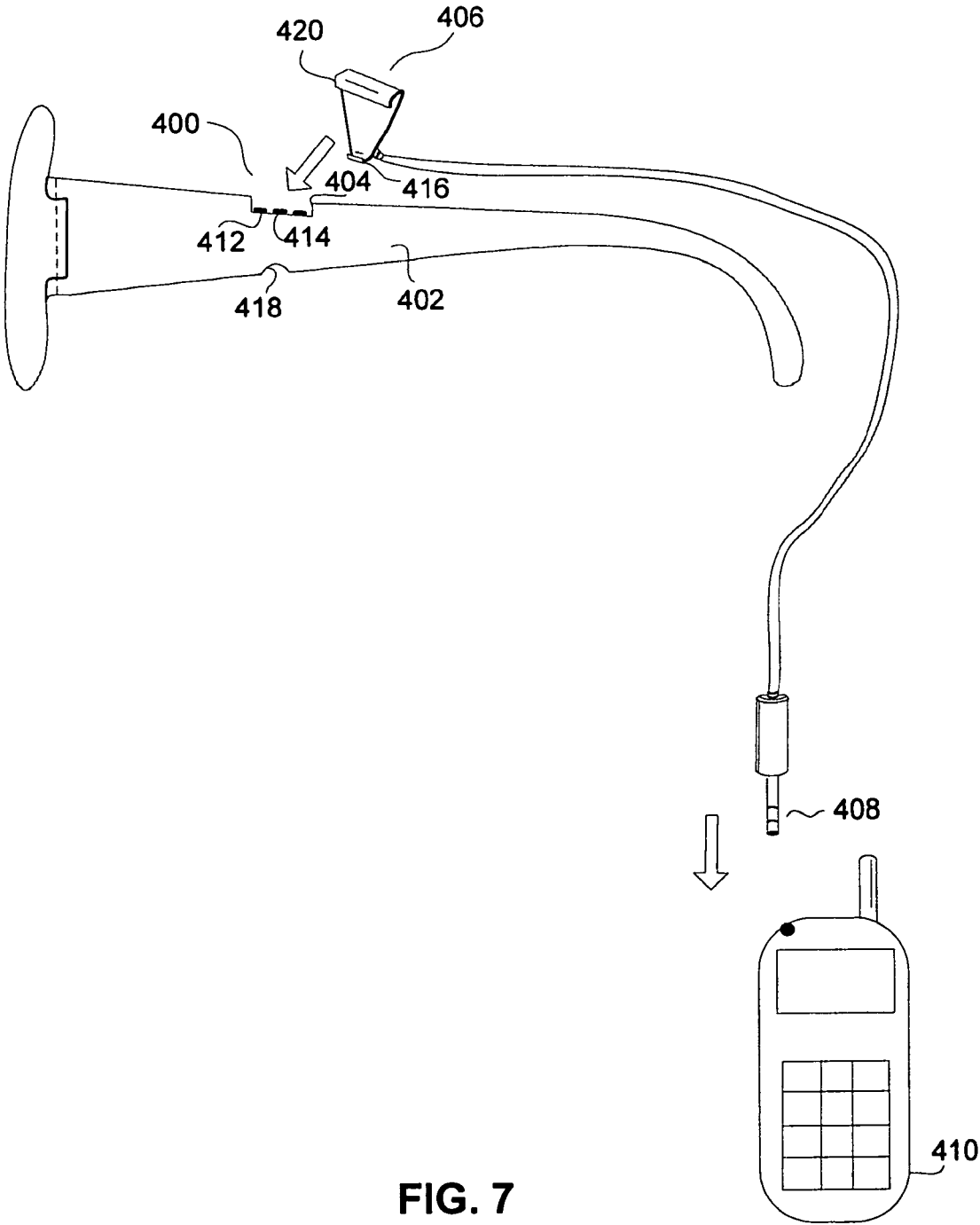
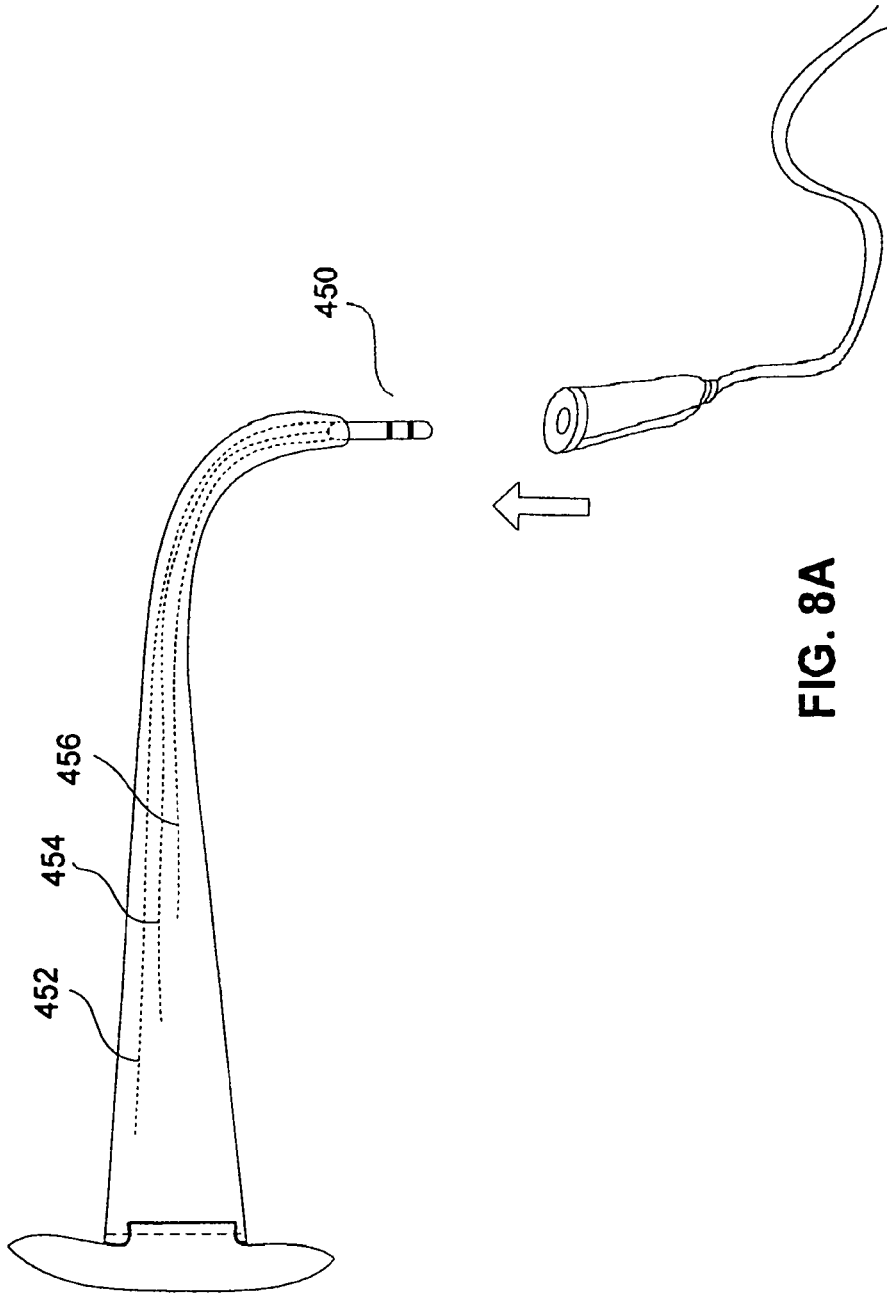


