konditioniert oder eingestellt werden. Die Sensoren können etwa auf die Haut aufgeklebt oder in speziellen Fällen implantiert werden.

Apple Inc. Exhibit 1015 Page 1501

23.05.00

Woodward Corporation Ltd.
Douglas, Isle of Man

16329

Schutzansprüche

1. Vorrichtung zur Datenübertragung zwischen einer Person und einer Basis, gekennzeichnet durch folgende Merkmale:
   - an der Person anzusetzende Einrichtungen (6, 7, 8, 9, 10, 11, 12) zur Dateneingabe und Datenausgabe;
   - eine an der Person anzusetzende, den Datenaustausch zu und von der Basis ermöglichende Sende/Empfänger-Einrichtung (8).

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass die Sende/Empfänger-Einrichtung ein drahtloser Sender/Empfänger (8) ist.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass die Einrichtungen (6, 7, 8, 9, 10, 11, 12) zur Dateneingabe und Datenausgabe jeweils in ihrer Energieversorgung autark sind und mit jeweils einer Sender- und/oder Empfängereinrichtung zu einer Baueinheit zusammengefasst sind.

4. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Einrichtungen zur Dateneingabe und Datenausgabe ein Mikrofon (6) und einen Lautsprecher (7) umfassen.

5. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Einrichtungen zur Dateneingabe und Datenausgabe ein Display (11, 12) und/oder einen Sensor (17) und/oder eine Bildaufnahmeeinrichtung (13) umfassen.

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6. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Einrichtung einen Mikrocontroller (10) umfasst.

7. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Sender/Empfänger-Einrichtung ein im Megahertz-Bereich arbeitender Sender/Empfänger ist.

8. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die einzelnen Einrichtungen der Vorrichtung auf die Person aufklebbar oder in diese implantiert sind.

9. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass sie eine Vorrichtung zum Freisprechen über ein Mobiltelefon ist, wobei die einzelnen Einrichtungen an einer Brille (1) angeordnet sind.

10. Vorrichtung nach Anspruch 9, dadurch gekennzeichnet, dass zumindest ein Mikrofon, ein Ohrhörer und eine Signalverbindungseinrichtung in die Brille integriert sind.

11. Vorrichtung nach Anspruch 10, dadurch gekennzeichnet, dass die Signalverbindungseinrichtung einen an der Brille angeordneten batteriebetriebenen, drahtlosen Sender/Empfänger (8) aufweist.

12. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass sie zur zentralen Energieversorgung eine Batterie (9), nämlich eine Knopfzelle oder eine Solarbatterie aufweist.

Apple Inc. Exhibit 1015 Page 1503

13. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass bei Verwendung eines Mikrofones (6) dieses so angeordnet ist, dass es an einem oder in der Nähe eines Schädelknochens der Person anliegt, oder in der Nähe des Mundes der Person angeordnet ist (6´).

14. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Vorrichtung (1) zumindest einen Datenträger (10, 12) umfasst.

15. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, dass zumindest ein Datenträger mit einem Mikrocontroller (10) verbunden ist.

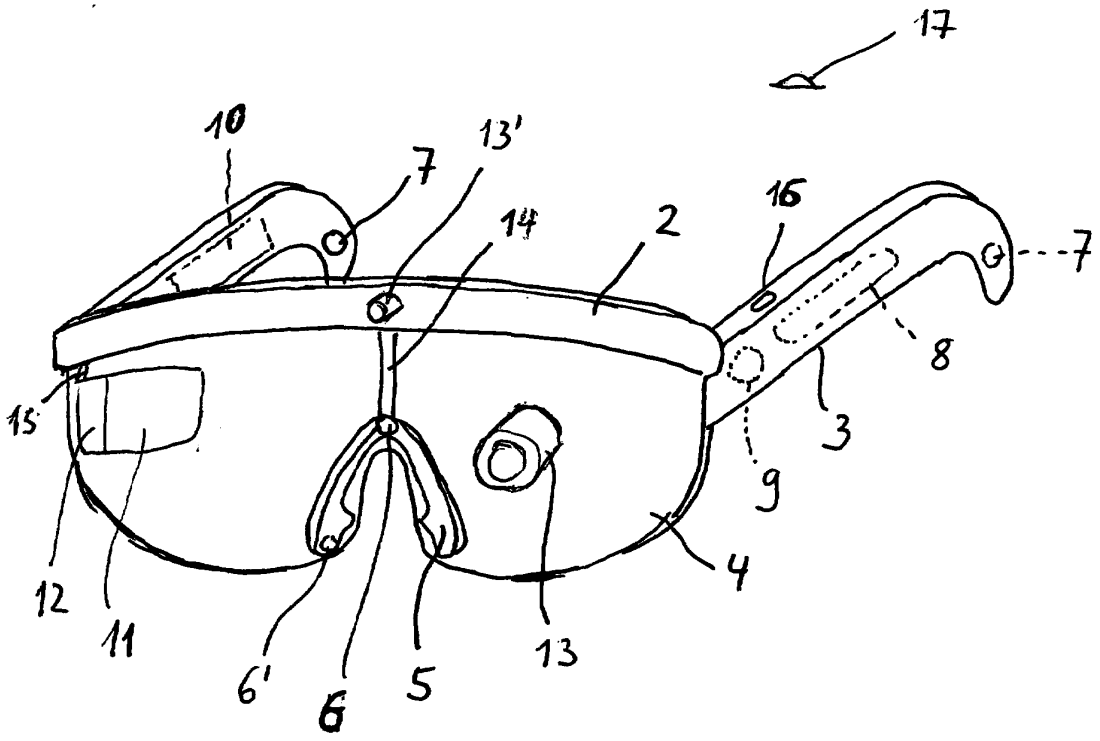
16. Vorrichtung nach Anspruch 15, dadurch gekennzeichnet, dass der Mikrocontroller (10) die Funktion der Vorrichtung steuert.

17. Vorrichtung nach Anspruch 16, dadurch gekennzeichnet, dass die Vorrichtung Teil eines Systems zum Zahlungsverkehr, oder zu einer Zugangskontrolle, Teil des Internets, eines Computersystems oder eines Positionsbestimmungssystems ist.

18. Vorrichtung nach einem der Ansprüche 9 bis 17, dadurch gekennzeichnet, dass die Brille in einem Randbereich ihrer Sichtscheibe (4) ein Display (11) zum Einspielen von optischen Informationen aufweist.

Apple Inc. Exhibit 1015 Page 1504

1



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(54) Combination headset having adjustable means for positioning speakers to combine ambient and speaker sounds.