FIG. 7



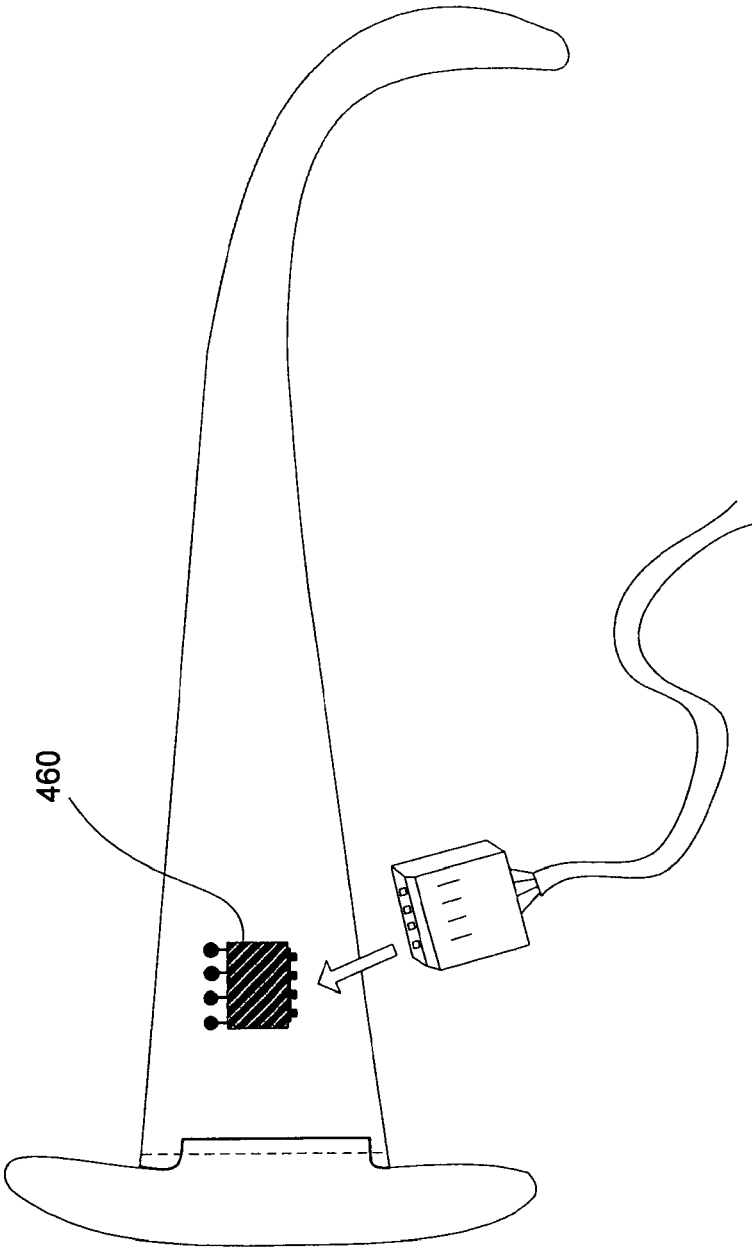


FIG. 8B

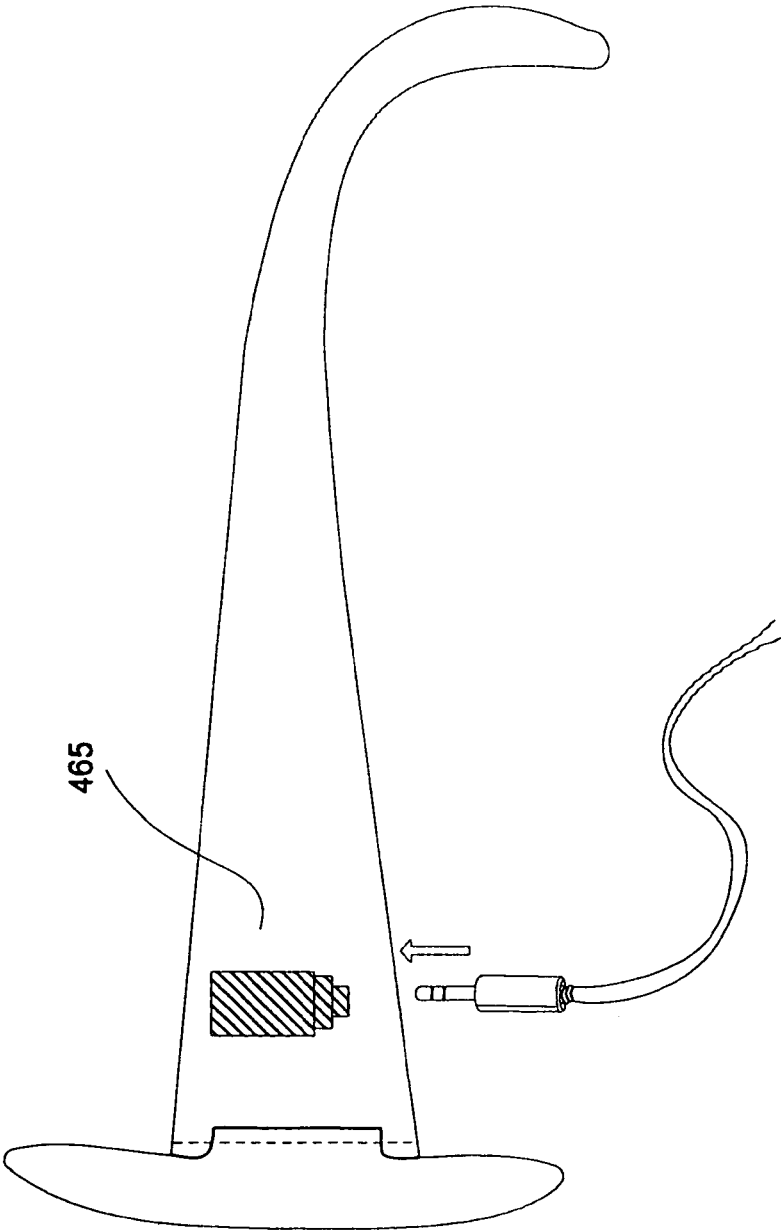


FIG. 8C

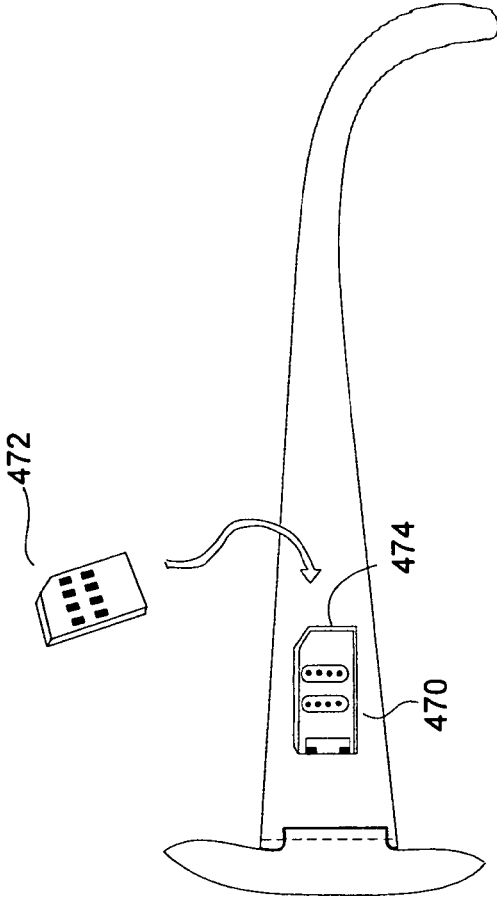


Fig. 8D

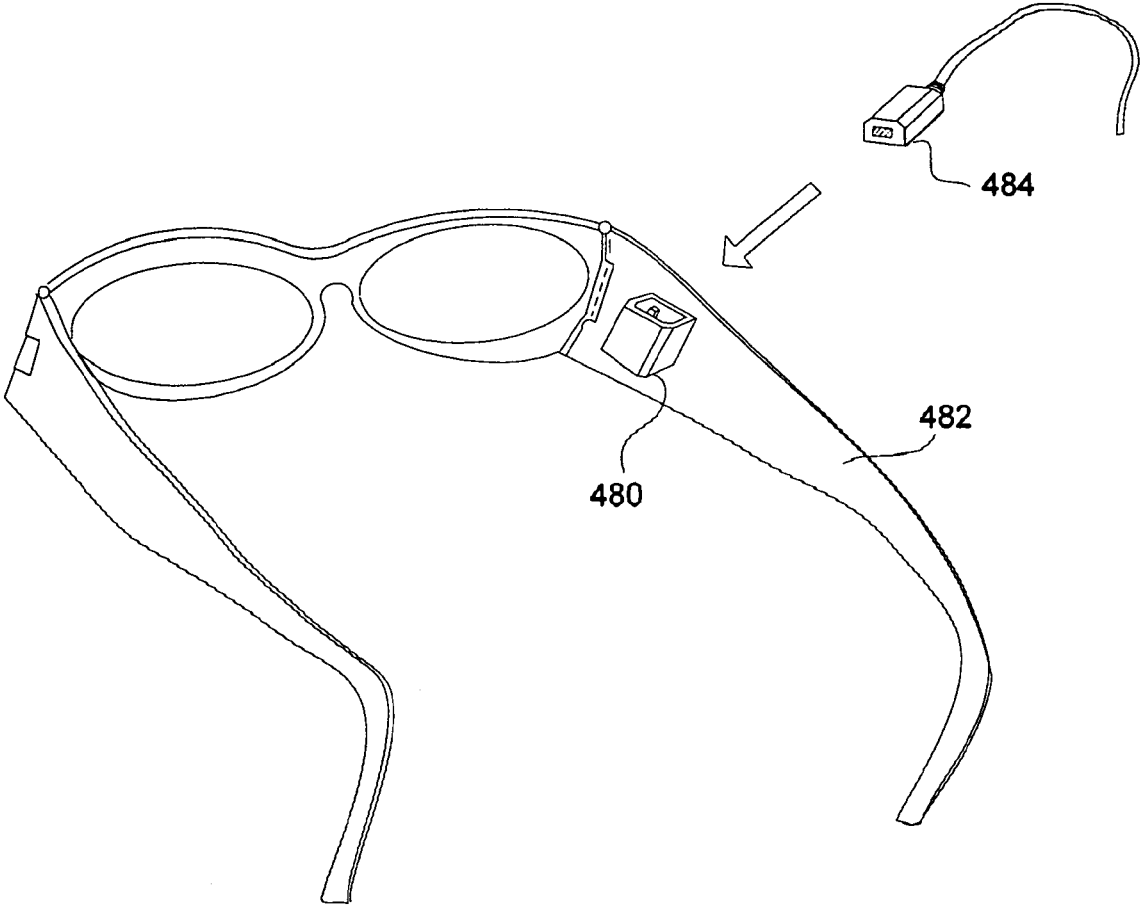


Fig. 8E

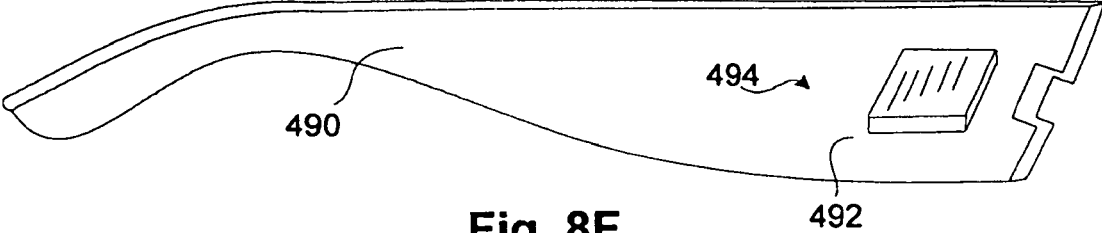


Fig. 8F

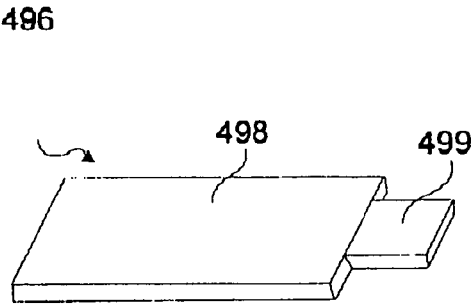


Fig. 8G

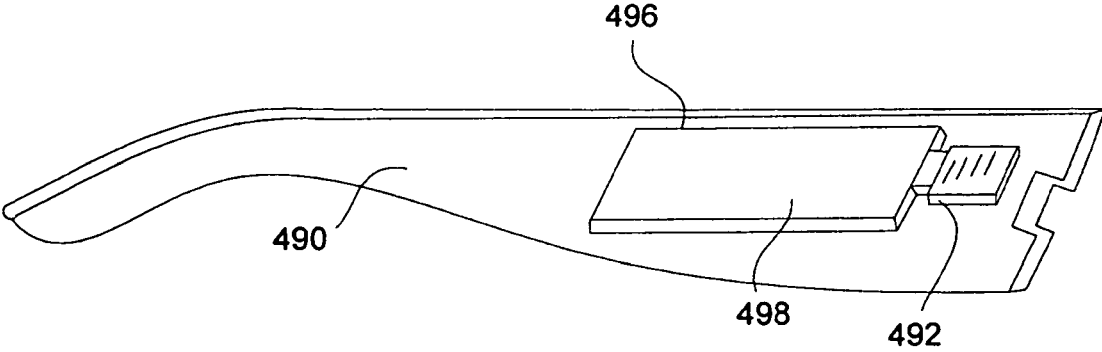


Fig. 8H

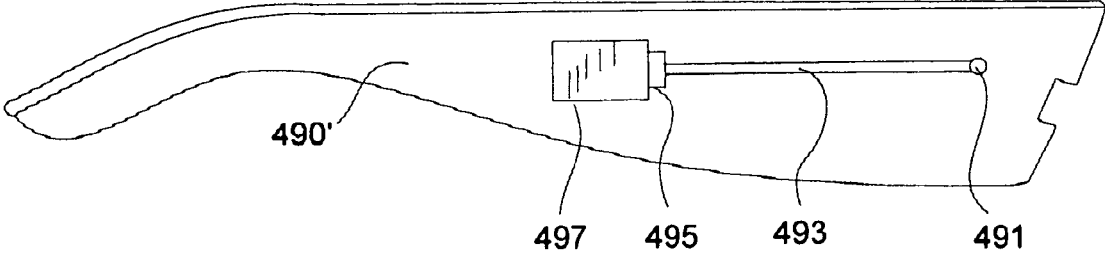


Fig. 8I

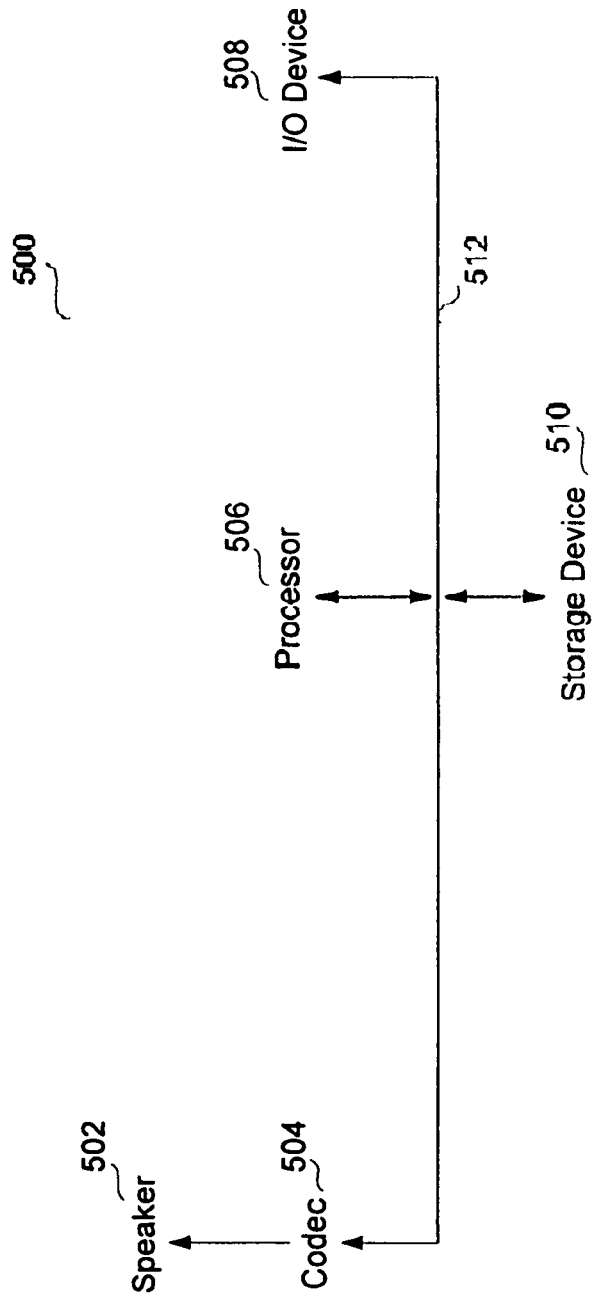


FIG. 9

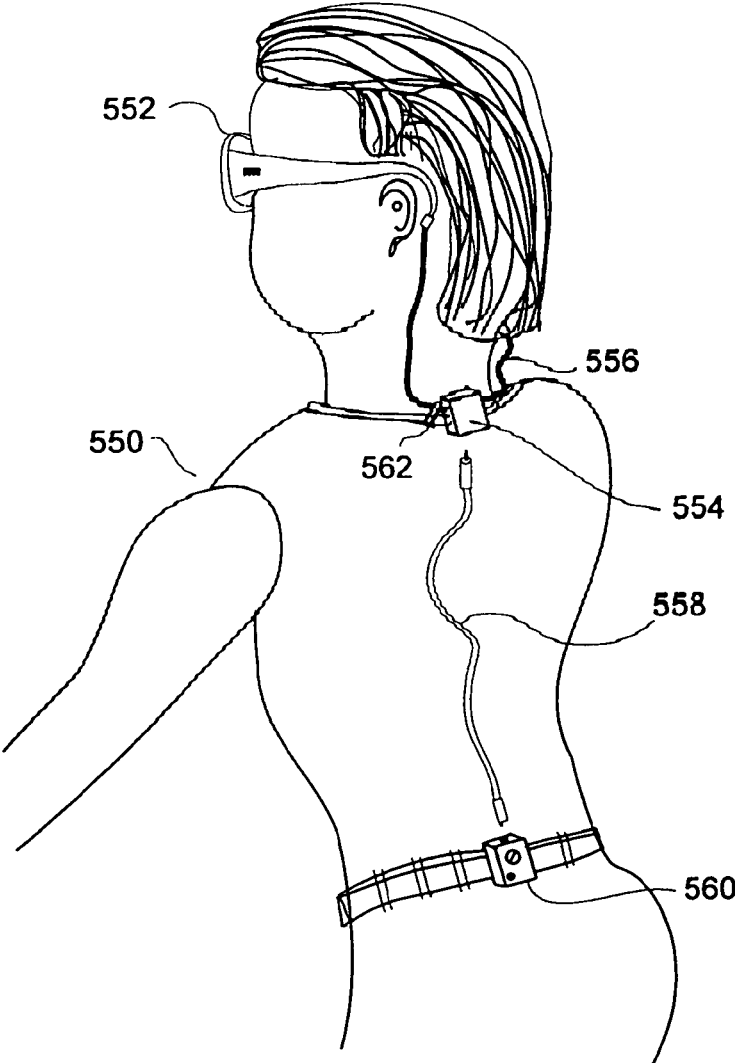


FIG. 10

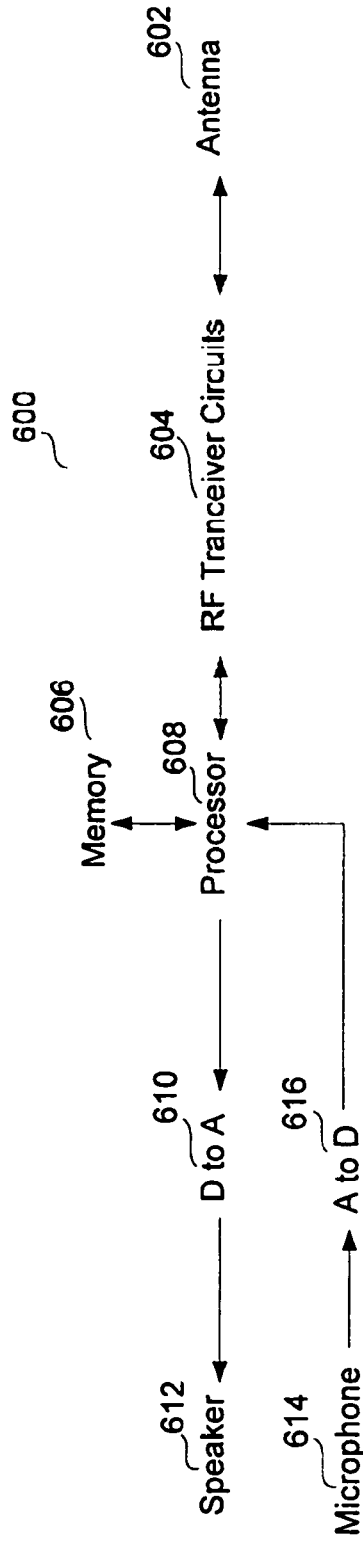


FIG. 11A

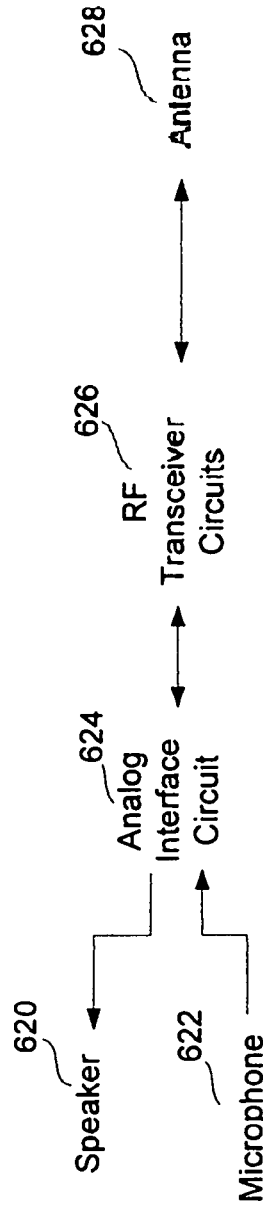


FIG. 11B

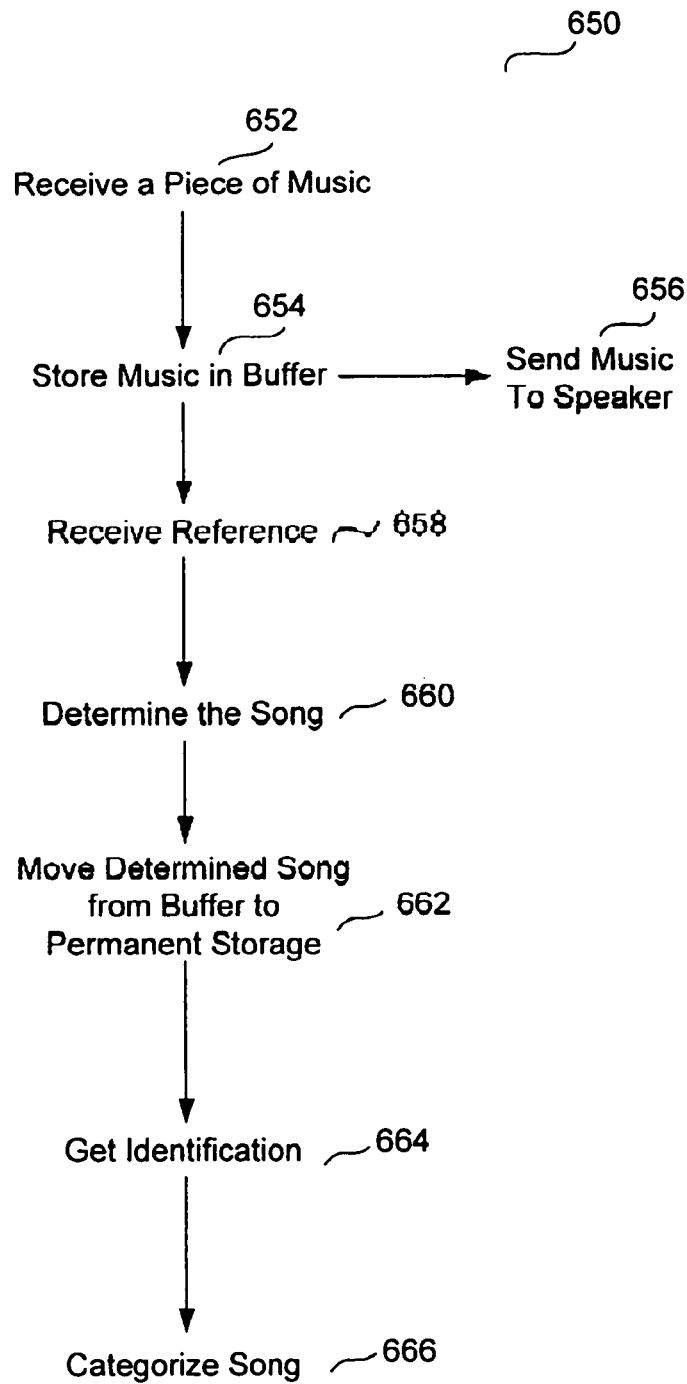


FIG. 12

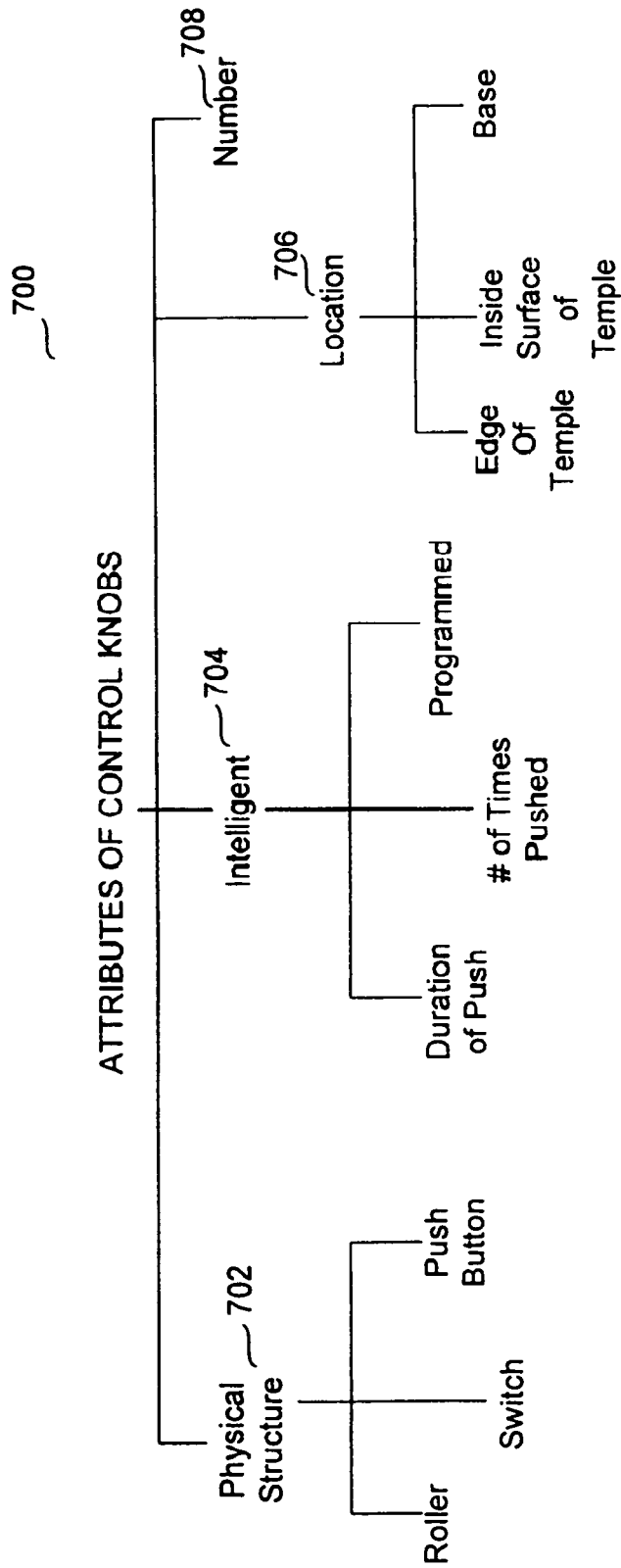


FIG. 13

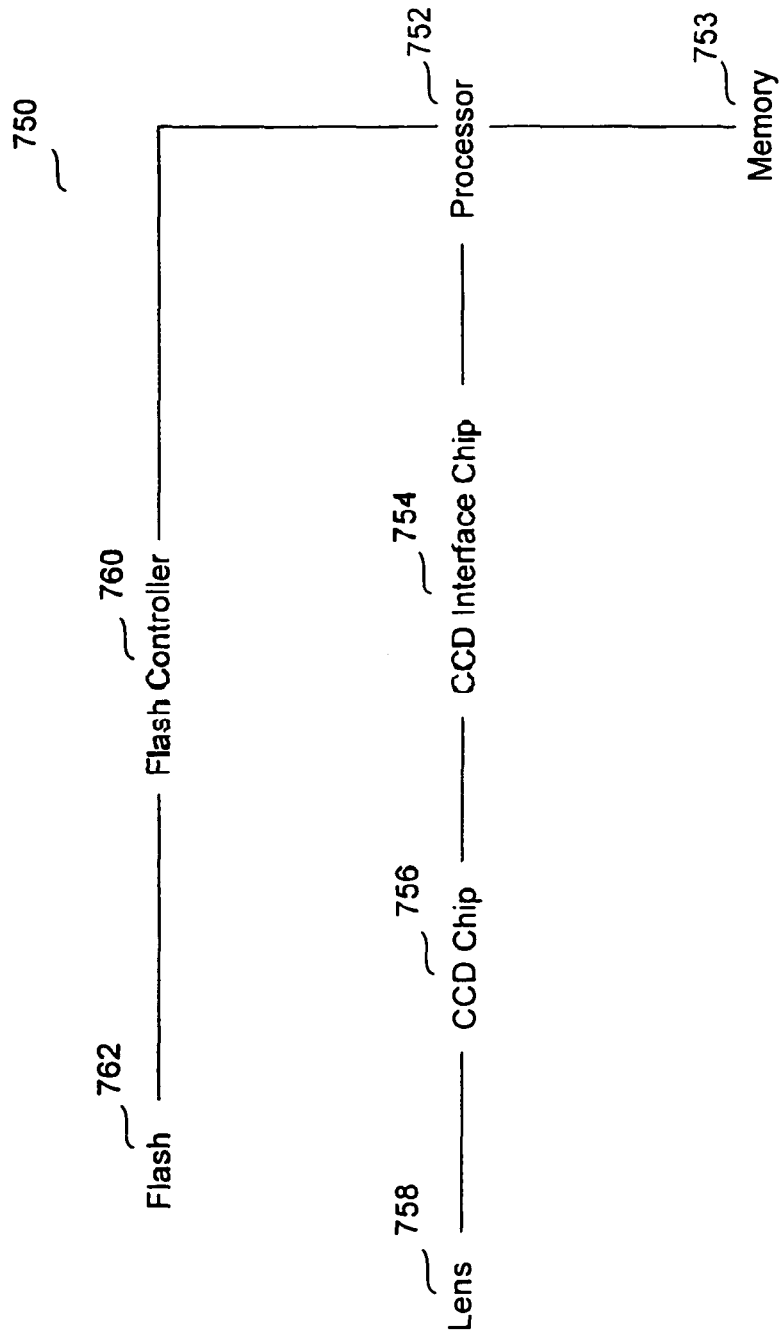


FIG. 14

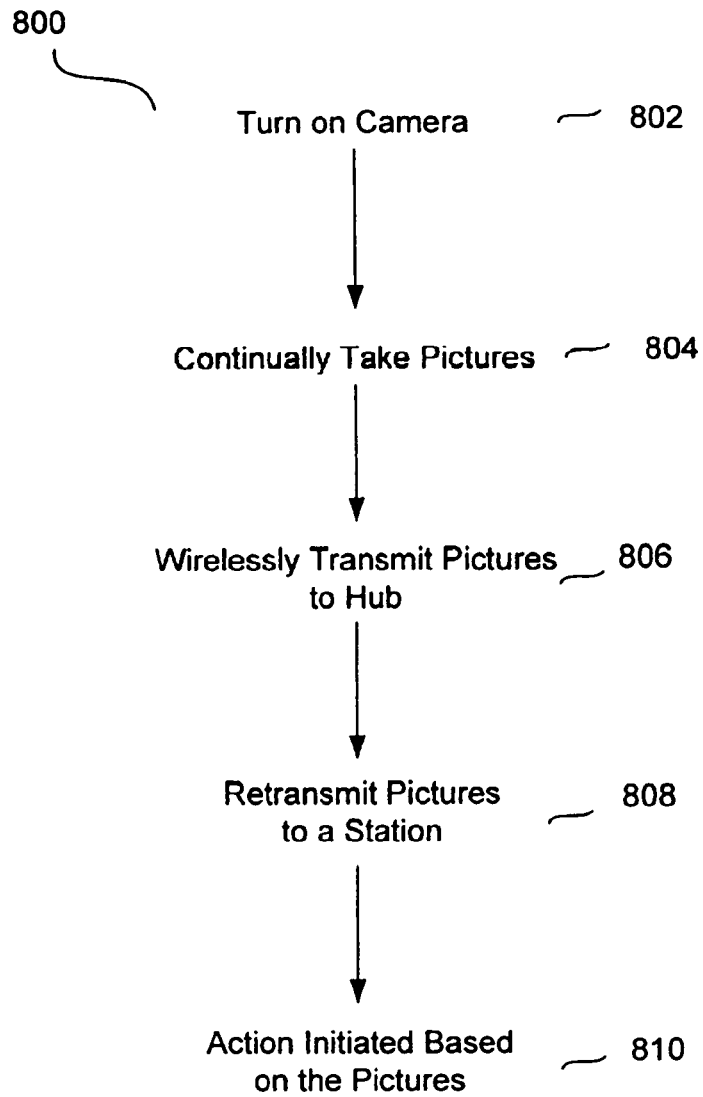


FIG. 15

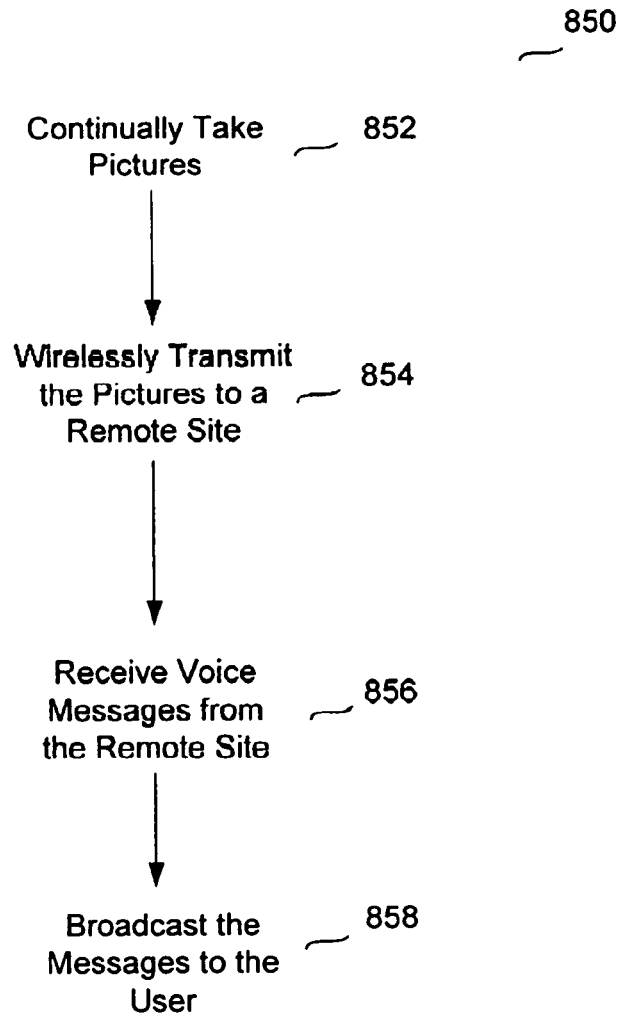


FIG. 16

900

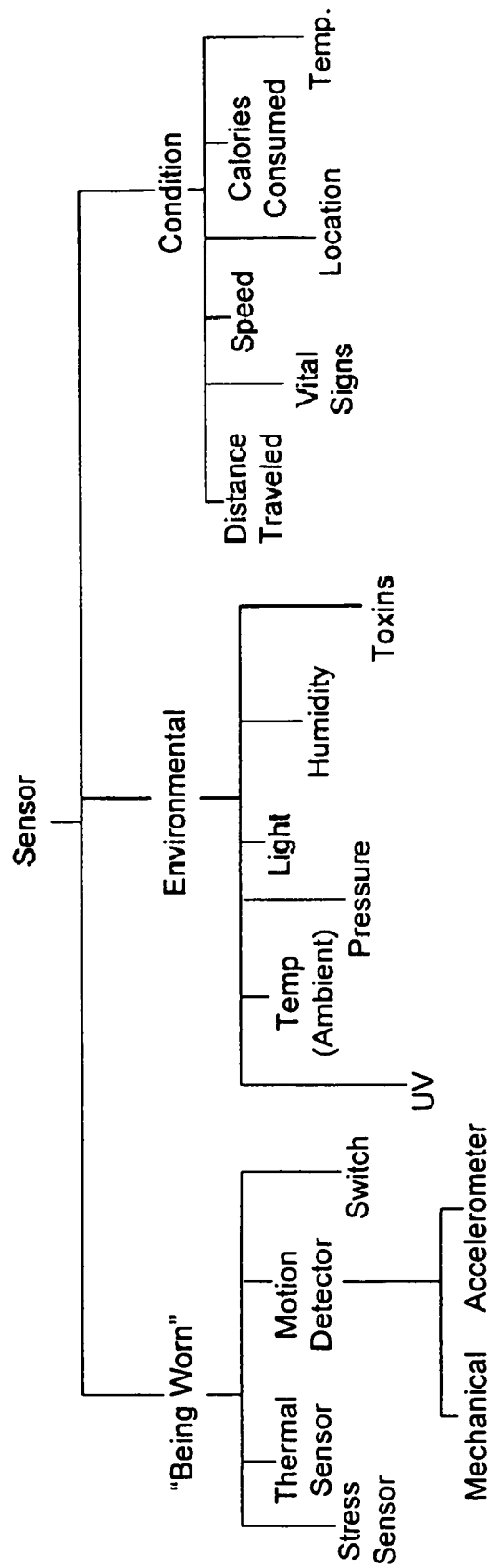


FIG. 17A

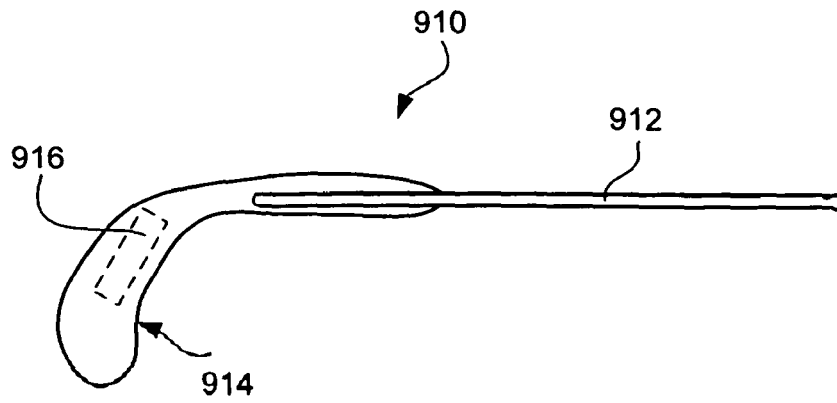


FIG. 17B

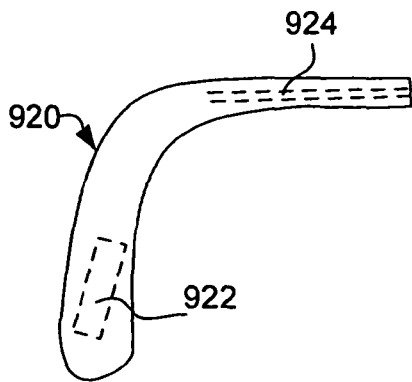


FIG. 17C

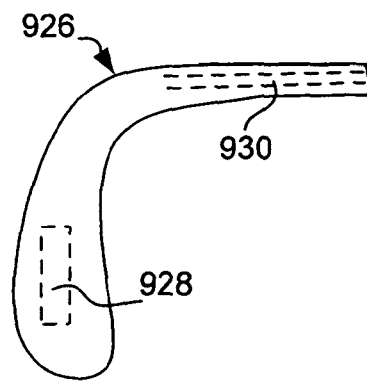


FIG. 17D

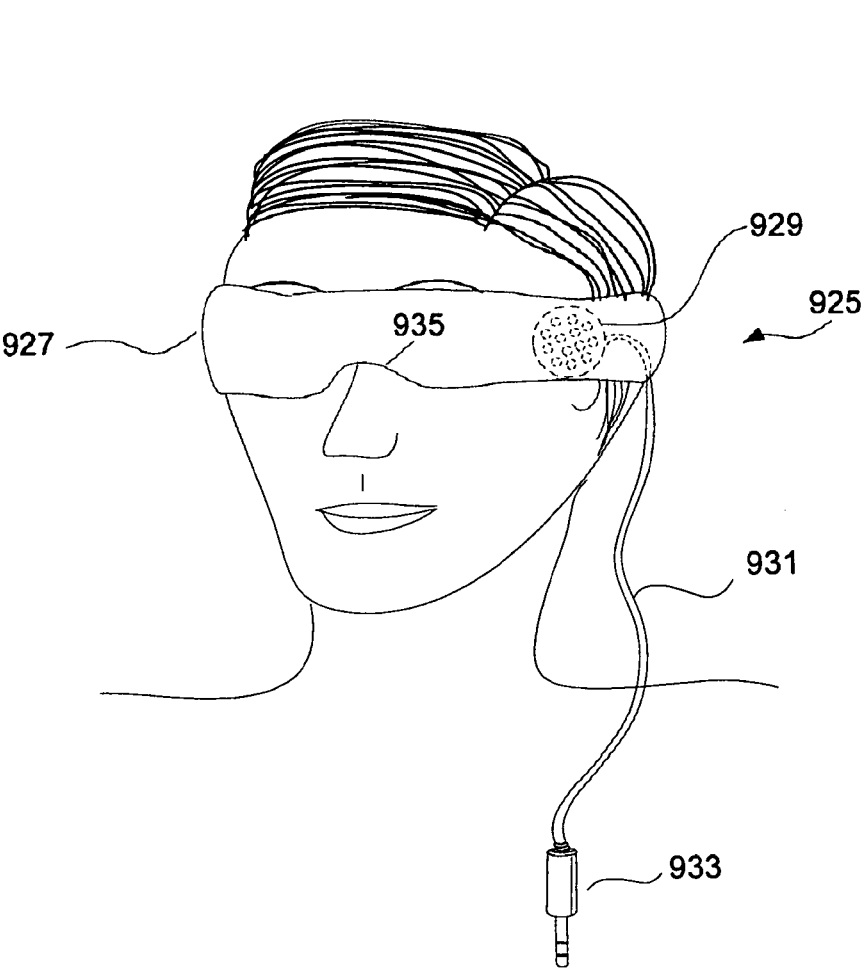


FIG. 18

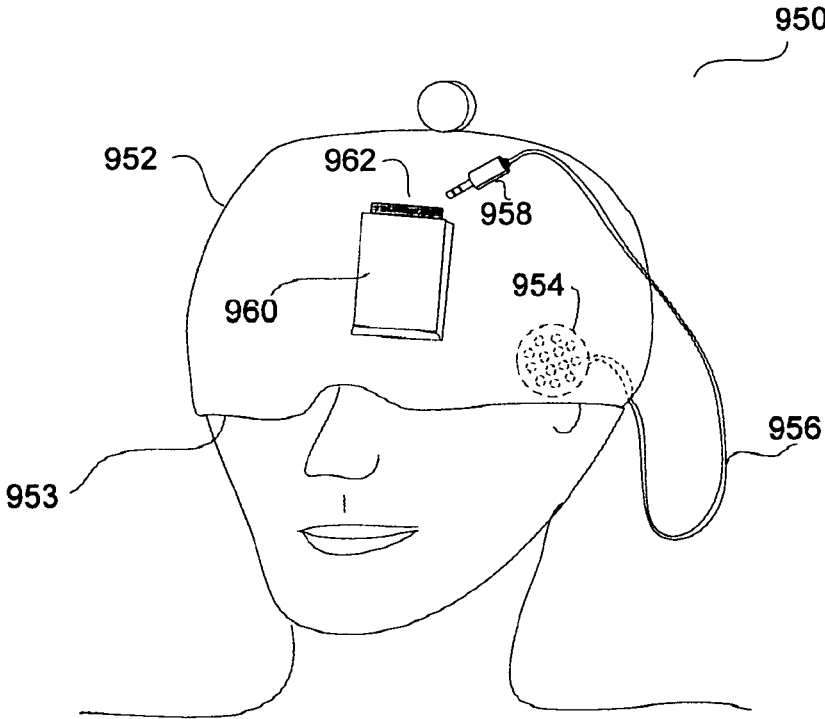


FIG. 19

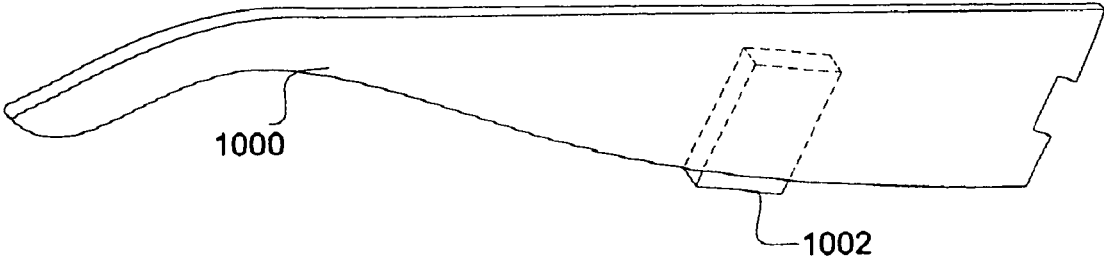


FIG. 20A

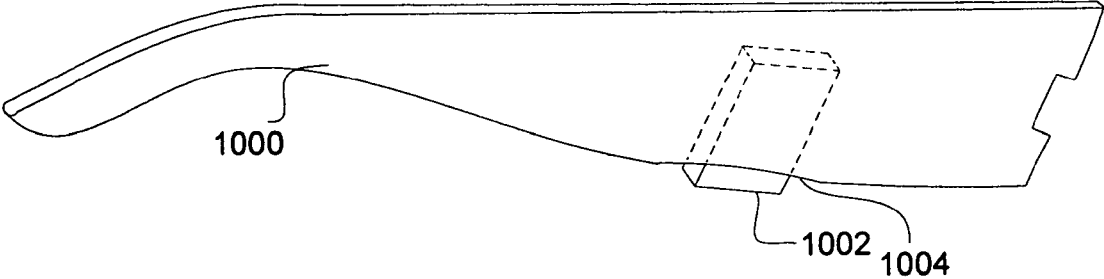


FIG. 20B

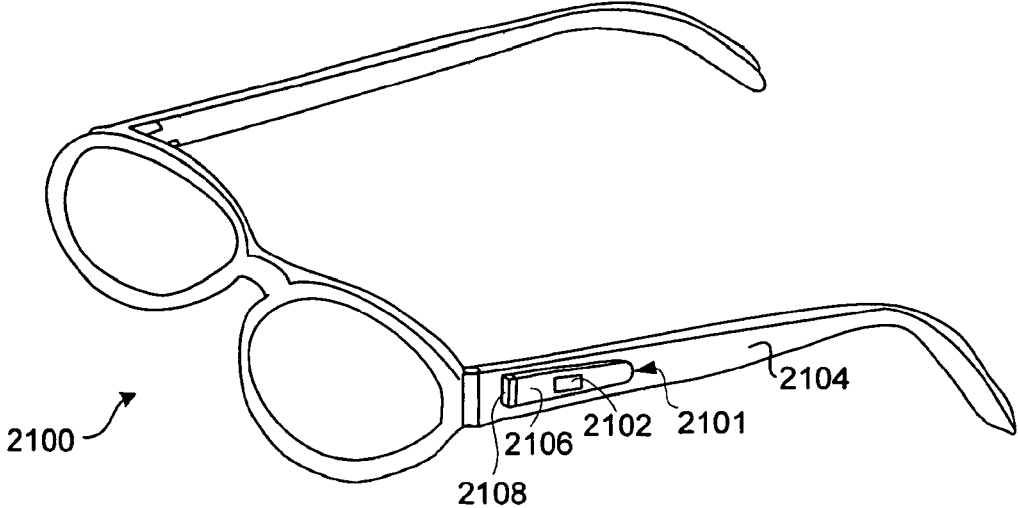


FIG. 21A

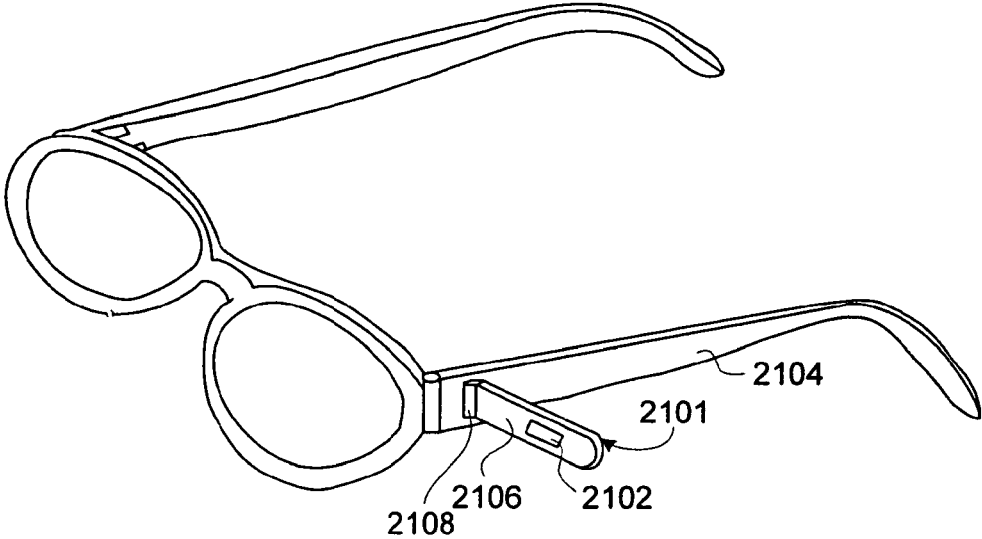


FIG. 21B

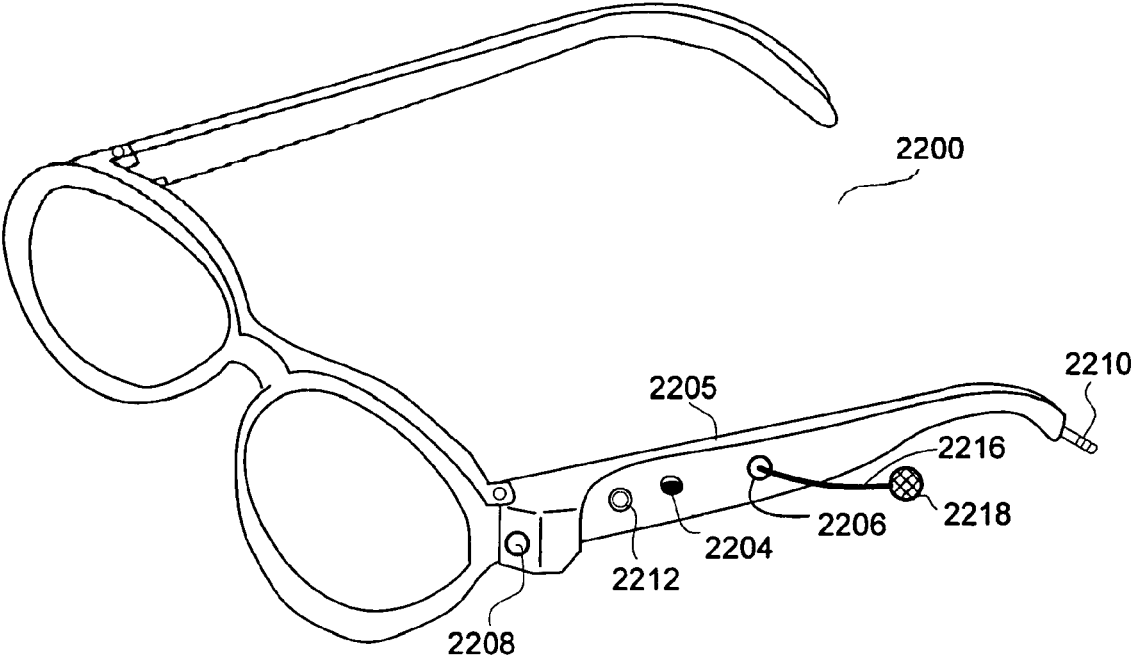


FIG. 22

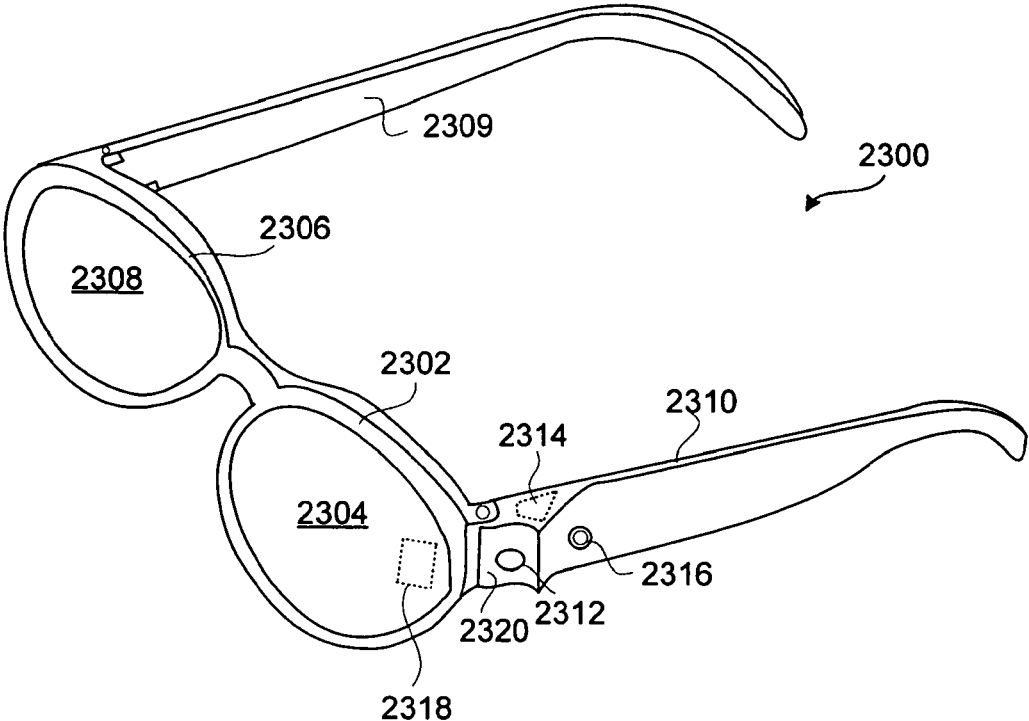


FIG. 23A

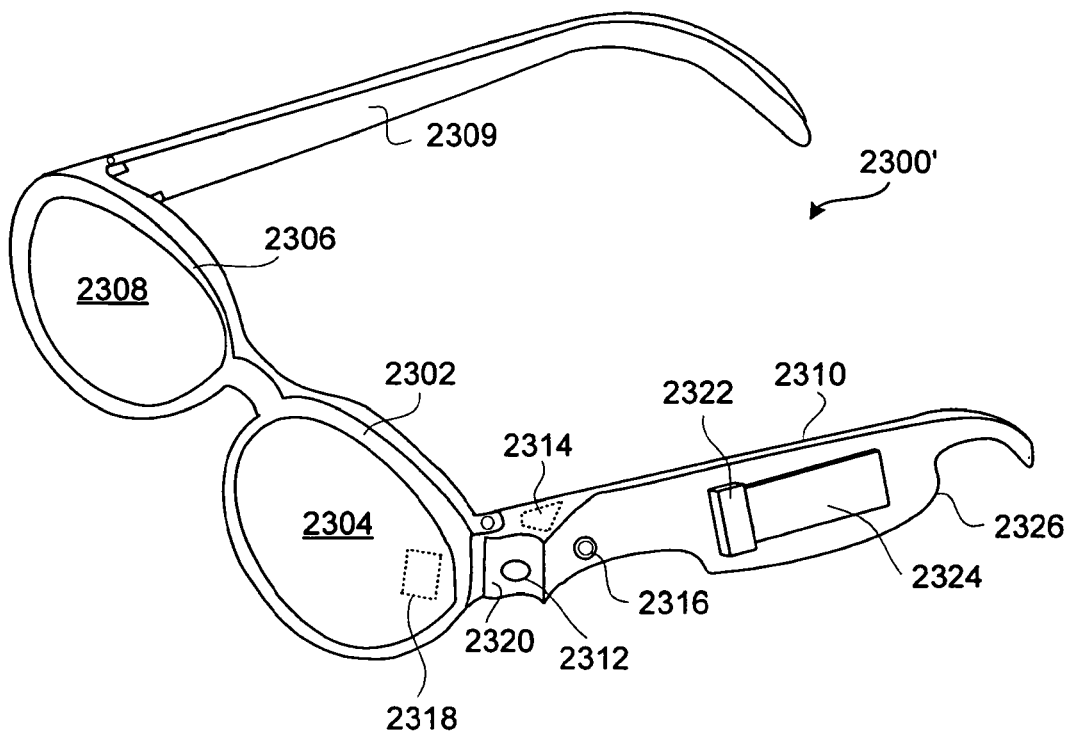


FIG. 23B

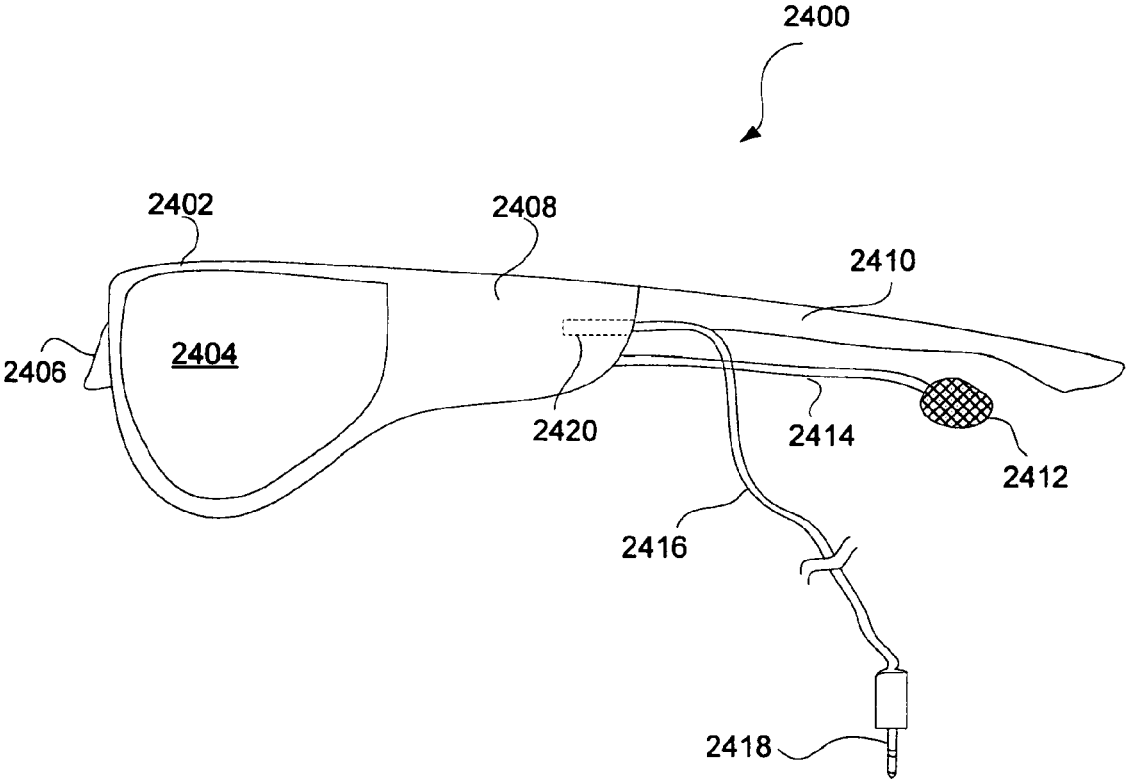


FIG. 24

EYEWEAR WITH PRINTED CIRCUIT BOARD**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a continuation of U.S. patent application Ser. No. 12/803,732, filed Jul. 1, 2010, now U.S. Pat. No. 8,434,863, and entitled "EYEGLASSES WITH A PRINTED CIRCUIT BOARD" which is hereby incorporated herein by reference, which in turn is a continuation of U.S. patent application Ser. No. 11/546,685, filed Oct. 11, 2006, now U.S. Pat. No. 7,806,525, and entitled "EYEGLASSES HAVING A CAMERA" which is hereby incorporated herein by reference, which in turn is a continuation-in-part of U.S. patent application Ser. No. 11/183,256, filed Jul. 15, 2005, now U.S. Pat. No. 7,500,747, and entitled "EYEGLASSES WITH ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference, which in turn is a continuation-in-part of U.S. patent application Ser. No. 10/964,011, filed Oct. 12, 2004, now U.S. Pat. No. 7,192,136, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference, which in turn claims priority to each of: (i) U.S. Provisional Patent Application No. 60/509,631, filed Oct. 9, 2003, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/527,565, filed Dec. 8, 2003, and entitled "ADAPTABLE COMMUNICATION TECHNIQUES FOR ELECTRONIC DEVICES," which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/562,798, filed Apr. 15, 2004, entitled "EYEWEAR WITH ULTRAVIOLET DETECTION SYSTEM," and which is hereby incorporated herein by reference; (iv) U.S. Provisional Patent Application No. 60/583,169, filed Jun. 26, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference; (v) U.S. Provisional Patent Application No. 60/592,045, filed Jul. 28, 2004, entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," and which is hereby incorporated herein by reference; and (vi) U.S. Provisional Patent Application No. 60/605,191, filed Aug. 28, 2004, entitled "ELECTRICAL COMPONENTS FOR USE WITH EYEWEAR, AND METHODS THEREFOR," and which is hereby incorporated herein by reference.

U.S. patent application Ser. No. 11/183,256 also claims priority to each of: (i) U.S. Provisional Patent Application No. 60/618,107, filed Oct. 12, 2004, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/620,238, filed Oct. 18, 2004, entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," and which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/647,836, filed Jan. 31, 2005, and entitled "EYEGLASSES WITH HEART RATE MONITOR," which is hereby incorporated herein by reference; and (iv) U.S. Provisional Patent Application No. 60/647,826, filed Jan. 31, 2005, and entitled "EYEWEAR WITH ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference.

U.S. patent application Ser. No. 11/546,685 also claims priority to each of: (i) U.S. Provisional Patent Application

No. 60/725,896, filed Oct. 11, 2005, and entitled "EYEGLASSES WITH ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference; (ii) U.S. Provisional Patent Application No. 60/725,999, filed Oct. 11, 2005, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference; (iii) U.S. Provisional Patent Application No. 60/787,850, filed Apr. 1, 2006, and entitled "EYEGLASSES WITH A HEART RATE MONITOR," which is hereby incorporated herein by reference; and (iv) U.S. Provisional Patent Application No. 60/846,150, filed Sep. 20, 2006, and entitled "EYEGLASSES WITH ACTIVITY MONITORING," which is hereby incorporated herein by reference.

In addition, this application is related to each of: (i) U.S. patent application Ser. No. 10/822,218, now U.S. Pat. No. 7,792,552, filed Apr. 12, 2004, and entitled "EYEGLASSES FOR WIRELESS COMMUNICATIONS," which is hereby incorporated herein by reference; (ii) U.S. patent application Ser. No. 10/964,011, filed Oct. 12, 2004 now U.S. Pat. No. 7,192,136, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYEGLASSES," which is hereby incorporated herein by reference; (iii) U.S. patent application Ser. No. 11/006,343, filed Dec. 7, 2004 now U.S. Pat. No. 7,116,976, and entitled "ADAPTABLE COMMUNICATION TECHNIQUES FOR ELECTRONIC DEVICES," which is hereby incorporated herein by reference; (iv) U.S. patent application Ser. No. 11/078,855, filed Mar. 11, 2005 now U.S. Pat. No. 7,500,746, and entitled "EYEWEAR WITH RADIATION DETECTION SYSTEM," which is hereby incorporated herein by reference; (v) U.S. patent application Ser. No. 11/078,857, filed Mar. 11, 2005, and entitled "RADIATION MONITORING SYSTEM," which is hereby incorporated herein by reference; (vi) U.S. patent application Ser. No. 11/183,269, filed Jul. 15, 2005 now U.S. Pat. No. 7,380,936, and entitled "EYEWEAR SUPPORTING AFTER-MARKET ELECTRICAL COMPONENTS," which is hereby incorporated herein by reference; (vii) U.S. patent application Ser. No. 11/183,283, filed Jul. 15, 2005, and entitled "EVENT