(57) A personal audio assembly including a pair of miniature speakers (12,14) releasably connected with the sidepieces (38) of a pair of spectacles (10) or headgear in a manner permitting adjustment of the speakers longitudinally, angularly and vertically with respect to the sidepieces or headgear and toward and away from the ears of a user. Leads (16,18) connect the speakers with an audio source controlling sound entering the ear and are provided with an adjusting member (32) maintaining the speakers in a selected position allowing the user to simultaneously hear a combination of speaker and ambient sounds.

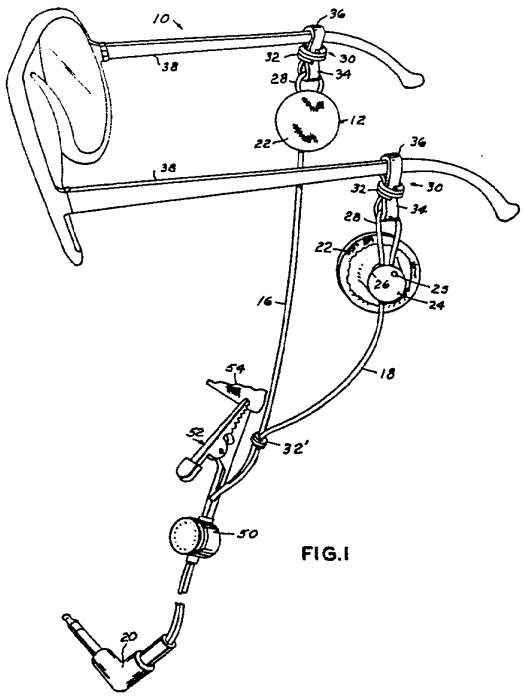


FIG.1

EP 0 403 701 A1

Combination Headset Having Adjustable Means for Positioning Speakers to Combine Ambient and Speaker Sounds

The present invention relates to audio communication and more particularly to a sound intake control device and adjustable supports therefor.

Radios, tape players and other audio equipment have been miniaturized to such an extent that they may be conveniently carried on the person of a user, such as in a pocket or other portion of the wearer's clothing or accessories. Many diverse audio sources are now in use.

At present audio headsets and earphones are limited to a single position; existing headsets and earphones enclose the ear; are pressed adjacent to the ear; are placed in the outer ear; or, are positioned inside the auditory canal.

Prior art devices, due to this single position limitation, have the inherent effect of masking outside sounds with sound produced by the earphones. With respect to safety, the wearer is hindered in his ability to hear surrounding sounds such as instructions, warnings, automobiles, sirens, conversations etc.

The most widely used, present design audio headset is awkward to wear and cumbersome to carry. Cord entanglement problems occur regularly and the resulting entanglement can cause short circuiting of speaker or microphone leads, as well as incur the bother and loss of time spent untangling headset wires.

Additional entanglement problems arise when the now common "leash" (a retainer cord used to suspend the glass es around the wearer's neck when not in use) is worn simultaneously with the prior art headset.

Another difficulty involves the wearing of a hat, visor or helmet and a prior art headset simultaneously. Since the majority of headsets in use today consist of a band, which transversely spans the head, a hat, helmet or visor does not fit the wearer's head properly when worn in combination with the headset. At present the small in eartype headsets circumvent this problem however sound quality is sacrificed due to the extra small size of the speakers and they are limited to a single position.

Further shortcomings of prior art include the lack of single hand placement. Both hands are needed to place the headset or earphones in listening position.

Other prior art devices disclose speakers or earphones used as hearing aids for the hard of hearing some of which were supported by spectacles or constructed as a part thereof, in which the terminal end of the respective sidepiece supports a speaker.

The present invention overcomes the above problems of prior art devices by adjustably supporting a pair of miniature speakers on headgear or spectacle sidepieces which can be positioned relative to the headgear or sidepiece either laterally, longitudinally or vertically to position the earphones in a comfortable position adjacent or within the ear for maximum audio and which can serve multiple functions and places the sound in the control device where it can be safely heard, worn, transported and utilized more effectively.

The invention is illustrated in the accomanying drawings in which,

Figure 1 is a perspective view of the device supported by a pair of spectacles;

Figure 2 is a fragmentary view similar to Fig. 1 illustrating spring clips supporting the device on the spectacle sidepiece;

Figure 3 is a fragmentary perspective view illustrating the manner of supporting the device on the user's visor or other head encircling band; and,

Figure 4 is a fragmentary perspective view, similar to Fig. 2, illustrating another embodiment.

The reference numeral 10 indicates the unit as a whole. The device 10 comprises a pair of conventional, commercially available miniature speakers 12 and 14 operatively connected with one end of audio leads 16 and 18, respectively, with the other end of the leads connected with a plug 20 in a conventional manner. Each of the speakers may include a cover 22 through which audio sounds are transmitted and an opposite or rearward substantially cylindrical portion 24, having a vent 25, which receives and is connected with the above named one end portion of the respective audio lead. The respective cylindrical portion 24 is transversely apertured, as at 26, for frictionally receiving, in sliding relation, a portion of the respective audio lead adjacent its connected end to form an audio lead closed loop portion 28 which may be increased or reduced in size to allow the speakers 12 or 14 to be moved vertically for adjustment purposes.

A flexible connector 30 is connected with each speaker loop 28. The flexible connectors 30 are preferably endless bands with juxtaposed portions of its wall surrounded and gripped in sliding relation by a tension adjuster 32 to define a substantially figure eight configuration.

The connectors 30 may be formed by an endless band or may be a strap-like length of flexible plastic material doubled back upon itself from both of its ends and secured together. A tension adjuster 32, transversely surrounding the connector

Apple Inc. Exhibit 1015 Page 1507

band, is formed by a helically twisted length of wire, or the like, and defines oppositely disposed closed loops 34 and 36 at respective ends of the flexible connector. The loop 34 is engaged with the speaker loop 28 in chain link fashion and the other loop 36 of the flexible connector transversely surrounds a respective one of a pair of spectacle sidepieces 38 intermediate its ends. The loop 36 allows horizontal movement of the speakers longitudinally of the respective sidepiece.

A tension adjuster member 32′ also surrounds the audio leads 16 and 18 intermediate their ends for the purpose presently explained. A rheostat 50 is interposed in the leads 16 and 18 between the tension adjuster 32′ and the plug 20 as a volume control. An alligator-type clip or clamp 52 is attached to the leads between the volume control 50 and the tension adjuster 32′ for supporting the volume control in a convenient location as by attaching the clamp 52 to a portion of the user's clothing 54.

Referring also to Figs. 2 and 3, the reference numerals 40 and 41 indicate a pair of spring clips or clamps which may be used in place of the connectors 30. This is accomplished by permanent attachment of the clamp to the speaker cord or manually opening the respective spring clamp so that the speaker cord loop 28 is received between the gripping end portion 42 of the clamp and its spring closed hinged connection 44 so that the respective speaker 12 or 14 is then supported in depending relation from the respective clamp. The clamp gripping end 42 is then disposed on opposing sides of the respective spectacle sidepiece 38 at a selected location intermediate its length.