EYEGLASSES," which is hereby incorporated herein by reference; (viii) U.S. patent application Ser. No. 11/183,262, filed Jul. 15, 2005, and entitled "EYEGLASSES WITH HEARING ENHANCED AND OTHER AUDIO SIGNAL-GENERATING CAPABILITIES," which is hereby incorporated herein by reference; (ix) U.S. patent application Ser. No. 11/183,263, filed Jul. 15, 2005 now U.S. Pat. No. 7,380,936, and entitled "EYEGLASSES WITH A CLOCK OR OTHER ELECTRICAL COMPONENT," which is hereby incorporated herein by reference; (x) U.S. patent application Ser. No. 11/183,276, filed Jul. 15, 2005 now U.S. Pat. No. 7,255,437, and entitled "EYEGLASSES WITH ACTIVITY MONITORING," which is hereby incorporated herein by reference; and (xi) U.S. patent application Ser. No. 11/580,222, filed Oct. 11, 2006 now U.S. Pat. No. 7,581,833, and entitled "EYEGLASSES SUPPORTING AFTER MARKET ELECTRICAL COMPONENTS", which is hereby incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates generally to glasses and more particularly to glasses utilizing electrical components.

BACKGROUND OF THE INVENTION

Many of us have experienced the inconvenience of trying to listen to a piece of music from a portable device in an

outdoor environment, particularly in cold weather. First, we remove the device from inside our jacket. Then, we take off our gloves to find the right song, connect the device to a headset, and put on the headset. After we have finished listening, we go through the process again to put the device back into our jacket. To a certain degree, we are somewhat used to such procedures. However, to look at this objectively, going through the multi-step process just to listen to a piece of music is cumbersome. Such inconvenient procedures are not limited to hearing music. For example, it may not be much easier for us to use the cell phones or cameras and the like.

It should be apparent from the foregoing that there is still a need to increase the ease of handling electronic devices.

SUMMARY OF THE INVENTION

In one embodiment, an eyeglass frame includes a lens holder, a first temple with a first end close to the lens holder and a second end further away, a second temple, an electrical connector and a printed circuit board. The printed circuit board with at least one electrical component attached thereon can be provided in the first temple. The connector can be provided close to the first end of the first temple, facing downward, and configured to be electrically connected to the at least one electrical component.

In another embodiment, an eyeglass frame includes a first printed circuit board with at least one electrical component. The first printed circuit board can be connected to an electrical component at the frame via a second printed circuit board.

Other aspects and advantages of the present invention will become apparent from the following detailed description, which, when taken in conjunction with the accompanying drawings, illustrates by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows one embodiment of the invention with a speaker in one of the temples of the glasses.

FIG. 2 shows a tube extending from a speaker at a temple of the glasses to guide sound to one of the ears of the user according to one embodiment of the invention.

FIG. 3 shows a retractable tube extending from a speaker at a temple of the glasses according to one embodiment of the invention.

FIG. 4 shows a funnel at the output of a speaker in the glasses according to one embodiment of the invention.

FIG. 5 shows a male connector at the end of a temple according to one embodiment of the invention.

FIGS. 6A-6B illustrate a process to make a non-standard female plug couple to a male connector at a pair of glasses according to one embodiment of the invention.

FIG. 7 illustrates another non-standard connector, applicable to clamp onto a temple of a pair of glasses according to an embodiment of the invention.

FIGS. 8A-8E shows different embodiments of standard connectors located at different positions on the temple of a pair of glasses according to the invention.

FIGS. 8F-8H are diagrams pertaining to providing a removable electronic device with an eyeglass frame according to one embodiment of the invention.

FIG. 8I is a diagram of a temple of an eyeglass frame according to another embodiment of the invention.

FIG. 9 shows some of the electrical components for a MP3 player according to an embodiment of the invention.

FIG. 10 shows an embodiment of the invention where a user is wearing a pair of glasses with electrical components, tethered to a base, which is connected to a portable device.

FIGS. 11A-11B show different embodiments of the present invention illustrating some of the electrical components for wireless connections to a pair of glasses.

FIG. 12 shows a process for a personalized radio according to one embodiment of the present invention.

FIG. 13 shows a number of attributes of control knobs according to different embodiments of the present invention.

FIG. 14 shows some of the electrical components for capturing images with a pair of glasses according to an embodiment of the present invention.

FIG. 15 shows an operation of taking actions based on images captured with a pair of glasses with wireless transceiver capability according to one embodiment of the invention.

FIG. 16 shows an operation to provide messages to a user based on images captured by a pair of glasses according to an embodiment of the present invention.

FIG. 17A is a chart that depicts examples of sensors in a pair of glasses according to different embodiments of the present invention.

FIG. 17B is a diagram of a temple arrangement according to one embodiment of the invention.

FIG. 17C is a diagram of a cover that at least partially covers a temple according to one embodiment of the invention.

FIG. 17D is a diagram of a fit-over temple that at least partially fits over a temple according to one embodiment of the invention.

FIG. 18 shows an embodiment including an eye mask according to the invention.

FIG. 19 shows an embodiment including a night cap according to the invention.

FIG. 20A is a diagram illustrating a temple having a slot for receiving a removable electronic device according to one embodiment of the invention.

FIG. 20B is a diagram illustrating the temple having a recessed lower portion according to another embodiment of the invention.

FIGS. 21A and 21B are diagrams illustrating a pair of glasses having a camera coupled thereto, according to one embodiment.

FIG. 22 is a diagram of a pair of glasses having a camera according to one embodiment of the invention.

FIG. 23A is a diagram of a pair of glasses having a camera according to one embodiment of the invention.

FIG. 23B is a diagram of the pair of glasses according to another embodiment.

FIG. 24 is a side view of a pair of eyeglasses according to another embodiment of the invention.

Same numerals in FIGS. 1-24 are assigned to similar elements in all the figures. Embodiments of the invention are discussed below with reference to FIGS. 1-24. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to these figures is for explanatory purposes as the invention extends beyond these limited embodiments.

DETAILED DESCRIPTION OF THE INVENTION

A number of embodiments according to the present invention regarding glasses with one or more electrical components attached, partially embedded or fully embedded are described. Many of them are applicable to different types of

glasses, such as sunglasses, auxiliary frames, fit-over glasses, prescription glasses, safety glasses, swim masks, and goggles, such as ski goggles. In a number of embodiments, the frames of the glasses have more surface area than frames with minimal structure. For example, the temple regions of the glasses can have a tapered profile. They are wider or broader when they are closer to the lens holders. Then they get narrower. In one embodiment, a wider or broader temple implies that the temple spans across a wider or broader area longitudinally down from the top of the head of the user. FIG. 1 shows an example of such an embodiment.

FIG. 1 shows one embodiment **100** of the invention where there is a speaker **102** at least partially embedded in one of the temples **104** of the glasses **106**. The speaker **102** is closer to one end of the temple **104** than the other end. The end of the temple that the speaker **102** is closer to is the end that is in the vicinity of the lens holder or the hinge of the glasses **106**, instead of the end **108** that is free. The speaker can be partially embedded in the glasses. For example, the mouth of the speaker, where sometimes there can be small holes on a cover, can be exposed.

In the embodiment shown in FIG. 1, the speaker **102** outputs audio signals in the direction towards the user. In another embodiment, the speaker **102** outputs audio signals in the direction away from the user. For example, the mouth of the speaker **102** can be facing outwards away from the user.

There are different approaches to embed an electrical component into a pair of glasses. For example, the glasses can be made of plastic (e.g., plastic frames). One way to produce such frames is to first assemble electrical components onto a circuit board. The circuit board can be shaped to fit, for example, the temple of the glasses. The circuit board is placed into a mold. Then, hot, molten plastic is injected around the circuit board to form the temple piece of the glasses. To reduce weight, the wall of the glasses can be made relatively thin through injection molding techniques.

In another embodiment, the glasses have metallic frames. For example, the frames can be made of Titanium, which is a relatively light metal. Also, Titanium is relatively non-conductive and strong, and is quite immune to corrosion. Further, Titanium can be anodized or heat colored.

For glasses with metallic frames, to prevent circuits from being shorted or to reduce leakage current, one embodiment provides an insulating layer between the electrical components or circuit board and the metallic frames. One example of an insulating layer is a tape to encapsulate the electrical components. The tape is non-conducting so as to provide insulation and, to a certain degree, can also provide mechanical stiffness. One way to make such temples is to have two sheets of the metal die-stamped to form the two halves, or the two faces of the temple piece. A circuit board is made to fit into the space between the faces. Then, two die-cut pieces of insulator material (e.g., dielectric tape) can cover the top and the bottom surfaces of the circuit board. The board is then sandwiched between the faces to form the temple. In one example, the dielectric tape can be double-sided sticky tape, with one side sticking to the circuit board, and the other side sticking to the temple. An adhesive can be used to glue the two faces of the temple piece together.

In yet another embodiment, the frames are made of hard rubber. The frames can be manufactured in an approach similar to injection molding techniques, with circuit boards inserted into the mold along with the rubber at the time of molding.

Different types of speakers can be used, such as, standard, fixed-magnet/moving coil speakers; speakers with fixed-coil and a steel diaphragm; piezoelectric speakers; and electrostatic speakers.

In one embodiment, the glasses further include a tube, such as a plastic tube, extending from a speaker. The tube serves to guide sound generated by the speaker to one of the ears of the user. FIG. 2 shows an embodiment where a tube **150** is located on the outside of a temple **152**. In another embodiment, the tube can be on the inside of a temple.

In one embodiment, the tube **150** can be rotated, such as from behind the temple **152** (if the tube is on the inside of the temple) to being downward at an angle towards one of the ears of the user, such as the position shown in FIG. 2. To increase flexibility, the tube can be attached to a rotating disk **154**, which allows rotation about the speaker.

In another embodiment, the tube is malleable. This allows the tube to be placed in different positions.

In one embodiment, the length of the tube is adjustable. FIG. 3 shows such an embodiment **200** of a pair of glasses with a retractable tube **202**. In the figure, the tube is shown to be in its extended position.

To further enhance sound coupling, in one approach, there is a plug **156** at the end of the tube for inserting into an ear of the user. The plug can be an ear bud. The plug can provide a cushion, foam rubber or other materials. Such materials give comfort and/or enhance sound coupling to the ear canal.