In the event the user of the device does not wear spectacles, the clamps 40 permit attachment to other headgear, such as the sweatband of a hat, not shown, or the band of a visor, as indicated at 46 (Fig. 3). The respective clamp 40 and 41 is positioned as shown with its gripping end edge 42 gripping opposing sides of the depending edge portion of the visor band 48.

Referring more particularly to Fig. 4 other clamps 60, only one being shown, similarly griping the spectacle sidepieces 38, support similar speakers 62 in cantilever fashion by arm means 64. A pad 63 surrounds the major portion of the speaker. In the example shown the arm means 64 comprises a forward bar 66 rigidly attached at one end to the clamp 60 opposite its gripping end portion 68 and longitudinally slidably attached at its other end portion to the forward end portion of a rearward arm 70 having its opposite or rearward end rigidly secured to the speaker 62. This permits vertical adjustment of the speaker relative to the sidepiece 38 and the user's ear, not shown, by the angular position of the clamp 60 relative to the longitudinal axis of the sidepiece. Forward and rearward adjustment of the speaker 62 relative to the sidepiece and the user's ear is achieved primarily by the sliding movement of the arm 70 relative to the bar 66 and secondly by the position of the clamp 60 longitudinally of the sidepiece. It seems obvious that the arm 70 may serve as a gooseneck having a ball at its rearward end cooperatively received by a socket formed in the housing supporting the speaker components to impart substantially all the advantages of ball and socket movement of the speaker 62 relative to the user's ear, if desired.

In use the flexible connectors 30 have their free loop ends 36 transversely surrounding the respective spectacle sidepiece. With the spectacles in wearing position, the speakers are adjusted by moving the flexible connectors 30 longitudinally of the respective sidepiece so that the speakers are positioned relative to the user's ear in a desired position in accordance with other parameters which may or may not be limiting the user's attention. For example, the speakers may be positioned so that a desired audio program may be heard and yet other sounds may also be received, such as automobiles, warnings, instructions or the conversations of others. By moving the adjuster 32 toward the respective sidepiece the size of the loop 36 is reduced to grip the sidepiece so the speakers are frictionally maintained adjacent or in the user's audio canal, as desired. The speakers may be positioned independently of each other to further enhance listening capabilities.

The strap-like configuration of the connectors 30, in combination with a small size for the loop 34, prevents angular rotation of either speaker about a vertical axis through the respective connector 30. The coefficient of sliding friction between the connector loop 36 and the surface of the sidepiece 38 prevents movement of one component relative to the other except as manually induced.

The speakers are easily adjusted vertically relative to the sidepieces or the user's ears by increasing or decreasing the size of the lead loop 28. Further, if the user desires the speakers to be in close proximity to the ear the lead adjuster 32′ may be moved longitudinally of the leads until disposed in underlying relation with respect to the user's chin to place a slight tension on the leads 16 and 18 and draw the speakers inwardly toward each other.

Alternatively, the leads may be positioned rearwardly of the user's head and the adjuster 32′ disposed adjacent the back of the head to maintain the speakers adjacent the ears and to maintain the spectacles in place on the face of the user. In this position the speaker assembly 10 may also be employed to support the spectacles in a position

Apple Inc. Exhibit 1015 Page 1508

hanging from the user's neck.

It seems obvious that the spring clamps 40 and 41 may be connected with the lead loops 28, as described hereinabove, for use with the headgear as desired.

Claims

1. A personal audio unit for connection with an audio source, comprising a pair of speakers, (12,14) flexible leads extending between and having opposing ends respectively operatively connecting said speakers with an audio source, mounting means including a clamp (40,41) secured to each speaker of said pair of speakers for attachment with means on the head of a user and supporting the respective speaker of said pair of speakers in a position to select a combination of sounds, said combination of sounds to be heard simultaneously by the user, the combination of sounds being generated from the speakers as well as from external, ambient sources position relative to the user's ears in which the means on the head of the user includes, each speaker of said pair of speakers having a cylindrical portion (24) and having a transverse aperture (26) therethrough slidably receiving an intermediate portion of the respective lead for forming a closed lead loop (28) adjacent the speaker connected end of the respective lead, and, said clamp surrounding an intermediate portion of the respective lead forming the lead loop in speaker supporting relation.

2. The audio unit according to claim 1 in which the means on the head of the user includes, a pair of spectacles (10) having sidepieces (38) adapted for engaging a user's head adjacent the ears for supporting the spectacles, each speaker of said pair of speakers (12,14) having a cylindrical portion (24) and having a transverse aperture (26) therethrough slidably receiving an intermediate portion of the respective lead for forming a closed lead loop (28) adjacent the speaker connected end of the respective lead, and, means adjustably connecting each speaker of said pair of speakers (12,14) with the respective sidepiece (38) of said spectacles including an elongated flexible connector (30) having a closed connector loop (34,36) at each of its ends respectively surrounding for manual adjustment longitudinally along an intermediate portion of a sidepiece and connected, in chain link fashion, with a respective said closed lead loop (28) for permitting swinging movement of each speaker of said pair of speakers toward and away from a user's head and disposing each speaker of said pair of speakers in a predetermined position relative to the user's ears.

3. The audio unit according to claim 2 in which each flexible connector (30) comprises, an endless strap-like band, and, a first tension means (32) including a helically wound strand transversely surrounding, in frictional sliding relation, juxtaposed intermediate portions of the respective band for reducing the area encompassed by the sidepiece surrounding closed connector loop (36) and precluding movement of the respective flexible connector (30) relative to the attached sidepiece.

4. The audio unit according to claim 3 in which the other end portion of the flexible leads depend from the speakers and further including, a second tension means (32′) frictionally slidably surrounding the flexible leads (16,18) intermediate their ends for limiting movement of the pair of speakers (12,14) away from a user's head when the spectacles (10) are in normal wearing position and the second tension means (32′) is disposed toward the speaker connected end of the leads.

5. A personal audio unit as claimed in claim 1, wherein the speakers (12,14) are positioned within the user's ears, thereby preventing a substantial amount of the external, ambient sounds from being heard by the user.

6. A personal audio unit as claimed in claim 1, wherein the speakers (12,14) are positioned forwardly and away from the user's ears, thereby allowing the user to clearly and simultaneously hear sounds coming from the speakers as well as the sounds coming from external, am bient sources.