In another approach, there is a funnel at the output of the speaker. FIG. 4 shows the cross section of such a funnel from a speaker at a temple region of the glasses. As shown in FIG. 4, the speaker **254** sits on a speaker frame **252**, and the speaker **254** is electrically connected to a circuit board **256**. As sound is generated from the speaker **254**, the sound propagates to a tube **258** through a structure **260** in the shape of a funnel. Such a structure helps guide the sound to the tube (i.e., improved sound coupling). Also, FIG. 4 shows the tube, which can be the tube **150** shown in FIG. 2, mounted onto the temple region of the glasses with a circular lip **262**. Such a lip **262** allows the tube **258** to rotate relative to the glasses. In the embodiment shown in FIG. 4, the speaker **254** is fully embedded in the glasses.

As an alternative to or in conjunction with the tube, the glasses can include a channel to likewise guide sound generated by the speaker to one of the ears of the user. For example, the channel can be formed within a temple. The temple also has an opening to output the sound towards the user's ear.

FIG. 1 shows one speaker at one of the temples. There can be more than one speaker at each temple. In one embodiment, there can also be at least one speaker at each temple. The two speakers can generate stereo effects.

In another embodiment, the glasses can provide four or more speakers to give a high fidelity sound or a surround sound effect. For example, each temple can include one speaker in front of the user's ear, and one speaker behind the user's ear. The different speakers can generate different portions or sections of the sound. Further, if a base (discussed below) or portable electronic device is coupled to the glasses, the base or portable electronic device can contain another speaker, such as a base or woofer speaker. Such embodiments enable the glasses to provide a personal high-fidelity sound or a surround-sound environment.

Electrical signals can be coupled to an electrical component, such as a speaker, in a pair of glasses through a number of mechanisms. In one embodiment, there is an electrical connector at least partially embedded in the glasses. In other words, at least a portion of the connector is inside the

glasses. The connector is electrically coupled to the speaker (or other electrical component) by, for example, a conductor. The conductor can be on a printed-circuit board. In one embodiment, the conductor is also embedded in the glasses.

Regarding connectors, FIG. 5 shows one embodiment where the connector is not a standard connector. The end 108 of the temple 104 of the glasses 106 shown in FIG. 1 has a similar connector. In FIG. 5, the connector is a male plug or a male connector 300 at the end of a temple 302 of a pair of glasses. The connector 300 is connected to the speaker through, for example, one or more wires embedded in the temple. Electrical signals external to the glasses can then be coupled to the speaker (or other electrical component) through the plug.

As shown in FIG. 5, the free end of the temple 302 can have a relatively flat cross section. There can be one or more electrically-conductive contacts, such as 304 and 306, on one or both of the flat surfaces of the temple. In FIG. 5, four contacts are shown on one surface of the temple. The contacts, 304 and 306, can be metal pads or bumps.

In one embodiment, a non-standard connector can be made using printed-circuit board technologies. First, a printed-circuit board with printed conductors connected to metal contact bumps is produced. Then plastic is overmolded around the printed-circuit board, with the mold designed to shut off around the bumps or pads. The overmolded plastic can serve as the temple, and the pads would be left exposed. Thus, portions of the printed circuit board are covered by plastic, and areas with the bumps or pads are exposed for connection. These pads serve as the connectors for the glasses.

Regarding printed-circuit boards, there can be one or more circuit boards in the glasses. For example, there can be a circuit board in one of the temples of the glasses. Or, the circuits can be divided into two circuit boards, one in each temple of the glasses. The circuit boards can carry additional electrical components to be described below.

In one embodiment, the circuit boards are rigid. In another embodiment, the circuit boards are made of flexible materials, such as a polyimide sheet, like Kapton®. In one embodiment, the circuit board is configured or adapts to the shape of the temple in which it resides.

As shown in FIG. 5, the end of the temple 302 serves as a male connector (plug) 300. The non-standard male connector 300 can be received by a non-standard female connector (plug) 310. Typically, the female connector 310 makes electrical and physical connection through grabbing around the male plug. The female connector 310 can be connected to a cable 312.

FIGS. 6A-6B illustrate a process to make the non-standard female plug 310. First, an electrical wire 354 is attached to a small sheet or piece of metal 356. FIG. 6A shows a number of such wires, with a number of the metal sheets or pieces crimped to a hard PVC 358. The figure shows the back side of the crimped board with the wires and with a number of holes, such as 360. Then the frame is overmolded with a soft PVC. FIG. 6B shows a cross section of the overmolded frame 362 with the soft PVC. As shown in the figure, a number of the metal sheets, such as 364 and 366, are exposed. They are the metal contacts in the female connector 310. Instead of the above approach, alternatively, a wire can be attached to a sheet of metal by putting the wire between the metal and the plastic as the metal is crimped onto a plastic. When the temple (i.e., male connector 300) is inserted into the female plug, the soft PVC material stretches slightly, providing a spring-force to keep the contacts connected.

The hard PVC can have a hardness of over 80 durometer, while the soft PVC can have a hardness of less than 50 durometer. The hard PVC can be replaced by other materials, such as Polypropylene or cloth. The soft PVC can be replaced by Silicone, or a thermo-plastic elastomer, such as Kraton®.

Referring to both FIG. 5 and FIG. 6B, when the male connector 300 is inserted into the slot 314 of the female connector 310, the metal pads, 304 and 306, will get in contact, or mate, with the metal sheets, 364 and 366.

In one embodiment, as long as the male connector 300 is pushed all the way into the female connector 310, the pads are aligned correctly to the sheets for electrical connections. In another embodiment, there is an alignment mechanism to guide the position of the temple relative to the female connector so as to ensure the conductive sheets to be in contact with the conductive pads. For example, there can be a registration location to indicate that the male connector is at the appropriate position relative to the female connector. There can be an alignment extension, which can be a partial sphere, close to the end of the temple 302, such as between the pads 304 and 306, at 316. And, there can be a corresponding alignment notch at the female connector 310. When the extension is received or caught by the notch, the male connector 300 is in the appropriate position relative to the female connector 310. In other words, the alignment is proper, and the pads and the sheets are in contact.

FIG. 5 shows the non-standard male connector 300 at one end of a temple of a pair of glasses. In yet another embodiment, a non-standard connector can be at another location. FIG. 7 shows another example of a non-standard connector 400. The connector 400 includes one or more conductive pads, 412 and 414, on the top side of a temple 402. The connector 400 is designed to receive another connector 406 that grabs onto the side of the temple 402. There can be an indentation 404 on the temple 402 to receive the other connector 406. The other connector 406 can include a top 420 and a bottom 416 clip. There are a number of conductive pads or sheets inside the other connector 406. The indentation 404 provides an alignment to indicate where the top clip 420 of the other connector 406 should grab onto the temple 402 for connection. At that position, the conductive pads or sheets at the other connector 406. There can also be another indentation 418 at the temple 402 to receive the bottom clip 416. This can further enhance the alignment process and to secure the connection.

In FIG. 7, the other connector 406 is coupled to one end of a cord and a plug 408, which can be inserted into a portable device 410, can be connected to another end of the cord. The portable device, for example, can be a cell phone. This type of non-standard clip-type connector could be easily applied to the temple with one hand, for example, while the user is driving a car.

A number of non-standard connectors have been described. In another embodiment, the contacts are based on standard connectors, which can be off-the-shelf connectors. FIGS. 8A-8E show a number of examples of such connectors.

In one embodiment, the standard connector is a standard cylindrical plug located at the end of a temple. From a different perspective, the temple molds around the end of the plug. FIG. 8A shows one such embodiment. The plug 450 can be a standard audio connector or a 3-wire or three terminal plug, such as a 3.5 mm male stereo mini-phone plug. The 3 wires for such a plug are typically one for ground, the other two applicable for two signals, such as for

creating stereo effects. FIG. 8A also shows the three wires, 452, 454 and 456, inside the temple, extended from the plug 450. These wires are for connection to electrical components of the glasses.

In one embodiment, the cylindrical plug 450 shown in FIG. 8A can be protected, encapsulated or shrouded. Or, at least a portion of the plug is protected, encapsulated or shrouded. Such protection can, for example, be for aesthetic reasons, or to prevent the plug from scratching the face of the user when the user is putting on the pair of glasses. In FIG. 8A, the plug 450 is partially embedded in a temple.

Instead of a three terminal plug, other types of standard cylindrical plugs applicable to different embodiments of the present invention include a serial connector with 3 pins, typically one for ground, one for transmitting data (Tx) and the third for receiving data (Rx); or (b) a 2-wire connector, one served as ground, the other for carrying, such as power and modulated signals.

In yet another embodiment, instead of a cylindrical plug, the standard connector at the end of a temple of a pair of glasses is a USB or a FIREWIRE connector.

A number of embodiments have been described where the standard connector(s) at the glasses are male connectors. In yet another embodiment, the standard connector(s) in the glasses are female connectors. For example, there can be a 3.5 mm female stereo mini-phone plug at the end of a temple of a pair of glasses. At least a portion of the female connector can be protected, encapsulated or shrouded. For example, the female connector can be recessed within the end of a temple.

FIGS. 8B-8E show different examples of standard connectors located or partially embedded not at the end of a temple of a pair of glasses, but, for example, on the side of the temple, such as on the inside surface or the outside surface of a temple. FIG. 8B shows a 0.10" header plug 460, commonly known as a MOLEX connector, on such a surface. FIG. 8C shows a female mini-phone plug 465 on such a surface. FIG. 8D shows a card connector 470 to receive a card 472, such as a removable media card (e.g., memory card). There can be a cover 474 to secure and/or protect the media card 472 in place after it is inserted into the card connector 470. FIG. 8E shows a female USB connector 480 on the inside surface of a temple 482 to receive a male USB connector 484.

FIGS. 8F-8H are diagrams pertaining to providing a removable electronic device with an eyeglass frame according to one embodiment of the invention. FIG. 8F illustrates a temple 490 that includes a connector 492. The connector 492 includes an opening 494. A removable electronic device can be coupled to the temple 490 using the connector 492. More particularly, FIG. 8G illustrates a removable electronic device 496 that includes an electronic device housing 498 and a connector 499. As an example, the removable electronic device 496 can be a memory storage device, sometimes referred to as a memory card. FIG. 8H illustrates the removable electronic device 496 coupled to the temple 490. The removable electronic device 496 is coupled to one side of the temple 490, such side can be either an inside or outside surface of the eyeglass frame. When the removable electronic device 496 is coupled to the temple 490, the connector 499 of the removable electronic device 496 is inserted into the opening 494 of the connector 492. Physical forces between the connector 499 and the connector 492 operate to secure the removable electronic device 496 to the temple 490, yet permit the removable electronic device 496 to be removable therefrom.

In one embodiment, the connector 492 is not electrically connected to any electronic circuitry within the temple 490 or other parts of the eyeglass frame. In other words, the connector 492 provides a convenient means by which removable electronic devices can be coupled to the eyeglass frame. In another embodiment, the connector 492 can be coupled to electrical circuitry within the temple 490 or elsewhere within the eyeglass frame. Such an embodiment allows the electronic components within the removable electronic device 496 to be utilized with the electrical circuitry within the temple 490 or elsewhere within the eyeglass frame. For example, the removable electronic device 496 can provide data storage and/or other software modules to be utilized by or to utilize the other electrical circuitry within the temple 490 or elsewhere within the eyeglass frame. In any case, by attaching the removable electronic device 496 to the temple 490 (and thus the eyeglass frame), the removable electronic device 496 is able to be conveniently carried by the user of the eyeglass frame. In one implementation, the eyeglass frame, which includes the connector 492, becomes a docking station for the removable electronic device 496. As such, a variety of different removable electronic devices can be interconnected with the eyeglass frame, as desired. For example, the eyeglass frame can thus support different function or operations depending on the removable electronic device that is attached. For example, the eyeglass frame might operate as a camera, data storage device, FM radio, MP3 player, mobile telephone, pedometer, hearing enhancer, sun sensor, time piece, etc.

In one embodiment, the removable electronic device 496 can align itself with the orientation of the temple 490, such as shown in FIG. 8H. In FIG. 8G, the electronic device housing 498 can be said to have an elongated housing. The configuration (e.g., shape) and/or color of the removable electronic device 496 can also be designed to conform or complement the design of the temple 490. In one embodiment, the temple 490 might also have a recessed region to allow the portable electronic device to be less visually perceptible when attached to the temple 490 or to provide a more consistent contour of the temple 490.

In one embodiment, the connector 499 is a male connector, and the connector 492 is a female connector or a similarly sized structure. In one implementation the connector 499 is a peripheral bus connector, such as a Universal Serial Bus (USB) connector. In such cases, the connector 492 can also be a peripheral bus connector (either electrically functional or non-functional as noted above).

Although the embodiment illustrated in FIGS. 8F-8H utilize connectors, namely, electrical connectors, the removable electronic device 496 could be attached to the temple in other ways. For example, other means to provide physical forces to hold the removable electronic device 496 in place can be used.

FIG. 8I is a diagram of a temple of an eyeglass frame according to another embodiment of the invention. In this embodiment, the temple 490' includes an opening 491 through which a cable 493 extends outward. The cable 493 has an electrical connector 495 connected at its end. The electrical connector 495 is electrically connected to electrical circuits within the temple 490' or elsewhere within the eyeglass frame such as by way of one or more wires contained within the cable 493. In one implementation, the length of the cable 493 is about one to four inches. The temple 490' shown in FIG. 8I also includes a receptacle 497. The receptacle 497 is affixed to or integral with the temple 490' to receive the electrical connector 495. Typically, the receptacle 497 provides a holding mechanism for the elec-

trical connector **495** when not been utilized. When the electrical connector **495** is being utilized, the electrical connector **495** is removed from the receptacle **497** and coupled to a corresponding counterpart connector of another electrical device. The cord **493** can provide ease-of-use so that the electrical connector **495** can be maneuvered to couple to the counterpart connector. In one embodiment, the temple **490'** can provide a recess for receiving the entire cable **493**, with the outer surface of the receptacle **497** being substantially flush to the surface of the temple **490**. So when the connector **495** is not in use, the connector **495** can be in the receptacle **497**, with the cable **493** in the recess. In one embodiment, when the cable **493** is in the recess and the connector **495** inside the receptacle **497**, the cable **493** has substantially no slack. Also, in another embodiment, the cable **493** can be retractable into the opening **491**. In the embodiment shown in FIG. **8I**, the electrical connector **495** is a male connector, and the receptacle **497** is a female connector or a similarly sized structure.

A number of standard and non-standard connectors have been described. Other types of connectors can also be used. In one embodiment, there is a connector adapter, which serves to transform such other type of connectors to a different interface. For example, an adapter can be a cord with one type of connector at one end and a different type of connector at the other end.

In one or more of the above embodiments, the glasses can access audio signals from another device through a connector at the glasses. The another device can be a multimedia asset player or a radio.

In one embodiment of the invention, the glasses have a storage medium (i.e., memory). The memory can be on a printed-circuit board and, for example, store 256 MBs or more. The memory can be a built-in or removable flash memory. The memory can be coupled to a device external to the glasses through one or more connectors at the glasses. As an example, a 256 MB flash memory is in one of the temples of a pair of glasses, and there is a USB connector at the free end of that temple to couple to an external device.

With the embedded storage medium, the glasses can upload information in the memory to or download information into the memory from an external device, such as a computer. A user can plug the glasses into the computer through a connector, either directly, or indirectly, with, for example, an intermediate wire in between. The user can store files in the glasses. Such an embodiment should reduce the chances of the user losing the files because the user has to lose the glasses as well.

In yet another embodiment of the invention, a pair of glasses includes a multimedia asset player, such as a MP3 player. FIG. **9** shows some of the electrical components for a MP3 player **500** according to an embodiment of the invention. The player **500** includes a speaker **502** and a data bus **512**, which facilitates data transfer among, for example, a processor **506**, a storage device **510**, and a coder/decoder (CODEC) **504**. The processor **506**, which can be a micro-processor or controller, controls the operation of the player **500**. The storage device **510** stores the multimedia assets, such as MP3 files, or other types of media data that are appropriately formatted. In one example, the MP3 files are digitally encoded songs or other types of audio signals. The storage device **510** can include a number of separate storage elements. For example, the device **510** can be a flash memory device, or a minidisk device, and a cache, which can improve the access time and reduce power consumption of the storage device. The storage device **510** typically also includes a Read-Only Memory (ROM), which stores pro-

grams, utilities or processes to be executed in a non-volatile manner. The player **500** can also include a RAM, such as for the cache.

Once a media asset, such as a song, is selected to be played, the processor **506** would supply the asset to the CODEC **504**, which decompresses the asset and produces analog output signals for the speaker **502**. In one embodiment, the bus **512** is also coupled to an input/output device **508**, which would allow a user to upload songs in the glasses to an external instrument, such as a computer, or download songs from the instrument to the glasses.

There are different approaches to select a song. In one embodiment, the songs or the media assets can be categorized in the MP3 player, and the categorization can be hierarchical, with multiple levels in the hierarchy. To illustrate, assume that there are three levels. The top level can be the name of the singer; the second level can be the time period when the asset was produced, and the third level can be the names of the songs. The entries, such as the name of the singer, can be abbreviated. There can be a small display and a control knob to allow a user to scroll down entries in a level. By pushing the knob, the user selects an entry, which can lead the user to a lower level. There can be an entry for moving up a level also. In another embodiment, the display is a touch-screen display, allowing entries to be entered directly on the display. In yet another embodiment, entries can be selected based on voice recognition.

A number of embodiments have been described with the glasses having a connector. In one embodiment, the glasses can have more than one connector. For example, a pair of glasses with two connectors also has a speaker. One connector is, for example, at a broad side of a temple, as in FIG. **8D**. The connector can be for coupling to multimedia assets of a MP3 player. Another connector is, for example, at the end of a temple, as in FIG. **8A**. That connector can couple power to the glasses. The speaker can play the multimedia assets accessed from one connector, based on power from another connector.

As described, power (e.g., external power source) can be coupled to the glasses through a connector. In one embodiment, the power source is embedded inside or inserted into the glasses. Different types of power sources are applicable. For example, the power source can be a battery, a fuel cell, a solar cell, or a re-chargeable battery. The rechargeable battery can be charged through a connector at the glasses.

In an earlier application, namely, U.S. Provisional Patent Application No. 60/509,631, filed Oct. 9, 2003, and entitled "TETHERED ELECTRICAL COMPONENTS FOR EYE-GLASSES," which has been incorporated herein by reference, there can be a base connected to the glasses through a cord. The cord can be just a piece of flexible conductor encapsulated by a flexible insulator. Typically, a cord includes a number of electrical wires or conductors. There can be one or more electrical components in the base, and there can also be one or more electrical components in the cord. The different types of connectors previously described can be located in the base. In one embodiment, a power source is an electrical component in the base tethered to a pair of glasses. In another embodiment, the glasses are tethered to a base that has a connector. The connector is connected to and draws power from an external electronic device. In this embodiment, electrical components in the glasses draw power from the external electronic devices.

FIG. **10** shows an embodiment where a user **550** is wearing a pair of glasses **552**, which include electrical components. There are also tethered electrical components in a base **554**, which is connected to the glasses **552** through

a cord **556**. In addition, there is a wire **558** connected to a connector at the base **554** to a portable electronic device **560**. The portable device **560** can be (a) a multimedia device, such as a MP3 player/recorder or a minidisk players, (b) a wireless communication device, such as a cell phone, or (c) a personal digital assistant, or other types of portable devices with computing and/or entertaining and/or communication capabilities.

Note that instead of connecting to the portable electronic device **560** through the base **554**, in another embodiment, the glasses **552** directly connect to the portable device **560** through a cord.

In one embodiment, there is an attachment device **562**, such as a pin or clip. The attachment device attaches at least a part of the glasses to the user's clothing. The attachment device **562** can serve to attach the cord **556** and/or the wire **558** and/or the base **554** to the user's clothing. The attachment can also be through other mechanisms, such as Velcro.

In a number of embodiments, the speaker described is assumed to emit audio signals. In one embodiment, the speaker emits ultrasonic signals. The glasses can be used, for example, as an insect repellent by transmitting ultrasound to repel insects, such as mosquitoes. In this embodiment, the one or more speakers broadcast the ultrasonic signals away from the user. In other words, the speakers face outwards, not inwards towards the user. In this embodiment, the glasses, which can include a base, also has a power source to provide power to the speaker. There can also be a control knob to turn the one or more speakers on/off on the glasses. There will be additional discussions on the control knob below.

In another embodiment, the glasses generating ultrasonic signals can be used to produce audio signals that are more directional. For example, two ultrasonic signals are generated by a speaker in the glasses, with their difference frequencies being the audio signals. The audio signals generated based on mixing the two ultrasonic signals can be much more directional than audio signals directly generated from the speaker.

Referring back to FIG. 1, in one embodiment, the glasses include a microphone **110**. The microphone **110** can be at the end of a temple **104** close to a lens holder **112**. Or, the microphone **110** can be in the lens holder **112**, located directly adjacent to the temple **104**. In yet another embodiment, there can be a small protrusion extending down from the temple to house the microphone.