7. A personal audio unit for connection with an audio source, comprising, a pair of speakers, (12,14) flexible leads (16,18) extending between and having opposing ends respectively operatively connecting said speakers with an audio source, mounting means including a clamp (40,41) secured to each speaker of said pair of speakers for attachment with means on the head of a user and supporting the respective speaker of said pair of speakers in a position to select a combination of sounds, said combination of sounds to be heard simultaneously by the user, the combination of sounds being generated from the speakers as well as from external, ambient sources position relative to the user's ears, a pair of spectacles (10) having sidepieces (38) adjacent and extending forwardly from the ears of the user, and, a pair (66,70) of elongated arm means (64) slidably connected together at one end portion in longitudinal overlapping relation and connected at their other ends with the respective said clamp and speaker of said pair of speakers.

8. A personal audio unit for connection with an audio source, comprising, a pair of speakers, (12,14) flexible leads (16,18) extending between and having opposing ends respectively operatively connecting said speakers with an audio source,

Apple Inc. Exhibit 1015 Page 1509

mounting means including a clamp (40,41) secured to each speaker of said pair of speakers for attachment with means on the head of a user and supporting the respective speaker of said pair of speakers in a predetermined audio range position relative to the user's ears in which the means on the head of the user includes, each speaker of said pair of speakers (12,14) having a cylindrical portion (24) and having a transverse aperture (26) therethrough slidably receiving an intermediate portion of the respective lead for forming a closed lead loop (28) adjacent the speaker connected end of the respective lead, and, said clamp (40,41) surrounding an intermediate portion of the respective lead forming the lead loop in speaker supporting relation.

9. A personal audio unit for connection with an audio source, comprising, a pair of speakers, (12,14) flexible leads (16,18) extending between and having opposing ends respectively operatively connecting said speakers with an audio source, and, mounting means including a clamp (40,41) for attachment with means on the head of a user and supporting the respective speaker of said pair of speakers in a desired position relative to the user's ears, said mounting means further including, a pair of spectacles (10) having sidepieces (38) adapted for engaging a user's head adjacent the ears for supporting the spectacles, each speaker of said pair of speakers having a cylindrical portion (24) and having a transverse aperture (26) therethrough slidably receiving an intermediate portion of the respective lead for forming a closed lead loop (28) adjacent the speaker connected end of the respective lead, and, means adjustably connecting each speaker of said pair of speakers with the respective sidepiece of said spectacles including an elongated flexible connector (30) having a closed connector loop (34,36) at each of its ends respectively surrounding for manual adjustment longitudinally along an intermediate portion of an sidepiece (38) and connected, in chain link fashion, with a respective said closed lead loop (28) for permitting swinging movement of each speaker of said pair of speakers toward and away from a user's head and disposing each speaker of said pair of speakers in a predetermined position relative to the user's ears.

10. The audio unit according to claim 9 in which each flexible connector comprises, an endless strap-like band, and, a first tension means (32) including a helically wound strand transversely surrounding, in frictional sliding relation, juxtaposed intermediate portions of the respective band for reducing the area encompassed by the earpiece (38) surrounding closed connector loop (36) and precluding movement of the respective flexible connector relative to the attached sidepiece.

11. The audio unit according to claim 10 in which the other end portion of the flexible leads depend from the speakers and further including, a second tension means (32') frictionally slidably surrounding the flexible leads (16,18) intermediate their ends for limiting movement of the pair of speakers away from a user's head when the spectacles are in normal wearing position and the second tension means is disposed toward the speaker connected end of the leads.

12. A personal audio unit for connection with an audio source, comprising, a pair of speakers, (12,14) flexible leads (16,18) extending between and having opposing ends respectively operatively connecting said speakers with an audio source, mounting means including a clamp (40,41) secured to each speaker of said pair of speakers for attachment with means on the head of a user and supporting the respective speaker of said pair of speakers in a desired position relative to the user's ears, a pair (66,70) of elongated arm means (64) slidably connected together at one end portion in longitudinal overlapping relation and connected at their other ends with the respective said clamp and speaker of said pair of speakers.

13. A personal audio unit for connection with an audio source supported by the user, comprising, a pair of speakers, (12,14) flexible leads (16,18) extending between and having opposing ends respectively operatively connecting said speakers with an audio source, and, mounting means including a clamp (40,41) secured to each speaker of said pair of speakers for attachment with means on the head of a user and supporting the respective speaker of said pair of speakers in a desired position relative to the user's ears, said means on the head of the user further including, a pair of spectacles (10) having sidepieces (38) adjacent and extending forwardly from the ears of the user, and, a pair (66,70) of elongated arm means (64) slidably connected together at one end portion in longitudinal overlapping relation and connected at their other ends with the respective said clamp and speaker of said pair of speakers.