With glasses having a microphone, one can use the glasses to record voices into, for example, a storage medium. The storage medium can be in the glasses, or can be in a base or a portable device attached to the glasses.

Different types of microphones can be used. For example, they can be electret microphones, crystal microphones, resistance microphones, piezoelectric microphones or moving-coil microphones.

In one embodiment, the glasses with a microphone also include a speaker that can generate directional sound. A user can speak into the microphone and his message can be transmitted from the glasses in a more directional manner.

In another embodiment, the glasses also include a notification electrical component to provide a notification to the user wearing the glasses. The notification can be to notify, alert or display information to the user. There can be a display located at the inside **114** of the lens holder, or at the vicinity of the junction **116** or the hinge of a lens holder and its corresponding temple facing the user. Or, there can be a display at the inside surface of a temple, or at other locations on the glasses. The display can be one or more light emitting

diodes. To alert the user, one or more diodes can blink. The blinking can be of a specific sequence. Instead of diodes, the display can be a liquid crystal display. The display can provide indications or information to the user. For example, a number or a variable-height bar can be shown. Other than visual indications, the notification or alert can be audio, like a beeper.

In one embodiment, the notification electrical component is for selecting a multimedia asset in a multimedia asset player in a pair of glasses for the multimedia to play. The multimedia asset player can be a MP3 player.

A number of embodiments of the present invention have been described where electrical signals are transmitted to or from a pair of glasses through a physical connection. In one embodiment, electrical signals are wirelessly coupled to a pair of glasses. The coupling can be short range or long range. The coupling can be directly to the glasses, or to a base connected to a pair of glasses. The glasses with wireless coupling capabilities can be used to couple to a Bluetooth network, the Internet, a WiFi network, a WiMax network, a cell-phone network or other types of networks. The coupling can also be through a point-to-point link, such as an infrared link. In different embodiments, the glasses provide wireless communication capability for its user. In this regard, the glasses contain wireless communications circuitry that enables the eyeglasses to communicate in a wireless manner, to, for example, a wireless communication device (e.g. mobile telephone), a portable computing device (e.g. Personal Digital Assistant (PDA), handheld computer or wearable computer), or an entertainment device (e.g., stereo system, television, media player (portable or stationary)).

FIGS. **11A-11B** show examples of some of the electrical components in or tethered to a pair of glasses for wireless connections, according to embodiments of the present invention. In FIG. **11A**, a high frequency or RF antenna **602** wirelessly captures high frequency or RF signals for RF transceiver circuits **604**. If the transceiver circuits are for a conventional superheterodyne system, the transceiver circuits **604** mix the RF signals down to IF signals. Then the IF signals are processed by baseband circuits. Digital outputs from the baseband circuits are coupled to a processor **608** for analysis and synthesis.

Outputs from the processor **608** are fed to a D-to-A converter **610** to generate audio signals for a speaker **612**. Similarly, audio analog signals from a microphone **614** can be fed to an A-to-D converter **616** to generate digital low frequency signals for the processor **608** and then to the RF transceiver circuits **604**. The low frequency signals are up-converted by the RF transceiver circuits **604** and wirelessly transmitted by the antenna **602**.

In another embodiment, digital conversion is moved closer to the antenna. For example, instead of mixing RF into IF signals, the RF transceiver circuits **604** directly perform digital conversion from the RF signals.

Typically, high frequency filters are used at the front end of the RF transceiver circuits **604** for the RF signals. In one embodiment, to save space, FBAR (film bulk acoustic resonator) duplexer is employed. A set of piezoelectric filters can be used to separate incoming and outgoing signals. For cell phone operation, such filters can enable a user to hear and speak simultaneously. A number of these electronic devices can be on a circuit board in the glasses. Or, some of the devices are in the glasses, while other in the base tethered to the glasses.

FIG. **11B** shows another example of some of the electrical components in or tethered to a pair of glasses for wireless connections according to the present invention. In this

embodiment, there does not need to have digital data. A speaker **620** and a microphone **622** are connected to an analog interface circuit **624**, which is coupled to a RF transceiver circuit **626** and an antenna **628**. For the speaker application, the transceiver circuit **626** mixes the RF signals down into IF signals, which are converted by the analog interface circuit **624** into analog signals for the speaker **620**. Similarly, for the microphone application, its analog signals are converted into the IF signals by the analog interface circuit **624** to be up converted by the transceiver circuit **626** into RF signals for the antenna **628**. These types of circuitry are suitable for, such as, simple radios, analog cell phones, CB radios, walkee-talkies, police radios or intercom systems.

In one embodiment, most of the electrical components are not in the glasses. The pair of glasses includes an antenna to capture the wireless signals, and a connector. The wireless signals captured are transmitted through the connector to electrical circuits external to the glasses.

A number of processors have been described. The processors can use different types of operating systems. In one embodiment, Symbian Operating Systems are used. In another embodiment, operating systems, such as TinyOS, are used. The operating system could be programmed in C++ and then compiled into machine codes.

For privacy protection, signals can be encrypted before transmission. Encryption can take significant computation power, and may generate a fair amount of heat. In one embodiment, encryption capabilities are located in a base tethered to the glasses. There can be a fan inside the base. The fan can be turned on during encryption. In another embodiment, the fan is activated during other high capacity uses for heat dissipation purposes.

In yet another embodiment, there is a fan in the glasses. The fan is located at a temple of the glasses, in the region close to its lens holder. The fan is used to cool the wearer of the glasses.

In one embodiment, a pair of glasses has access to voice recognition software. The software can be embedded in (a) the glasses, (b) a base tethered to the glasses, (c) a portable device wired or wirelessly coupled to the glasses or to the base, or (d) a computing system wired or wirelessly coupled to the glasses. Or, the software or firmware can be in more than one of the above devices.

Glasses that can couple to signals wirelessly can be used in different applications. For example, the glasses can be a cell phone wireless head set, such as a Bluetooth cordless headset. Such short-distance wireless technologies allow the headset to connect to the user's cell phone without a wire. This would allow the user to drive, eat or perform other functions without getting tangled in a pesky wire.

In one embodiment, the cell phone is a VOIP (voice over Internet protocol) phone.

In one embodiment, for the glasses operating as a cell phone head set, the head set includes active noise cancellation mechanism. For example, the glasses include two microphones. One microphone is for capturing the voice of the user. But the microphone captures ambient noise also. It can be embedded in a protrusion extending from the end of the temple close to a lens holder, towards the mouth of the user, as the microphone **110** in FIG. 1. Another microphone can be located at the top of one of the lens holders pointing away from the mouth of the user. This microphone is for capturing ambient noise. As a first order approximation, outputs from the two microphones could be subtracted from each other to provide voice signals with noise reduced.

In yet another embodiment, the glasses with wireless coupling capabilities also have a multimedia asset player, such as a MP3 player. The glasses can be used to receive music directly in digital format over, for example, a data-capable network of a mobile operator. The music can be received, for example, at a speed of 16 Kbits per second, providing sound quality close to compact disc. If the music is transmitted in a compressed manner, such as in a MP3 format, then the music data can be received at a much lower speed. In one embodiment, the glasses also have a microphone and can serve as a cellular phone or a wireless headset of a cellular phone.

In yet another embodiment, the glasses can serve as a radio, again through electrical components in or tethered to the glasses. In this embodiment, the glasses can include a tuner with one or more control knobs. The knobs can be used to select channels and to set the volume.

In one embodiment, a pair of glasses allows personalization by including a preference indicator. The indicator allows a user to provide his preference, such as on whatever is being output by the glasses. In one example, the glasses also has a radio having a speaker and with electrical components for wireless connection. In this example, the indicator can be used by the user to provide his preference regarding whatever is being played by the radio at that time. This preference can be wirelessly transmitted from the glasses to a third party. To illustrate, when the user is listening to a piece of music, the user can indicate he likes the piece of music by pressing a control knob on the glasses. This piece of preference information is then transmitted and received by a service provider, which is then informed of the user's preference. Instead of a control knob, in another embodiment, the preference indicator is a system with a microphone and voice recognition software. The user can indicate his preference vocally.

In another example regarding the personalization process, the glasses can serve as a multimedia asset player, such as a MP3 player. The song that the user has shown preference can be stored in a storage device, which can be in the glasses.

FIG. 12 shows a process **650** according to one embodiment of the present invention for a personalized radio.

Initially, a pair of glasses according to the present invention receives **652** a piece of music from a radio station. That piece of music is stored **654** in a buffer or a temporary storage area. This temporary storage area can be in the glasses or tethered to the glasses. The piece of music is also sent **656** to a speaker in the glasses.

Assume that the user likes the music. Based on the preference indicator, the user shows his preference. After the glasses receive **658** an indication of the user's preference, the glasses determine **660** the song corresponding to the indication. That piece of music can then be moved **662** from the buffer to a permanent storage area, such as into a flash memory. This would then allow the user to subsequently access the piece of music.

There are different ways to determine **660** the song or the content being played by the radio corresponding to the indication. For example, one rule is that when the user pushes the preference button or voices his preference, the song (or media asset or media file) that is being played is the one the user likes. Since the operating system knows what song is being played at what time, based on the rule, the song of preference is determined. Another rule is that when the user shows his preference, and there is no song being played at that instance, the song immediately preceding the break is the song of preference.

In another embodiment, the glasses can get **664** an identification for the song of preference. For example, the glasses can ask the user to provide an identification for the piece of music. This identification can be the type of music, the singer, the name of the music or other identification. In another embodiment, there can be meta data embedded, such as in the beginning part of the music (or media asset). Having such meta data embedded is not uncommon for music in digital format. The meta data can include identifications for the music. The glasses can get **664** such identification. Based on the identification, the song is categorized **666** accordingly, such as grouped with other songs having the same identification. Such categorization process would enhance the ease of accessing the song by the user at a later time.

A number of control knobs have been described. FIG. **13** shows a number of attributes **700** regarding control knobs according to the present invention. The knobs can be of different physical structure **702**. For example, a control knob can be a roller, a switch or a push-button. A control knob serving as an up/down controller can use two buttons, or a roller.

A control knob can be more intelligent **704**. For example, a push-button control knob can serve different purposes depending on the duration the knob is being pushed. If a user pushes it for more than three seconds, the knob serves as an on-off toggle switch. In another example, a knob can serve multiple purposes, and the specific purpose depends on the number of times the knob is pushed.

A knob can also be programmed. A user can connect the glasses to a computer and program the knob accordingly. For example, one can program a knob such that if the knob is pushed more than three seconds, the knob would serve as an on/off switch for the glasses. As another example, a knob can provide reset to delete certain information previously captured by a process and to allow re-starting the process.

The location **706** of a control knob can vary for different applications. A control knob can be located on the glasses. A control knob can be on the top, the side or the bottom of the temple. A control knob can be located at the inside of a temple facing the user. Assume that there are a number of control knobs and all of them are on the edges of a temple, except one. By being at a position different from other control knobs, this knob can serve a specific purpose. For example, it can be an on/off control knob. In yet another embodiment, a control knob can be located in a base tethered to the glasses.

The number **708** of control knobs can vary depending on operations. For example, there is an on/off control knob and a volume up/down control knob. If the glasses are used for cell phone headset application, in one embodiment, there is also an answer/hang-up control knob. If the glasses serve as a radio, in one embodiment, there is also a tuning control knob, which can be two push buttons. If the glasses serve as a CD player, in one embodiment, there is a play control knob, a stop control knob, and a skip forward/backward control knob. If the glasses serve as a multimedia asset player, such as a MP3 player, in one embodiment, there is a save-this-song control knob, a skip-forward/backward-song control knob and a select-song-to-play control knob.

A number of embodiments of the present invention have been described regarding audio signals. In one embodiment, the glasses further serve as a camera.

FIG. **14** shows one embodiment of electrical components in a pair of glasses with image capturing capabilities. A processor **752** is coupled to a CCD interface chip **754** and then to a CCD chip **756**. Images focused by a lens **758** are

captured and collected by the CCD chip. In another embodiment, there is also be a flash controller **760** connected to the processor **752** to control a flash **762**.

In one embodiment, a number of pixels of the CCD chip **756** are used as light sensors. The pixels can be used to adjust the sensitivity of the CCD chip **756** based on the amount of ambient light. For example, if the outside environment is dim, it would take a longer period of time to collect enough charges by the CCD chip **756** to re-create the image. This implies that the integration time of the CCD chip **756** should increase.

In yet another embodiment, the camera can pertain to a video camera. The capacity of the memory **753** increases so as to store the video images.

In one embodiment, the glasses do not offer adjustment on the image distance. The CCD chip **756** can be located, for example, at the focal point of the lens **758**. In another embodiment, there is an image distance control knob. For example, a mechanical lever can be pre-programmed or pre-set to move the lens to one or more different positions. One position can be for close-up shots, such as objects from 2 to 4 ft, and another for scenic or vista images, such as objects greater than 6 ft.

Depending on the embodiment, electrical components of a camera can be in a pair of glasses, and/or a base tethered to the glasses, and/or a portable device tethered to the glasses or to the base. For example, the memory **753** can be in the base tethered to the glasses.

The location of the lens **758** can vary depending on the embodiment. In one embodiment, referring to FIG. **1**, one location is at the bridge of the glasses, with the lens of the camera facing forward. In this situation, what the user sees is substantially what the captured image would be. In other words, in a general sense, what the user sees is what the user gets. With such an embodiment, it is relatively easy for a user to take pictures, hands-free. In another embodiment, another location for the lens **758** are at a side portion adjacent to a lens holder, before the joint of the corresponding temple, such as at **116** in FIG. **1**. Again, the lens of the camera faces forward. Some of the electrical components of the camera can be in that location, and other components in the temple **104**. These components are electrically connected through one of the joints, such as with a flexible pc board. In yet another embodiment, the lens **758** can face sideways and outwards in a temple of a pair of glasses, towards the left or right side of the user.

Regarding storing the images, in one embodiment, the images are stored locally. One approach to determine which image to store is the first-in-first-out approach. Once the camera is turned on, the camera takes pictures continually in an automatic mode, such as once every few seconds. When the memory becomes full or under other pre-set or pre-programmed condition, the first picture stored will be deleted when the next picture comes in. In another embodiment, the digital content in one picture is compared to the digital content in, for example, the fifth picture further down. If the difference between the two is not more than a pre-set threshold, the four pictures in between will be deleted. One approach to determine the difference is by comparing the total charges collected by the CCD chip for the two images. If the two sets of charges do not differ by more than a certain threshold, the images in between would be deleted.

The images captured can also be stored at a remote site. For example, the glasses can upload the images to a computer, wirelessly or through a wired connection from a connector at the glasses.

FIG. 15 shows an operation 800 of taking certain actions based on images captured by a pair of glasses with a wireless transceiver, according to one embodiment of the invention. This operation can be used by a police officer on patrol. Before the officer gets out of his patrol vehicle to confront a suspect, the officer can inform the station. At that point, the camera is turned on 802.

There can be different approaches to turn on the camera. In one embodiment, an operator at the station can remind the officer to turn on the camera. Or, the operator can remotely turn on the camera. In yet another embodiment, the camera can be automatically turned on under certain condition. One such condition is that if the camera is out of the patrol vehicle, the camera is automatically turned on. With the glasses having the capability to wirelessly communicate with the patrol vehicle, one method to detect if the glasses are out of the patrol vehicle is based on the wireless signal strength of the glasses. The patrol vehicle can detect the signal strength of the wireless signals, which depends on the distance between glasses and the vehicle. A threshold can be set. If the signal strength is below the preset threshold, the glasses would be assumed to be out of the car, and the camera would be automatically turned on.

After the camera is turned on 802, the glasses start to continually take 804 pictures, such as once every few seconds. The pictures taken are automatically transmitted back 806 to the patrol vehicle in a wireless manner. In this situation, the patrol vehicle serves as a hub, which stores the pictures. Then, the hub re-transmits 808 the pictures back to the station. Note that the pictures can be compressed by standard algorithms before they are transmitted. This compression mechanism can be performed by a computer in the patrol vehicle. When the station gets the pictures, they are de-compressed before being viewed, such as by the operator. The pictures enable the operator at the station to see what the officer is confronting. This effectively allows the operator at the station to perform real-time monitoring of or for the officer. If it is a high risk situation, the operator can quickly react 810, such as by dispatching additional support for the officer. In one embodiment, the glasses can include not only a camera but also a microphone for audio pickup, such as sounds from the officer, suspect, witness or environmental sounds (such as door opening, gun shot, etc.).

Regarding ownership of the glasses, the user can own the glasses. In one embodiment, the user leases the glasses from a provider. For example, the user leases a ski goggle with a camera. After the user turns on the camera, as the user skis, the goggle automatically takes pictures. Later, the user can return the goggle to the provider or a kiosk, where the pictures can be retrieved and/or stored. Alternatively, the goggle can include a wireless transceiver and the images could be uploaded continually or automatically to the provider or the kiosk via a wireless network. The provider or the kiosk can transmit the images to a website, such as a website associated with the user. In another embodiment, the user picks up hardcopies of the images, e.g., a CD with the images or a DVD with the video, from the provider or the kiosk.

In one embodiment, the glasses allow the user to enter his identification. This can be done, for example, through a control knob at the glasses. Such identification is then linked to the images. Based on the identification, the user can return to the provider or kiosk at a subsequent time to pick up the images previously left behind.

In yet another embodiment, the pair of glasses with a camera also has a speaker and a wireless transceiver. It can

be used to remotely control or direct the user wearing the glasses. FIG. 16 shows one such operation 850 according to one embodiment.

To illustrate the operation 850, assume that the user is a paramedic helping a patient. The glasses continually take pictures 852 of objects directly in front of the paramedic, such as images around four feet away from the eyes of the paramedic. The pictures are wirelessly transmitted 854 to a remote site, such as a hospital, to be viewed by a doctor. Again, this transmission can be a two-step process. For example, pictures can be transmitted to the paramedic's ambulance, which can then re-transmit to the remote site. The first transmission from the glasses to the ambulance can be through a low-power, short-range, broadband, wireless transmission protocol. The second transmission from the ambulance to the hospital can be through a much longer-range, higher power, broadband, wireless transmission protocol. Again, compression and de-compression techniques can be used to enhance the rate of transmission by reducing the amount of data to be transmitted.

Based on the images, the doctor sends out voice messages to the paramedic. These messages are wirelessly transmitted to and received 856 by the glasses. The speaker in the glasses outputs 858 the messages to the paramedic.

In another embodiment, the glasses also have a microphone, which allows the paramedic to communicate directly with the doctor also.

In one embodiment, the glasses can take pictures and can be a multimedia asset player. Pictures and the multimedia assets can share the same memory storage device. In this situation, the capacity for the multimedia assets and pictures can be interrelated. For example, a user can take more pictures if there are less multimedia assets, such as fewer songs in the storage device.

A number of embodiments have been described regarding electrical components in the temples of glasses. The locations selected are for illustration purposes. In other embodiments, some of the components are embedded fully or partially in other areas of the glasses, such as the lens holders or the bridges of the glasses. For example, there are glasses where there are shields at the edges of the lens holders of the glasses. These shields can wrap around, or better conform to the profile of, the face of the wearer. There can be transparent or translucent windows on these shields also. The shields are not limited to be in primary frames. They can be in, for example, fit-over glasses, auxiliary frames or safety glasses. To illustrate, in fit-over glasses, such shields can go over or cover at least a portion of the primary frames. One or more electrical components can be in such shields. In still another embodiment, one or more electrical components can be in a strap tied to the corresponding eyewear, such as a sports strap tied to the corresponding sports eyewear. For example, the one or more electrical components can be at least partially embedded in or attached to a strap. As one particular example, an audio player or wireless communication module can be at least partially embedded in or attached to the strap. The strap may also provide electrical conductors (that are attached or internal to the strap). Such electrical conductors can be coupled to a speaker to produce audio output to the speaker, or can be coupled to a microphone to receive audio input from the microphone. The speaker and/or microphone can also be attached to or integral with the strap.

Note that in one embodiment, a pair of glasses does not have to include lenses. Also, a number of embodiments have been described with a pair of glasses tethered to a base. In

one embodiment, a pair of glasses includes a base and a cord connecting the base to the glasses.

In yet another embodiment, a pair of glasses also includes a sensor. FIG. 17A is a chart 900 that depicts examples of sensors in the glasses.

In one embodiment, the sensor is a “being worn” sensor. The “being worn” sensor indicates whether the glasses are being worn by its user. The “being worn” operation can be performed using, for example, a thermal sensor, a motion detector, a stress sensor or a switch.

In one embodiment, a motion detector is used as a “being worn” sensor. A threshold can be set, such that if the amount of motion exceeds the threshold, the eyewear is assumed to be worn. The motion detector can, for example, be achieved by a mechanical means or an accelerometer.

In another embodiment, the “being worn” sensor includes two thermal sensors. One sensor can be at approximately the middle of a temple, such as in a region that touches the head of the user wearing the glasses. The other sensor can be at the end of the temple, close to its hinge. If the temperature differential between the two sensors is beyond a certain preset value, the eyewear would be assumed to be worn. The differential is presumed to be caused by a person wearing the pair of glasses.