Apple Inc. Exhibit 1015 Page 1510

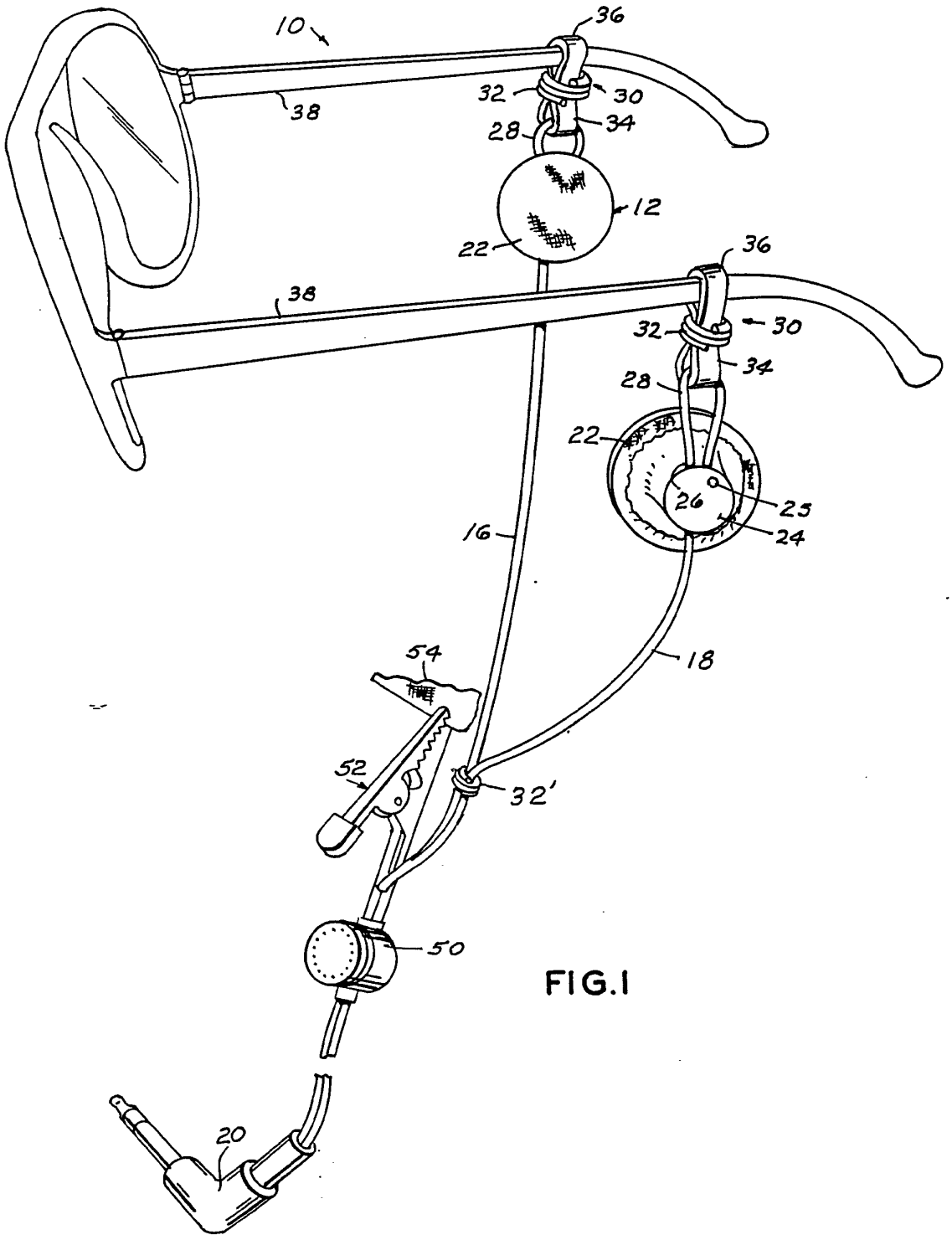

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FIG.1

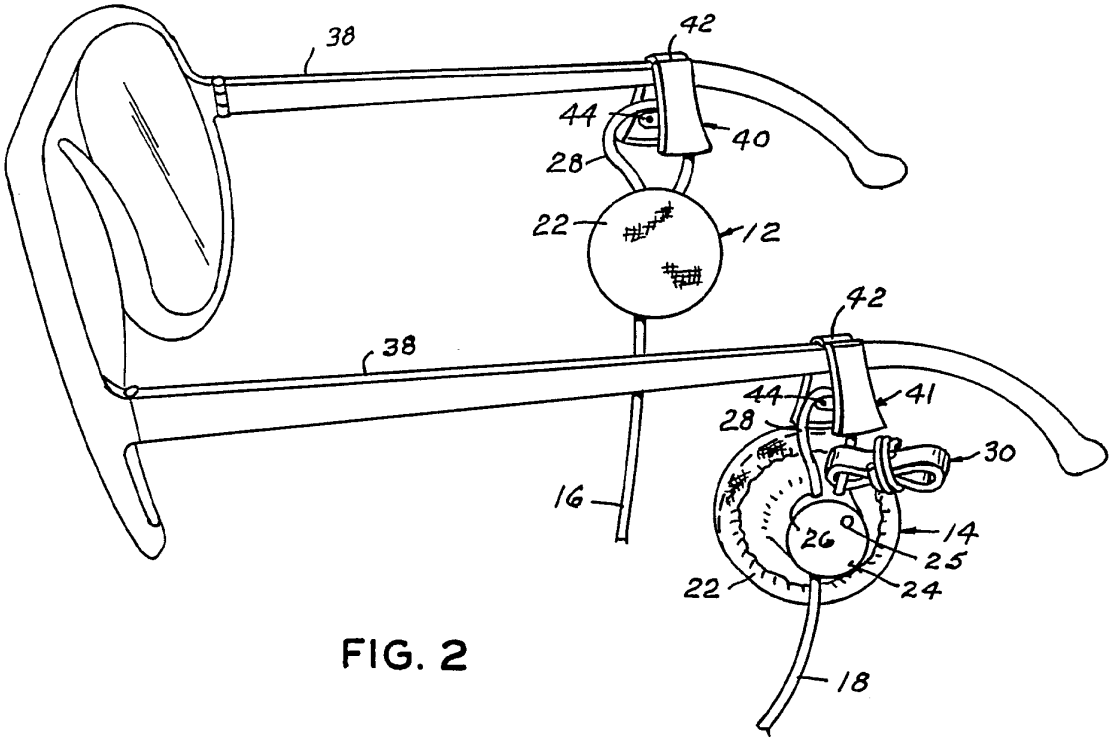


FIG. 2

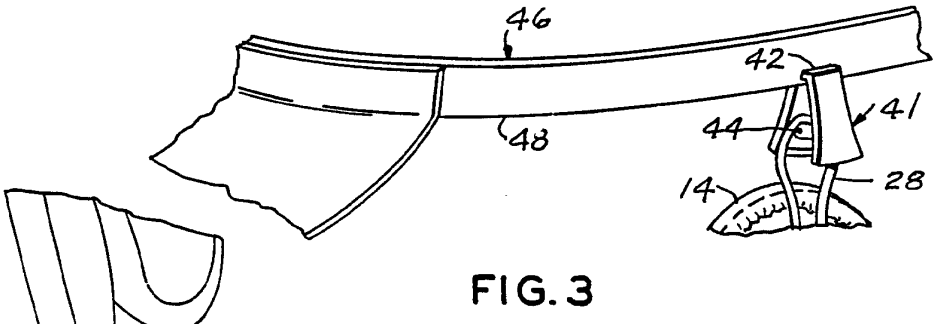


FIG. 3

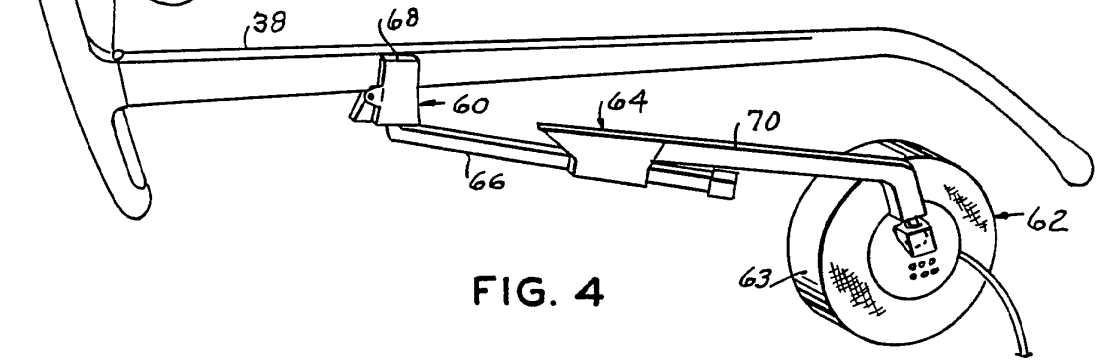


FIG. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 30 6306

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	EP-A-0 291 913 (POLAROID CORP.) * The whole document *	1,7-9, 12,13	H 04 R 1/10 G 02 C 11/00
A		2,6	

Y	US-A-4 753 514 (KUBIK) * Abstract; column 2, line 55 - column 3, line 5; figure 1 *	1,8,9	
A		2	

Y	US-A-3 943 925 (LEIGHT) * Abstract; figure 1 *	7,12,13	

A	GB-A- 628 661 (KIMMEL) * Claims 1-3; figure *	1,2,5	

A	US-A-4 802 243 (GRIFFITHS) * Column 2, line 25 - column 3, line 34; figures *	1,8,9	

A	DE-A-2 351 504 (T. PALMAER) * Page 3, lines 11-19; figure 2 *	1,8,9	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 04 R
H 04 M
H 04 B
G 02 C
A 61 F
A 42 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26-02-1990	GASTALDI G.L.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/597,874	**01/10/2025 06:24:36 PM Z ET**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7223	FILED BY	Angela Nijim
PATENT CENTER #	68650948	FILING DATE	03/06/2024
CUSTOMER #	34071	FIRST NAMED INVENTOR	Thomas A. Howell
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Peter Tong

Documents

TOTAL DOCUMENTS: 15

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
CN_2145478_Y_wAbstract.pdf	7	Foreign Reference	330 KB
CN_2365848_Y_wAbstract.pdf	15	Foreign Reference	722 KB
EP_0403701_A1.pdf	8	Foreign Reference	906 KB
GB_2343263_A.pdf	93	Foreign Reference	7245 KB
GB_2405049_A.pdf	19	Foreign Reference	1078 KB
GB_2411009_A.pdf	18	Foreign Reference	995 KB
DE_20009219_U1_wTranslation.pdf	22	Foreign Reference	1165 KB

JP_2000197173_A_wAbstract.pdf	8	Foreign Reference	511 KB
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KR_200221392_Y1_wTranslation_CUTE.pdf	17	Foreign Reference	902 KB
IPVCP003X1C4X1C2_IDSTrans_1-25.pdf	2	Letter specifying the conditions for filing under 37 CFR 1.97	20 KB
Tse-TheEffectOfVisualStimulation.pdf	11	Non Patent Literature	481 KB
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Spitzer_Eyewear-based_Displays.pdf	6	Non Patent Literature	3533 KB
IPVCP003X1C4X1C2_1449_1-25.pdf	2	Information Disclosure Statement (IDS) Form (SB08)	30 KB

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Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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Spitzer_Eyewear-based_Displays.pdf	E2190E1C8AA6B9EBF97DDDB7BB6250976BEC32429152DD82 D64679437CB25D4123273B79DD166F863BC384093E62F4A681 245F2A01B51646302F36A4C1E17C28
IPVCP003X1C4X1C2_1449_1-25.pdf	DEC382699B8B51448CF44E0D274A2BE2C97B8B0EF0D3F023 F71FB03673A22BF03F5F8C6BEE130E72CF754D97B57700FC7 9C218208D9F5D69DDD516F840BCD579

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

National Stage of an International Application under 35 U.S.C. 371

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

New International Application Filed with the USPTO as a Receiving Office

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

Form 1449 (Modified)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
	Filing Date	March 6, 2024
	Group	2872
(Use Several Sheets if Necessary)		Page 1 of 2

U.S. Patent Documents

Examiner Initial	No.	Patent No.	Date	Patentee	Class	Sub-class	Filing Date
	1.	2001/0043266 A1	Nov-01	Robinson et al.			
	2.	2002/0089469 A1	Jul-02	Cone et al.			
	3.	2002/0101510 A1	Aug-02	Basson et al.			
	4.	2004/0178970 A1	Sep-04	El Sayed et al.			
	5.	2005/0275714 A1	Dec-05	Ishikawa et al.			
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	9.	5,455,638	Oct-95	Kallman et al.			
	10.	6,181,304	Jan-01	Robinson et al.			

Foreign Documents

							Translation	
Init.		Document No.	Date	Country	Class	Subclass	Yes	No
		CN 2145478Y	Nov-93	China			X abstract	
		CN 2365848Y	Feb-00	China			X abstract	
		EP 0 403 701 A1	Dec-90	Europe				
		GB 2,343,263 A	May-00	Great Britain				
		GB 2,405,049	Feb-05	Great Britain				
		GB 2,411,009 A	Aug-05	Great Britain				
		DE 20009219 U1	Dec-00	Germany			X	
		JP 2000197173A	Jul-00	Japan			X abstract	
		JP 3077384U	May-01	Japan			X	
		KR 200221392 Y1	Apr-01	South Korea			X	

Other Documents (Including Author, Title, Date, Pertinent Pages, etc.)

	A	Spitzer, Paul M. Zavracky, Tom Holzel, Noa M. Rensing, Angela Hyatt Hockman, P. D. Aquilino, Robert W. McClelland, J. Zardeskas, "Eyewear-based displays for personal electronics," Proc. SPIE 4021, Helmet- and Head-Mounted Displays V, (23 June 2000), pp. 27-32; https://doi.org/10.1117/12.389166

Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form 1449 (Modified) **Information Disclosure Statement By Applicant** (Use Several Sheets if Necessary)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
	Applicant	HOWELL et al.
	Filing Date	March 6, 2024
	Group	2872
		Page 2 of 2

	B	Falahee, M., Latham, K., Geelhoed, E. (2000). Safety and Comfort of Eyeglass Displays. In: Thomas, P., Gellersen, HW. (eds) Handheld and Ubiquitous Computing. HUC 2000, pp 236–247. Lecture Notes in Computer Science, vol 1927. Springer, Berlin, Heidelberg. https://doi.org/10.1007/3-540-39959-3_18
	C	Tse, Mimi MY, Jacobus KF Ng, Joanne WY Chung, and Thomas KS Wong. "The effect of visual stimulation via the eyeglass display and the perception of pain." *CyberPsychology & Behavior* 5, no. 1 (2002): 65-75. https://doi.org/10.1089/109493102753685890

Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/597,874	**12/04/2024 03:39:41 PM Z ET**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7223	FILED BY	Angela Nijim
PATENT CENTER #	68206554	AUTHORIZED BY	Peter Tong
CUSTOMER #	34071	FILING DATE	03/06/2024
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Thomas A. Howell

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 6752	**E2024B4F41105000**	**Angela Nijim**

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
503874	**37 CFR 1.21 (Miscellaneous fees and charges)**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1801	REQUEST FOR CONTINUED EXAMINATION (RCE) - 1ST REQUEST (SEE 37 CFR 1.114)	1360.00	1	1360.00
1202	EACH CLAIM IN EXCESS OF 20	100.00	99	9900.00
1201	EACH INDEPENDENT CLAIM IN EXCESS OF THREE	480.00	3	1440.00
			TOTAL AMOUNT:	**$12,700.00**