In yet another embodiment, the “being worn” sensor includes a stress sensor at the hinge of the temple. The assumption is that when the eyewear is worn, the hinge is typically slightly stretched because typically, the width of the head of the user is slightly wider than the width between the temples when the two temples are in the extended positions. If the value of the stress sensor is beyond a certain preset value, the glasses would be assumed to be worn.

In a further embodiment, the “being worn” sensor can be a switch. For example, at the hinge between a temple and its corresponding lens holder, there is a switch. When that temple is fully extended outwards, the switch is turned on. The switch can be a pin. When the temple is fully extended outwards, the pin is pressed. When both temples are fully extended outwards, in one embodiment, the glasses would be assumed to be worn by the user.

In one embodiment, another type of sensor is an environmental sensor. The environmental sensor can sense environmental conditions, such as one or more of ultraviolet radiation, temperature (e.g., ambient temperature), pressure, light, humidity and toxins (e.g., chemicals, radiation, etc.).

In another embodiment, another type of sensor is a condition sensor. The condition sensor can sense the conditions of the user of the glasses. Examples of physical sensors include sensing one or more of distance traveled, location, speed, calories consumed, temperature and vital signs associated with the user of the glasses. The distance traveled could represent the horizontal distance traveled or the vertical distance (i.e. elevation) traveled. The speed can be the rate of movement along the horizontal distance traveled and/or the vertical distance. In yet another embodiment, the condition sensor can sense the emotional conditions of the user of the glasses.

The sensors can be provided in a redundant or fault-tolerant manner. For example, sensors can come in pairs in the glasses. When one malfunctions, the other one will take over its operation. In another embodiment, the sensor information can be processed in a differential manner to examine changes to the sensor information. The sensors can be powered by a battery, solar energy, or kinetic energy. For reduced power consumption, the sensors can remain in a low-power state unless data is being acquired by the sensors. In yet another embodiment, two or more of the auxiliary

sensors can communicate with one another (wired or wirelessly) to exchange data or control information.

A number of embodiments have been described regarding one or more electrical components at least partially embedded in a pair of glasses. In one embodiment, one or more electrical components are at least partially embedded in a temple tip of a pair of glasses. Temple tips are particularly common for wire or metal frames. The pair of glasses has a first and a second lens holders for receiving lenses. Each of the lens holders has a first side and a second side. The pair of glasses has a bridge element that couples the first side of the first lens holder to the second side of the second lens holder. The pair of glasses also includes a first temple and a second temple. The first temple is pivotally secured to the second side of the first lens holder through a joint, while the second temple is pivotally secured to the first side of the second lens holder through another joint. A temple typically has two ends, a first end and a second end. The first end can be the end that is pivotally secured to a lens holder through a joint, and the second end can be the other end of the temple. It is not uncommon that a temple includes a main body and an enclosure that grabs onto the main body of the temple. The second end is typically where the enclosure grabs onto the main body. The enclosure can be made of a different material than the main body of the temple. In one embodiment, such an enclosure is a temple tip, and there is an electrical component, partially or fully, embedded in the tip. There can also be a connector, such as the connector 300 shown in FIG. 5, at the temple tip. In another embodiment, the temple tip can include a female connector, which can be similar to the female connector 310 shown in FIG. 6B. As the temple tip grabs onto the main body of the temple, the female connector can make electrical contact with a male connector at the main body of the temple. Typically, particularly before a pair of glasses has been extensively worn, the temple tip can be removed and re-inserted back on to the main body of the temple without a lot of difficulties. Such a temple tip can be an after-market component, with different temple tips having different electrical components to serve different functions.

FIG. 17B is a diagram of a temple arrangement 910 according to one embodiment of the invention. In this arrangement, a temple tip is not considered as a part of the temple. The temple arrangement 910 includes a temple 912 that is associated with a pair of eyeglasses. Over the end of the temple 912 that is opposite the associated lens holder, a temple tip 914 is provided. The temple tip 914 can be held to the temple 912 by frictional forces and/or adhesive. The temple tip 914 includes at least one electrical component 916 that is at least partially embedded therein. The temple tip 914 can be manufactured and delivered to resellers or retailers as such. Alternatively, the temple tip 914 can be separately provided as an optional replacement temple tip for an existing temple tip. Hence, as after manufacture, upgrade to the eyewear can be had through replacing the existing temple tip with the replacement temple tip. The colors and shapes of the temple tip 914 can vary widely. In the after manufacturing environment, the reseller or retailer can be provided with a range of different colors and shapes so that a user can receive a replacement tip that reasonably matches the color and shape of the temple or that provides an altered appearance as desired by the user.

Besides a replacement temple tip such as illustrated in FIG. 17B, a temple tip can also be effectively modified by a fit-over temple or temple cover. FIG. 17C is a diagram of a temple cover 920 that at least partially covers a temple (e.g., temple 912) according to one embodiment of the

invention. As another example, the temple cover **920** can be a fabric or other material, such as a sock or sleeve, that slides over and at least partially covers a temple tip. The temple cover **920** can include at one electrical component **922** that is either attached thereto or at least partially embedded therein. The temple cover **920** can also include an opening **924** so as to received a temple or a temple tip. The temple cover **920** can be held to a temple by frictional forces and/or adhesive. FIG. 17D is a diagram of a fit-over temple **926** that at least partially fits over a temple according to one embodiment of the invention. For example, the fit-over temple **926** can at least partial fit-over a temple tip. The fit-over temple **926** includes at one electrical component **928** that is either attached thereto or at least partially embedded therein. The fit-over temple **926** can also include an opening **930** so as to receive a temple. The fit-over temple **926** can be held to a temple by frictional forces and/or adhesive. As an example, the fit-over temple **926** can be plastic or other material. The colors and shapes of the fit-over temple **926** can vary widely. In the after manufacturing environment, the reseller or retailer can be provided with a range of different colors and shapes so that a user can receive a replacement temple cover or fit-over temple that reasonably matches the color and shape of the temple or that provides an altered appearance as desired by the user.

In one embodiment, a fit-over temple or temple cover according to the invention can further include a connector or cable to facilitate electrical connection with the at least one electrical component that is either attached to a temple or a temple tip or at least partially embedded therein.

In one embodiment, an electrical component is a component of an electrical circuit, and the electrical circuit is for performing at least a desired, intended or predetermined function.

A number of embodiments have been described above for an eyeglass frame, i.e., primary frame, are also applicable to an auxiliary frame. An auxiliary frame can attach to a primary frame through different techniques, such as using clips. Another technique to attach an auxiliary frame to a primary frame is by way of magnets. Examples of using magnets as an attachment technique can be found, for example, in U.S. Pat. No. 6,012,811, entitled, "EYEGLOSS FRAMES WITH MAGNETS AT BRIDGES FOR ATTACHMENT."

A number of embodiments have been described where one or more electrical components are at least partially embedded in a pair of glasses. In yet another embodiment, the one or more electrical components are at least partially embedded in an eye mask.

FIG. 18 shows one embodiment **925** where one or more electrical components are at least partially embedded in an eye mask **927**. The eye mask **927** includes a piece of fabric that is opaque so that when the mask is worn, the mask wraps around the eyes to block light from entering into the eyes of the user.

The embodiment **925** includes a wrapping mechanism to hold the fabric onto the head of a user so that when the mask is worn by the user, the mechanism allows the fabric to have a relatively tight and comfortable fit over the face of the user. In one approach the wrapping mechanism is achieved with the fabric in the shape of a band and having a certain degree of elasticity. When the mask is worn by the user, the elasticity of the fabric allows the mask to establish a relatively tight fit over the face of the user. In another example, the fabric is a long piece of material. The wrapping mechanism includes a clip or Velcro at the two ends of the piece of material to tie the two ends together. In another

example, the wrapping mechanism includes two elastic pieces of elastic materials at the two ends of the fabric. To wear the mask, each elastic piece of material goes over one of the ears of the user so that the fabric establishes a relatively tight fit over the face of the user. In yet another embodiment, the mask **927** includes a notch **935** to accommodate the nose of the user. In another embodiment, there can be additional padding in the vicinity of the one or more electrical components so that if an electrical component is pressed against the user, the padding serves as a buffer or cushion.

In one embodiment, a speaker **929** can be at least partially embedded in the mask **927**, and can be positioned close to and facing one of the ears of the user. The speaker **929**, through an electrical connector, is electrically connected to a cable **931**. The cable **931** can also have a connector **933** at its distal end. The connector **933** can be plugged into another device, such as a MP3 player or a CD player. After putting on the mask, with the connector **933** plugged into the another device, the user would be able to hear, for example, audio sounds such as music. The eyemask **925** can be applied to different areas. For example, the user can be on a plane, and would like to rest. The user can put on the eyemask **925**, and plug the connector **933** into a media outlet at an armrest of her seat in the plane. Thus, the user can enjoy music while taking a rest. The embodiment **925** could also include a plurality of speakers, such as one for each of the user's ears.

In another embodiment, the eyemask **927** includes the speaker **929** and a battery that is electrically connected to the speaker **929**. The battery can be in a pocket on the eyemask and can be replaceable. The battery can also be a rechargeable battery, such as a lithium-ion battery, and there is a connector at least partially embedded in the eyemask. The connector can be used to recharge the battery.

FIG. 19 shows another embodiment **950** where one or more electrical components are at least partially embedded in a night cap **952**. In one embodiment, the cap **952** is at least partially made of fabric. In another embodiment, the cap **952** is entirely made of fabric. The cap includes a wrapping mechanism. When the cap is worn, the wrapping mechanism holds the cap onto the head of the user, and allows the cap to have a relatively tight and comfortable fit over the head of the user. Again the wrapping mechanism can be an elastic band at the base **963** of the cap **952**. Or, the wrapping mechanism can include clips or Velcro as previously described.

The cap can include at least one speaker **954**, which is at least partially embedded in the cap **952**. When the cap **952** is worn by a user, the speaker **954** is positioned close to and facing one of the ears of the user. The speaker **954** can, for example, be electrically connected through a connector to a device **962** in a pocket **960** on the cap **952**. The electrical connection can be through a cable **956** external to the cap **952**. The cable **956** also can have a connector **958** to be plugged into the device **962**. In another embodiment, the cable **956** is embedded in the cap. The device **962** can be an asset player, such as a MP3 player, with a battery. Through the connector **958**, audio signals from the device **962** can be received by the speaker **954** and heard by the user. There can be one or more additional pockets on the night cap for one or more additional electrical components. When worn, the night cap does not have to cover the eyes of the user. In yet another embodiment, when worn, the night cap further covers the eyes of the user, as shown in FIG. 19. In one embodiment, the embodiment **950** further includes padding

in the vicinity of an electrical component to serve as a buffer or cushion between the user and the electrical component.

A number of embodiments have been described involving a speaker in an eyemask or a night cap. In one embodiment, the audio output from the speaker can serve to cancel the environmental sounds in the vicinity of the user. For example, if the user is on an airplane, the surrounding environmental sound has a relatively high level of white noise. This white noise can be detected by a pickup device and cancelled by noise cancellation circuitry provided within the eyemask or night cap. Namely, the audio output from the speaker serves to cancel the white noise of the user's environment. In another embodiment, the electrical component embedded or partially embedded is not a speaker, but can be a sensor, which can sense a physiological function of the user.

FIG. 20A is a diagram illustrating a temple 1000 having a slot for receiving a removable electronic device 1002 according to one embodiment of the invention. In one example, the removable electronic device 1002 can be a memory storage device, sometimes referred to as a memory card. As shown in FIG. 20A, the removable electronic device 1002 is inserted into the slot. Although the slot could be electrically non-functional, typically the slot provides an avenue for the removable electronic device 1002 to be physically and electrically connected to electrical circuitry within the temple 1000 or elsewhere within the eyeglass frame. FIG. 20B is a diagram illustrating the temple 1000 having a recessed lower portion 1004 according to another embodiment of the invention. The recessed lower portion 1004 facilitates the insertion and removal of the removable electronic device 1002. In either embodiment, the removable electronic device can be manually inserted and removed or can use more complicated mechanical mechanisms to assist with the insertion and removal (e.g., spring-based push and release structure).

FIGS. 21A and 21B are diagrams illustrating a pair of glasses 2100 having a camera 2101 coupled thereto, according to one embodiment. The camera includes an image sensor 2102 and a camera housing 2106 (also referred to as a camera support arm). In this embodiment, the camera 2101 is rotatably coupled to an exterior surface of a temple 2104 of the pair of glasses 2100. The camera support arm 2106 is attached to the temple 2104. The camera support arm 2106 can couple to the temple 2104 using a hinge 2108. In one implementation, the hinge 2108 can use a spring or cam mechanism so that the camera support arm 2106 is held either against the temple 2104 when not in use or held in an open or extended position when in use. FIG. 21A illustrates one position of the camera support arm 2106 when the camera 2101 is not in use. FIG. 21B illustrates one position of the camera support arm 2106 when the camera 2101 is in use. The presence of the camera 2101 with the pair of eyeglasses 2100 enables a wearer of the pair of eyeglasses 2100 to take pictures of what the wearer is looking at. It should be noted that other supporting circuitry such as data storage for pictures, switches, battery, and electronics for the camera 2101 can be in the temple 2104, in the camera support arm 2106, elsewhere in the pair of glasses 2100, or even tethered thereto. However, in one implementation, the camera 2101 is completely self-contained in the camera housing 2106. In one embodiment, the hinge 2108 can also serve as a switch to turn the image sensor 2102 on or off.

In one implementation, to improve overall appearance of the pair of glasses 2100, the temple 2100 can provide a recess for receiving the camera support arm 2106 when the

camera is not being utilized. Such may improve the aesthetic appearance of the pair of glasses 2100.

In another implementation, the pair of glasses 2100 can further provide a viewfinder. The viewfinder can assist the user in directing the image sensor 2102 towards whenever the user desired to photograph. The viewfinder can be a separate apparatus that is extended by user action or can be a viewfinder that is visually present or presented on one of the lenses. In one example, the viewfinder can be an extendable viewer through which the user can look through to determine the field of reference of the image sensor 2102. The viewfinder can be extendible from either of the temples, such as in a telescoping, sliding or flipping action. Additionally, when the camera support arm 2106 is extended, a viewfinder can be automatically initiated. For example, indicators on one of the lens can be visually presented, such as through optical projection from one or more light sources. In another embodiment, the viewfinder can be always present, such as with indicators on one of the lens of the pair of glasses 2100. The indicators can be a few faint dots to define an area (e.g., a square) on the lens.

In one embodiment, the camera support arm (camera housing) 2106 is removably coupled to the hinge 2108. As such, the camera 2101 can be removed from or attached to the pair of glasses 2100. Indeed, the camera support arm (camera housing) 2106 can be a camera body that houses electronics for the camera 2101. In such case, the camera 2101 can operate as a camera apart from the pair of glasses 2100.

In one implementation, the camera support arm 2106 has a connector and the hinge 2108 has a counterpart connector. In one example, the connectors are peripheral bus connectors, such as USB connectors. In such case, the camera support arm 2106 can be attached and removed from the pair of glasses 2100. Such a connection via the connectors can be electrically functional or non-functional. If functional, electrical components in the pair of glasses 2100 can be electrically connected to electrical components in the camera 2101.

Still further, in one embodiment, the connector at the end of the hinge 2108 enables connection of a variety of different peripheral devices to the pair of glasses 2100. For example, the different peripheral devices (portable electronic devices) can be the camera, a memory card, or a media player. In one embodiment, electrical components integral with the pair of glasses 2100 can be shared by the different peripheral components. The hinge 2108 is not necessary in other embodiments, see FIGS. 8F-8H, where a connector is attached or integral with a temple of a pair of glasses. If desired, the camera 2101 or other peripheral devices can include in its structure a hinge or other mechanism to permit positioning the camera or other peripheral devices.

In still another embodiment, an angled or hinged adapter can be inserted between a connector attached to the pair of glasses 2100 and a connector of the camera 2101 or other peripheral devices. The adapter can be electrically functional or non-functional.

In yet in another embodiment, a pair of glasses functioning as a headset with a speaker and a microphone further includes a camera. FIG. 22 is a diagram of a pair of glasses 2200 having a camera according to one embodiment of the invention. The glasses 2200 include a temple 2205 that has a microphone 2204, a speaker 2206 and a camera 2208 with a connector 2210. The connector 2210 is for connecting, for example, to another electronic device that provides at least one of data or information transfer capabilities or a power source for the glasses.

In one embodiment, the camera **2208** is a digital camera with an on/off switch **2212**. For example, the camera **2208** is a CCD camera including a CCD controller coupled to a CCD chip to capture images, a CCD memory device and a lens.

In one embodiment, with the connector **2210** connected to another electronic device (e.g., a portable electronic device), when the switch **2212** is pushed on, the CCD chip takes a picture. The charges in the CCD chip are digitized and transmitted through the connector **2210** to the other electronic device, under the management of the controller. At least some of the charges can be temporarily stored in the CCD memory device, for example, to accommodate the differences in speed in taking pictures and sending the pictures to the portable device through the connector. In this embodiment, images can be stored at the other electronic device. In another embodiment, the glasses can include sufficient data storage capabilities to store the pictures, at least until transferred to another electronic device.

In one embodiment, the glasses do not offer focusing capability. The CCD chip can be located, for example, at the focal point of the lens. In another embodiment, there is an image distance control knob. For example, a mechanical lever can be pre-programmed or pre-set to move the lens to one or more different positions. In one implementation, there can be just two positions. One position can be for close-up shots and another for distance shots, such as close-up being about 2 ft from the lens and the distant being about 6 ft away; or close-up being about 8 inches away and distant being about 2 ft away.

FIG. **22** shows one embodiment regarding the location of the camera **2208** at the end of the temple or arm **2205** of the glasses **2200** next to the hinge. The lens of the camera faces forward. In this situation, what the user sees is substantially what the captured image would be. In other words, in a general sense, what the user sees through the glasses is what the user gets, without the need for an additional view finder. With such an embodiment, it is relatively easy for a user to take pictures, hands-free, without the need for an additional strap for holding the camera.

The connector **2210** at the end of the glasses **2200** can be, for example, a 4-terminal connector, one for ground, one for power and the other two for transmit and receive signals. In another embodiment, the connector **2210** can be a 3-terminal connector, with the power line and one of the signal lines sharing one terminal.

Regarding the embodiment shown in FIG. **22**, the speaker **2206** can be in the glasses, with a tube **2216** and an ear bud **2218**, to help bring audio signals to the user. In one embodiment, the tube **2216** can be rotated at its end where it connects to the glasses. In another embodiment, the speaker **2206** can be provided at the ear bud **2218**.

In one embodiment, the CCD chip with the CCD memory device and the CCD controller are on the same integrated circuit.

The embodiment shown in FIG. **22** also includes a microphone **2204**. In one embodiment, the CCD memory device also stores audio signals from the microphone **2204**. For example, the memory device stores a duration of time, such as the last 15 seconds, of audio signals. When the user takes a picture, a duration of time before taking the picture, such as the previous 15 seconds, audio signals can be coupled to the picture. Another duration of time after taking the picture, such as the next 10 seconds, of audio signals can also be coupled to the picture. In one embodiment, the audio picked up can include environmental sounds present at that time. The audio signals or the digitized version of the audio

signals can also be transmitted to the other electronic device with the corresponding picture. In the future, if the user wants to view the picture, the audio signals can be played with the picture at the same time. As another example, the user can provide an auditory annotation to the pictures being taken. Here, the user can leave a specific audio message to be associated with the picture. For example, the user might take a picture of his childhood home and record an audio annotation, "This is where I grew up".

In one embodiment, a pair of glasses functions as a headset with a speaker, a microphone and a camera. The pair of glasses can be coupled to another electronic device through a connector of the glasses. Additional electrical components, such as those in the other electronic device, like a portable device, for the glasses can be incorporated in the glasses. For example, the power source can also be in the glasses and the glasses do not have to include a connector. In one embodiment, the glasses include non-volatile memory to store at least a number of pictures. In another embodiment, the glasses further include a connector to receive a memory card, such as a flash memory device. The card can be a standard memory card with a USB connector. Pictures taken can be stored in the removable memory card.

In yet another embodiment for the glasses with a camera, the glasses do not include a speaker or a microphone. The glasses include a temple that has a CCD controller coupled to a CCD chip, a CCD memory device and a lens. The temple also includes an on/off switch with a connector. The connector is for connecting, for example, to a portable device that includes at least a power source for the camera.

In still another embodiment, an auditory feedback by a speaker is provided or coupled to a pair of glasses. For example, a clicking or "snapshot" sound can be output when a picture is taken (such as when a user initiates the picture taking).

Additional disclosure on camera in glasses can be found in U.S. Provisional Application No. 60/583,169, filed on Jun. 22, 2004, which is hereby incorporated by reference.

A number of electrical components have been described. They can be on circuit boards, which can be made of flexible materials. They can be on a substrate. They can also be integrated into one or more integrated circuits.

FIG. **23A** is a diagram of a pair of glasses (i.e., eyeglass frame) **2300** having a camera according to one embodiment of the invention. The eyeglass frame **2300** illustrated in FIG. **23A** includes a lens holder **2302** holding a lens **2304** and a lens holder **2306** holding a lens **2308**. The eyeglass frame **2300** also includes temples **2309** and **2310**. In the embodiment shown in FIG. **23A**, the temple **2310** includes a camera **2312**, supporting electronics **2314** and a switch (e.g., button) **2316**. In one embodiment, the camera **2312** includes a CCD chip. The camera **2312** can also include a lens and buffer memory. In one embodiment, the electronics **2314** illustrated in FIG. **23A** can be embedded within the temple **2310**. The electronics **2314** can include at least a microcontroller (e.g., an image processor), a memory, and a battery. These electronics **2314** can support the camera **2312**. The eyeglass frame **2300** can further include various other electrical components. For example, the eyeglass frame **2300** can further include one or more of: a microphone, an earphone, a removable memory, a display, a clock, and a Global Positioning System (GPS). These electrical components can be used in conjunction with the camera **2312** or separately from the camera **2312**. The button **2316** enables a wearer of the eyeglass frame **2300** to turn the camera **2312** on/off and/or to cause a picture to be taken (recorded). For example, by pushing the button **2316** for more than a few

seconds, the camera will be turned off. However, by pushing and releasing the button **2316**, the camera takes a picture.

Still further, in the embodiment of the eyeglass frame **2300** shown in FIG. **23A**, the eyeglass frame **2300** further includes a view finder **2318** and an angled surface **2320**. Other embodiments of eyeglass frames need not include such features. Nevertheless, the view finder **2318** can assist a wearer (i.e., user) of the eyeglass frame **2300** in understanding the frame of the image (picture) being captured by the camera **2312**. In this example, the view finder **2318** is provided on the lens **2304** in a visible, yet non-distracting manner. As shown in FIG. **23A**, the view finder **2318** can be positioned such the wearer can direct the image (picture) to be captured. For example, the wearer would orient their head (using the view finder **2318**) to direct the camera **2312** towards the desired subject. Also, the angled surface **2320** allows mounting the camera **2312** in an angled manner. As a result, the direction of the camera **2312** is not straight forward but out towards the side. This facilitates the wearer in directing the camera **2312** using a single eye via the lens **2304**, and more particularly via the view finder **2318** if provided. The outward angle from straight forward being utilized by the camera **2312** can vary with implementation. For example, the outward angle can be in the range of 10-70 degrees or more particularly in the range of 15-60 degrees, or more particularly in the range of 20-40 degrees from the perpendicular direction of the plane of a front surface of the eyeglass frame **2300**. In one embodiment, with the camera positioned at an angle, the lens holder **2302** would not block the field of view of the camera even with the camera being positioned at a distance behind the lens holder **2302**.

Although the camera **2312** is provided on the left side of the pair of glasses **2300** as shown in FIG. **23A**, it should be understood that the camera could alternatively or additionally be provided on the right side of the glasses.

FIG. **23B** is a diagram of a pair of glasses (i.e., eyeglass frame) **2300'** according to another embodiment. In this embodiment, the eyeglass frame **2300'** is similar to the eyeglass frame **2300** illustrated in FIG. **23A**. However, the eyeglass frame **2300'** further includes a connector **2322** and a memory card **2324**. More particularly, the temple **2310** includes a region **2326** larger than the temple region shown in FIG. **23A**. The larger or enlarged region can provide additional space for the connector **2322** and the memory card **2324**. The memory card **2324** can be operatively connected electrically to the electronics **2314** within the temple **2310** via the connector **2322**. The connector **2322** also can serve to provide a physical connection of the memory card **2324** to the eyeglass frame **2300**. In one embodiment, such physical connection is removable so that the memory card **2324** can be connected to or removed from the temple **2310**. Accordingly, the memory card **2324** can facilitate porting of data or information (e.g., pictures) from the eyeglass frame **2300'** to another electronic device (e.g., computer). As an example, the connector **2322** can be a USB connector or other peripheral type connector.

The eyeglass frame having a camera according to one embodiment of the invention can further include one or more sensors. For example, the one or more sensors can include one or more of a "being worn" sensor, a motion sensor, and a light sensor. These sensors can be used to influence operation of the camera provided with the eyeglass frame. For example, a "being worn" sensor can be used to determine whether the eyeglass frame is being worn by a user. If the eyeglass frame is not being worn, then the camera can be deactivated to prevent unnecessary battery consumption and/or to prevent pictures from being taken. As an

example, if the camera is operated to automatically, periodically take a picture, then if the eyeglasses are not being worn, the automatic picture taking process could be stopped. In one embodiment, a motion sensor can be used in a variety of ways. A motion indication can indicate a rate of activity of the user. For example, the rate of activity could be used to avoid taking pictures during periods of high activity, such as rapid movements of the eyeglass frame (or the corresponding user), or to influence image processing, such as exposure rate. As another example, the rate of activity can be used to control the rate pictures are taken such as in the automatic picture taking example. In one embodiment, a light sensor can indicate the degree of light in the vicinity of the camera. The light indication can influence the image processing, such as exposure rate of the camera.

In one embodiment, in an automatic picture taking example, the location, time or device resources (e.g., available memory) can also be used to control the rate pictures are taken. Also, the ability of the eyeglass frame to know or acquire time and/or location information (such as the location of the eyeglass frame or the corresponding user) can enable pictures taken by the camera to be stored along with time and/or location indications.

The eyeglass frame having a camera according to one embodiment of the invention can further include a global positioning system (GPS). The information from the GPS can be used to alter configuration settings and/or influence operation of the camera. For example, the configuration settings can be different at night versus during daytime or can be different depending on time or location. As another example, the camera can take pictures depending on location. In one implementation, the camera can automatically take pictures dependent on a change in location. For example, after taking a picture, the camera can take a subsequent picture when the change in location exceeds a predetermined threshold.

In one embodiment, the camera utilized in the various embodiments is a digital camera, namely, a digital image capture device. The camera can be a still camera or a motion camera (i.e., video camera). The camera can be designed for manual focusing, auto-focusing, or predetermined fixed focusing. The camera can also support a wide angle or panoramic view.

FIG. **24** is a side view of a pair of eyeglasses (i.e., eyeglass frame) **2400** according to another embodiment of the invention. The eyeglasses **2400** include a lens holder **2402** for a lens **2404**. The lens holder **2402** is for the left side of the eyeglasses **2400**. A bridge **2406** couples the lens holder **2402** to another lens holder for the right side of the eyeglasses. In this embodiment, the lens **2404** and the lens holder **2402** extend substantially around the side and are sometimes referred to as "wrap-around" type frames. The eyeglasses **2400** include a temple having a forward temple portion **2408** and a rearward temple portion **2410**. Typically, the lens holder **2402**, the temple **2406**, the forward temple portion **2408** and the rearward temple portion **2410** are integrally formed as a single structure. The eyeglasses **2400** also support audio output to a wearer of the eyeglasses **2400**. To support audio, the eyeglasses **2400** include an ear bud **2412**, which serves as a speaker, and an extension arm **2414**. In this embodiment, the extension arm **2414** couples the ear bud **2412** to the forward temple portion **2408**. The extension arm **2414** can be pliable so that the wearer can adjust the position of the ear bud **2412**. In further support of audio, the eyeglasses **2400** couple to a cable **2416**. The cable **2416** provides audio signals to the ear bud **2412** via at least one electrical conductor extending through the cable **2416** and

the extension arm **2414** to the ear bud **2412**. In one implementation, one end of the cable **2416** has a connector **2418** and the other end is integral with or connected to the forward temple portion **2408**. The connector **2418** can connect to a media output device, such as a portable media player (e.g., radio, MP3 player, CD player, etc.). In another implementation, the cable **2416** can have a connector, such as a plug, that connects to a jack **2420** embedded in the forward temple portion **2408**, thereby allowing the cable **2416** to detach from the eyeglasses **2400**. Alternatively, the cable **2416** can directly connect to the media output device without the use of the connector **2418**. Optionally, the eyeglasses **2400** can also support audio input by providing a microphone with the eyeglasses **2400**. In one embodiment, with a microphone, the eyeglasses **2400** serve as a headset for a phone.

Regardless of the electrical components being utilized with the eyeglass frames, it may be desirable for the eyeglass frames to be substantially balanced in weight. In the event that electrical components are attached and/or at least partially embedded in one of the temples of the eyeglass frame, the other of the temples can include other electrical components or even a counter weight so that the eyeglass frame can be substantially balanced.

A number of embodiments have been described regarding electrical components in a temple of a pair of glasses. All of the electronic components can be self-contained inside the temple of the glasses. The components can be coupled to a printed circuit board. In other embodiments, some of the components are embedded fully or partially in other areas of the glasses, such as the lens holders or the bridge of the glasses. Or, one or more electrical components can be in a shield of the glasses. In one embodiment, one embedded electrical component can include a circuit board. The circuit board can be a rigid or a flexible circuit board. In a number of embodiments, electrical components have been described to be fully or partially embedded in a temple of glasses, or in a temple arrangement. In other embodiments, the component(s) can be in other parts of the glasses, such as the lens holders, the nose pads, the bridges or the shields.

The various embodiments, implementations and features of the invention noted above can be combined in various ways or used separately. Those skilled in the art will understand from the description that the invention can be equally applied to or used in other various different settings with respect to various combinations, embodiments, implementations or features provided in the description herein.

A number of embodiments in the invention can be implemented in software, hardware or a combination of hardware and software. A number of embodiments of the invention can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that can store data which can thereafter be read by a computer system. Examples of the computer readable medium include read-only memory, random-access memory, CD-ROMs, magnetic tape, optical data storage devices, and carrier waves. The computer readable medium can also be distributed over network-coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

Numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will become obvious to those skilled in the art that the invention may be practiced without these specific details. The description and representation herein are the common meanings used by those experienced or skilled in the art to most effectively convey the substance of their work to others skilled in the art. In other instances, well-known methods,

procedures, components, and circuitry have not been described in detail to avoid unnecessarily obscuring aspects of the present invention.

Also, in this specification, reference to “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one embodiment of the invention. The appearances of the phrase “in one embodiment” in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Further, the order of blocks in process flowcharts or diagrams representing one or more embodiments of the invention do not inherently indicate any particular order nor imply any limitations in the invention.

Other embodiments of the invention will be apparent to those skilled in the art from a consideration of this specification or practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with the true scope and spirit of the invention being indicated by the following claims.

Other embodiments of the invention will be apparent to those skilled in the art from a consideration of this specification or practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with the true scope and spirit of the invention being indicated by the following claims.

What is claimed is:

1. An eyewear frame for a user, comprising:

a front portion;

first and second side portions coupled to opposite sides of the front portion; and

a first printed circuit board provided in the eyewear frame, the first printed circuit board having at least one electrical component attached thereon, the at least one electrical component being a first electrical component, the first electrical component attached on the first printed circuit board and electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyewear frame,

wherein the first printed circuit board is in the eyewear frame, positioned in the vicinity of the middle area of the front portion of the eyewear frame,

wherein at least one of the plurality of other electrical components is in the front portion of the eyewear frame, and

wherein the plurality of other electrical components comprise at least a switch and a wireless communication component.

2. An eyewear frame as recited in claim 1 wherein the wireless communication component is at least partially in the eyewear frame to wirelessly couple to a portable electrical device separate from the eyewear frame.

3. An eyewear frame as recited in claim 2, wherein the portable electrical device is operable as a cellular phone.

4. An eyewear frame as recited in claim 1, wherein the plurality of other electrical components comprise at least a sensor configured to sense a physical condition of the user, and the sensor being in the eyewear frame.

5. An eyewear frame as recited in claim 4, wherein the sensor comprises an accelerometer.

6. An eyewear frame as recited in claim 4, wherein the sensor comprises a location sensor that is configured to provide location data.

7. An eyewear frame as recited in claim 1, wherein the plurality of other electrical components comprise at least an operation indicator configured to provide an indication perceivable external to the eyewear frame by humans regarding a status.

8. An eyewear frame as recited in claim 7, wherein the operation indicator comprises an optical indicator configured to illuminate in a predetermined manner to provide the indication.

9. An eyewear frame as recited in claim 1, wherein the plurality of other electrical components comprise a rechargeable battery configured to provide power to at least one electrical component in the eyewear frame, and the rechargeable battery being in the eyewear frame, and

wherein the plurality of other electrical components comprise an electrical connector configured to receive a counterpart electrical connector of an electrical device external to the eyewear frame.

10. An eyewear frame as recited in claim 1, wherein the eyewear frame comprises a non-mechanical selection mechanism configured to assist the user to set a preference.

11. An eyewear frame as recited in claim 1, wherein the eyewear frame comprises a lens holder, and wherein at least one of the plurality of other electrical components is in or covered by at least a portion of the lens holder.

12. An eyewear frame as recited in claim 1, wherein the plurality of other electrical components comprise a radiation detector for sensing radiation.

13. An eyewear frame as recited in claim 1, wherein the plurality of other electrical components comprise a camera and an output device, and wherein the output device is configured to present information based on at least an image captured by the camera, to the user.

14. An eyewear frame as recited in claim 13, wherein at least a part of the information is wirelessly received by the eyewear frame via the wireless communication component.

15. An eyewear frame as recited in claim 1, wherein the plurality of other electrical components comprise an output device, and wherein the output device is configured to present information related to a location of the eyewear frame.

16. An eyewear frame as recited in claim 15, wherein at least in view of the location of the eyewear frame indicating the eyewear frame being located at a store, the information related to the location configured to be presented is related to a product in the store.

17. An eyewear frame as recited in claim 1, wherein the plurality of other electrical components comprise (i) a location sensor to provide location data regarding the eyewear frame and (ii) an output device, and

wherein based on the location data regarding the eyewear frame from the location sensor, the output device is configured to present to the user information related to where the eyewear frame is located.

18. An eyewear frame as recited in claim 1, wherein the plurality of other electrical components comprise at least a microphone, a memory device, and an output device, and

wherein the memory device comprises at least a portion of computer code configured for voice recognition to recognize voice input received by the eyewear frame via the microphone, and to allow data to be searched

through voice via the microphone to produce searched results to be presented by the output device.

19. An eyewear frame as recited in claim 18, wherein the output device comprises a speaker, wherein the eyewear frame is configured to ask the user via the speaker if the searched results are appropriate after the searched results are presented by the output device, and

wherein in view of a response from the user that the searched results are not appropriate, the eyewear frame is configured to have the output device ask the user to verbalize the search again.

20. An eyewear frame as recited in claim 1, wherein the plurality of other electrical components comprise at least a camera, and

wherein as images are captured by the camera, the wireless communication component is configured to wirelessly transmit at least one of the images captured by the camera to another electrical device separate from the eyewear frame, to allow at least an observation to be shared with another user through the at least one of the images.

21. An eyewear frame as recited in claim 1, wherein the eyewear frame is configured to establish a wireless connection via the wireless communication component to enable at least voice over IP connection via the eyewear frame.

22. An eyewear frame as recited in claim 21, wherein the wireless connection comprises cellular connection.

23. An eyewear frame as recited in claim 1 further comprising a speaker at least partially in one of the side portions.

24. An eyewear frame as recited in claim 23 further comprising:

a flexible printed circuit board in the eyewear frame that is connected to an electrical component in the eyewear frame via the first printed circuit board, wherein at least one electrical component is secured to the flexible printed circuit board;

a light source at least partially in the eyewear frame; an electrical component, at least partially in the eyewear frame, configured to help display information to the user; and

a microphone at least partially in the eyewear frame.

25. An eyewear frame as recited in claim 24 further comprising:

a memory device with at least a portion of voice recognition computer code for recognizing voice input via the microphone; and

a camera with at least a lens to at least capture images of an environment of the eyewear frame, wherein the lens is configured to face forward when the eyewear frame is worn,

wherein the eyewear frame is configured to present data to the user based on at least an image captured by the eyewear frame.

26. An eyewear frame as recited in claim 25, wherein the eyewear frame is part of a portable electrical system, and

wherein the portable electrical system comprises:

a handheld device separate from the eyewear frame, the handheld device being configured to be wirelessly coupled to the wireless communication component; and

a wearable device, which is configured to be electrically tethered to the eyewear frame via a cord,

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wherein the wearable device includes at least a rechargeable battery, a processor, a memory and an electrical connector.

27. An eyewear frame as recited in claim 26 further comprising:

a first sensor configured to measure distance; and
a second sensor to track an attribute regarding at least an eye of the user.

28. An eyewear frame as recited in claim 1 further comprising a flexible printed circuit board in the eyewear frame that is connected to an electrical component in the eyewear frame via the first printed circuit board, wherein at least one electrical component is secured to the flexible printed circuit board.

29. An eyewear frame as recited in claim 1 further comprising a light source at least partially in the eyewear frame.

30. An eyewear frame as recited in claim 1 further comprising an electrical component, at least partially in the eyewear frame, configured to help display information to the user.

31. An eyewear frame as recited in claim 1 further comprising a microphone at least partially in the eyewear frame.

32. An eyewear frame as recited in claim 31 further comprising a memory device with at least a portion of voice recognition computer code for recognizing voice input via the microphone.

33. An eyewear frame as recited in claim 1, wherein the eyewear frame is part of a portable electrical system, and wherein the portable electrical system comprises a handheld device separate from the eyewear frame, the handheld device being configured to be wirelessly coupled to the wireless communication component.

34. An eyewear frame as recited in claim 1, wherein the eyewear frame is configured to present data via an output device to the user based on at least an image captured by a camera at least partially in the eyewear frame, wherein the data is configured to be received by the wireless communication component.

35. An eyewear frame as recited in claim 1 further comprising a camera with at least a lens positioned in the vicinity of the middle area of the front portion of the eyewear frame, to at least capture images of an environment of the eyewear frame, wherein the lens is configured to face forward when the eyewear frame is worn.

36. An eyewear frame as recited in claim 1 further comprising a sensor to track an attribute regarding at least an eye of the user.

37. An eyewear frame as recited in claim 1 further comprising a sensor configured to measure distance.

38. An eyewear frame as recited in claim 1, wherein the eyewear frame is part of an electrical system, and wherein the electrical system comprises a wearable device configured to be electrically tethered to the eyewear frame via a cord.

39. An eyewear frame as recited in claim 38, wherein the wearable device includes at least a rechargeable battery, a processor, a memory and an electrical connector.

40. A portable electrical system comprising an eyewear frame for a user, wherein the eyewear frame comprises:

a front portion;
first and second side portions coupled to opposite sides of the front portion;

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a printed circuit board provided in the eyewear frame, the printed circuit board having at least one electrical component attached thereon, the at least one electrical component being a first electrical component, the first electrical component attached on the printed circuit board and electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyewear frame; and

at least one lens that allow the user to view, without requiring any electrical components, at least a part of its physical environment through at least a portion of the at least one lens when the eyewear frame is worn,

wherein the printed circuit board is in the eyewear frame, positioned in the vicinity of the middle area of the front portion of the eyewear frame,

wherein at least one of the plurality of other electrical components is in the front portion of the eyewear frame,

wherein the plurality of other electrical components comprise at least a wireless communication component, a camera, a microphone, a memory device, and an output device,

wherein the eyewear frame is configured to present information to the user via the output device, with the information based on at least an image captured by the camera,

wherein the memory device comprises at least a portion of computer code configured for voice recognition to recognize voice input received by the eyewear frame via the microphone to perform a function via the eyewear frame, and

wherein the eyewear frame is configured to present to the user data wirelessly received by the eyewear frame via the wireless communication component.

41. A portable electrical system as recited in claim 40 further comprising a wearable electrical device configured to be electrically tethered to the eyewear frame via a cord.

42. An eyewear frame for a user comprising:

a front portion;
first and second side portions coupled to opposite sides of the front portion; and

a printed circuit board provided in the eyewear frame, the printed circuit board having at least one electrical component attached thereon, the at least one electrical component being a first electrical component, the first electrical component attached on the printed circuit board and electrically connected to a plurality of other electrical components, each of the plurality of other electrical components being provided at least partially in the eyewear frame; and

at least one lens that allow the user to view, without requiring any electrical components, at least a part of its physical environment through at least a portion of the at least one lens when the eyewear frame is worn,

wherein the printed circuit board is in the eyewear frame, positioned in the vicinity of the middle area of the front portion of the eyewear frame,

wherein at least one of the plurality of other electrical components is in the front portion of the eyewear frame,

wherein the plurality of other electrical components comprise at least a wireless communication component, an accelerometer, a location sensor, and an output device, wherein the location sensor is configured to provide location data regarding the eyewear frame,

wherein based on the location data regarding the eyewear
frame from the location sensor, the eyewear frame is
configured to present to the user via the output device,
information related to where the eyewear frame is
located, 5
wherein the accelerometer is configured to provide data
regarding movement of the user, with the user wearing
the eyewear, and
wherein the eyewear frame is configured to present to the
user data received via the wireless communication 10
component.

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