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IMAGE DISPLAY DEVICE

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INVENTOR INFORMATION

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Abstract

<P>PROBLEM TO BE SOLVED: To provide an image display device which has a compact and low-cost device constitution without using a half mirror, a lens or a concave mirror in an information display spectacles and is capable of uniting a virtual image of an output image and a background transmission image and observing the images while maintaining the function of the spectacle of its own. <P>SOLUTION: A lead wire 25b through which image data is introduced, a drive circuit 42, a laser diode array 43, and a galvanometer 44 are respectively disposed on left and right frames 31 of the spectacles 30. A Lippman-Bragg volume hologram sheet 27 is disposed on the lens 34. When an image signal is input to each of the left and the right, each light source of the laser diode array 43 is turned on or off in accordance with the signal and the galvanometer 44 is driven in synchronization with the signal. As the result, an image scanned on the sheet 27 is projected, the reflection light is made incident on pupils and, thereby, a user can unite and observe the background and the enlarged virtual image of the output image from the image output device. <P>COPYRIGHT: (C)2006,JPO&NCIPI

Description

TECHNICAL-FIELD

The present invention relates to an image display device such as a head-mounted display or a head-up display, and in particular, by providing a Lippmann Bragg volume hologram sheet in a spectacle lens, an enlarged display image and transmission through the spectacle lens are maintained while maintaining the original function of the spectacles. The present invention relates to display glasses that can be fused with a background image.

BACKGROUND-ART

Conventionally, as a portable display device, there are various devices such as a personal portable terminal display (PDA) direct view type small liquid crystal display, a head-up display (HUD), and a head mounted display (HMD) as shown in FIG. Proposed.

FIG. 25 shows an example of the configuration of optical components when a person wearing spectacles uses a conventional head-mounted display (HMD). In FIG. 25, an image output device 1 converts an electrical or optical image signal into an actual image and outputs the actual image. 2 is a half mirror, 3 is a concave half mirror, 4 is a spectacle lens, and 5 is a user's pupil (eyeball).

When the reflectance of each of the half mirrors 2 and 3 is 50%, the emitted light from the image output device 1 is reflected by 45 ° at the half mirror 2 and 50% of the light quantity enters the concave half mirror 3. A virtual image enlarged for the user by the reflection of the concave half mirror 3 is formed at an infinite distance or a finite distance. Here, 50% of the amount of light is reflected again, enters the half mirror 2 again, is attenuated to 50%, and then enters the lens 4 of the glasses worn by the user. That is, the outgoing light from the image output device 1 is transmitted or reflected three times through the half mirror, so that 12.5% of the light amount is effectively used. The light from the background is attenuated to 25% by passing through the concave half mirror 3 and the half mirror 2, and enters the pupil 5 after passing through the lens 4 of the glasses worn by the user together with the display virtual image.

DISCLOSURE

TECH-PROBLEM

At present, in order to fuse the virtual image of the output image of the image display device and the background transmission image while having a specific optical function (for example, a function as glasses), for example, as shown in FIG. In addition, at least one half mirror and a lens or a concave mirror (virtual image optical system) for providing a virtual image must be added to the optical system that provides this specific optical function.

In addition, it is possible to combine the virtual image of the output image of the image display device and the background transmission image by using a holographic optical element (HOE) without using a half mirror and a lens or a concave mirror. It does not have a specific optical function.

For example, a conventional portable display device such as a head-mounted display or a head-up display is a burden on the user in both size and weight, and cannot be used for a long time. In addition, because it is far from the shape and size of glasses that are commonly used in public places, the degree of tolerance for the surrounding users is low, or because the user feels uncomfortable about the surroundings. Sufficient usability is not necessarily realized anytime, anywhere.

For one thing, people with refractive errors in the eyes (myopia, hyperopia, presbyopia, astigmatism, etc.) must wear these head-mounted displays and head-up displays while wearing glasses. This is because it is difficult to reduce the size by securing the clearance. In addition, it is also affected by securing an exit pupil

diameter that is larger than necessary in consideration of variations in individual binocular spacing.

Then, in general, as the number of pixels of the image output device is increased, the area of the device increases accordingly, and high definition and miniaturization conflict. In addition, the adverse effect of using a half mirror in the optical path is that as the number of images increases, the displayed virtual image and the transmitted background image will become darker, and the incident angle and the emission angle of the light beam are equal, resulting in a double image. For example, the degree of freedom of arrangement of the optical system is reduced.

In the present invention, when the virtual image of the output image of the image display device and the background transmission image are fused while maintaining a specific optical function, the Lippmann Bragg is not specially used without using a half mirror and a lens or a concave mirror. An object is to realize this function in a compact and inexpensive manner by laying a volume hologram sheet on an optical component such as a lens constituting the original optical system.

TECH-SOLUTION

(1) In order to solve the above-described problems, the present invention provides a receiving unit that receives an image signal transmitted from an image information transmission source and a drive unit that decodes the image signal received by the receiving unit. And a display means for displaying an image decoded by the drive section, and a power supply section for supplying power to the receiving section, the drive section, and the display means, respectively, and the display means is an electrical or optical image. An image output device that converts a signal into an actual image and outputs the image, an optical member, and a virtual image of an output image of the image output device that is provided on the optical member, is displayed at a predetermined distance from the eye, and When the optical member transmits at least part or all of the visible light region, the virtual image is combined with the background image transmitted through the optical member (Lippmann Bragg volume hologram sheet). And a display unit having a, to constitute a composite image with a transparent background image and the virtual image or the virtual image to direct at least a single lens.

With the above configuration, the virtual image of the output image of the image output device and the background transmission image can be fused and viewed without using a half mirror, a lens, a concave mirror, or the like, while having a specific optical function in a compact and inexpensive manner. it can. In addition, usability and portability are improved.

(2) The Lippmann Bragg volume hologram sheet is sandwiched and held in the optical member. Thereby, the weather resistance of the hologram, particularly the moisture resistance, can be improved simultaneously with the thinning.

(3) The Lippmann Bragg volume hologram sheet is detachably attached to the optical member. This increases the degree of freedom of selection according to the intended use of the device.

(4) The light emitted from the image output device is made incident from the side of the optical member coated with the reflection attenuation film.

(5) Further, the image output device is configured to output a pre-distorted image so as to cancel out the aberration of the image reproducing optical system.

(6) The display unit includes a line-of-sight detection sensor that detects a user's line of sight, and is configured to display a virtual image of an output image of the image output device when the user's line of sight is in a specific range. did.

In addition, the display unit includes a line-of-sight detection sensor and a display position controller that detect a user's line of sight, and is configured to display a virtual image of the output image of the image output device following the line of sight of the user.

With the above configuration, visibility is further improved and usability is improved.

(7) Further, the optical member is constituted by a spectacle lens, the display unit is provided on a spectacles pattern, and the optical axis center distance of the light beam reflected by the Lippmann Bragg volume hologram sheet is varied in the spectacles. A binocular width adjustment mechanism was provided. As a result, the optical axis of the user's eyes and the optical axis of the Lippmann Bragg volume hologram sheet can be matched, and good visual characteristics can be obtained even at high magnification.

ADVANTAGEOUS-EFFECTS

(1) According to the present invention, a specific optical system can be provided in a compact and inexpensive manner by attaching a Lippmann Bragg volume hologram sheet to an optical component such as a lens constituting the original optical system without using a half mirror and a lens or a concave mirror. It is possible to realize an image display device that can combine the virtual image of the output image of the image output device and the background transmission image while having a functional function.

(2) Also, the usability is greatly improved by using the visual field sensor.

(3) By sandwiching the Lippmann Bragg volume hologram sheet into a lens or the like, it is possible to improve the weather resistance (particularly moisture resistance) of the hologram while reducing the thickness.

(4) A receiver, drive unit, display unit, and power supply unit are provided on the eyeglass handle, and a Lippmann Bragg volume hologram sheet is provided on the eyeglass lens to constitute a wireless information display eyeglass. Can be improved.

(5) By making full use of the present invention, a display terminal having the function of conventional glasses can be realized with almost the same shape and weight as conventional glasses.

(6) Also, those who had to wear a pair of spectacles and had to look at a liquid crystal display or a head-mounted display had the original spectacle function of correcting refractive errors, so that was no longer necessary and served two roles. Konasu.

(7) By providing the binocular width adjustment mechanism, it is possible to obtain good visual characteristics even at a high magnification, and to reduce the exit pupil of the optical system and increase the degree of design freedom.

(8) Further, as an advanced form of the present invention, for example, a communication tool for a hearing impaired person combined with a real-time speech recognition device (the other party's words are displayed in a space while looking at the face of the other party), an automatic translation device, Combined real-time subtitle creation device (for watching foreign language movies without subtitles, etc.), driving information display device combined with car navigation (display of target objects, etc.), reading device combined with electronic book player (in a crowded train or while lying down) If you have difficulty reading with a book in your hand, etc.)

(9) According to the present invention, the weaknesses of the direct-viewing type small liquid crystal display that is currently generally used as a PDA display device (personal portable terminal display) (reciprocity between miniaturization and visibility, low followability to the user, Low information privacy), and new information terminal displays that have eliminated the problems of HMD (size, weight, shape, background visibility), almost the same shape and weight as conventional glasses, and low cost Can be offered at.

(10) If the information display glasses to which the present invention is applied are worn, the display can be monitored at all times. Further, by arranging a plurality of spectacle frames, it becomes possible to obtain a more personal product according to the personal preference.

BEST-MODE

Embodiments of the present invention will be described below with reference to the drawings. 1 uses a Lippmann Bragg volume hologram sheet (holographic optical element, hereinafter referred to as HOE sheet) 6 instead of the concave half mirror 3 in the optical component configuration of FIG. 25, and is integrated with the lens 4 of the user's glasses. It has become.

The HOE sheet 6 has so-called reflection wavelength selectivity and image enlargement in which only light having a specific wavelength is reflected (diffracted) while other light is incident at a specific angle depending on the refractive index distribution in the sheet. It has a lens function such as action. In this case, although functionally similar to the concave half mirror 3 of FIG. 25, the following two points are different.

1. The reflectance (diffraction efficiency) of reflected light (diffracted light) selected by wavelength is such that a spectrum bandwidth is sufficiently small (for example, when a light source such as an LED is used) and a HOE film having a thickness of about 20 μm is used. In the case of 95% or more. When the thickness of the HOE film is about 7 μm, the reflectance (diffraction efficiency) is 80% or more.

2. The concave half mirror realizes the deflection of the light beam (in this case, virtual image formation) by its shape, while the hologram sheet (HOE sheet) realizes this by the way of refractive index distribution in the sheet. Therefore, the sheet shape can be selected arbitrarily.

Thus, by using a hologram sheet, Light usage efficiency can be increased. Output image = less than 50%, transmitted light from background = less than 50%. 2. Cost can be reduced compared to using a concave half mirror. 3. There is an advantage that the head mount display (hereinafter referred to as HMD) can be miniaturized by being integrated with the spectacle lens.

FIG. 2 is a diagram in which the half mirror 2 is removed from the optical component configuration of FIG. 1 and the output image from the image output device 1 is directly incident on the HOE sheet 6. Unlike the half mirror, in the case of reflection by the HOE sheet, the incident angle and the reflection angle do not necessarily have to be equal, and can be realized by being able to freely design to some extent depending on the manner of refractive index distribution in the sheet. As a result, the degree of freedom of the layout of the optical components such as the arrangement of the image output apparatus 1 can be increased, and double images due to reflection on the back surface, which are often problematic when using a half mirror,

can be prevented. . Moreover, since the number of parts can be reduced by one, it is very effective in reducing the size and weight and cost.

In FIG. 3, as an example of another optical apparatus to which the present invention is applied, a single-lens reflex camera or an optical that can see an output image from the image output device 1 fused with a background incident through the objective lens 7. The component configuration is shown. In FIG. 3, the HOE sheet 6 is provided on the eyepiece 14. First, the background light incident on the objective lens 7 is reflected by a flip-up mirror 8 (fixed mirror in the case of binoculars), inverted upside down by a pentaprism 9, and then enters the eyepiece 14, passing through the half mirror 2 and its light quantity. 50% of them go into pupil 5. The display virtual image is synthesized with the background image as described in FIG. 1, and 50% of the amount of light enters the pupil 5.

With such a configuration, in the case of a camera, shutter speed, aperture, exposure information, etc. can be seen in the viewfinder, and in the case of binoculars, information such as the direction of observation, elevation, etc. is displayed together with the observation object. Can see. Of course, in this case, the half mirror 2 may be omitted as in the example of FIG.

FIG. 4 shows the overall configuration of information display glasses as another embodiment of the present invention. This system is mainly composed of three main parts. A: a signal / image conversion unit (image output device) that converts an electrical or optical image signal into an actual image; B: an image conduction tube that transmits the image output to the display unit in the form of an image itself; C: a display unit for appropriately processing and displaying an image transmitted from the image conduction tube.

In this example, the signal / image conversion unit A includes a light source 21 (backlight), a liquid crystal display panel (transmission type color liquid crystal display panel LCD) 22, a diffuser 23, a large and small convex lens, and the like. It is composed of a reduction optical system 24 for fiber coupling.

In this example, the image conducting tube B uses a plastic fiber (optical fiber) 25 having a rectangular core shape with a cross section of 4: 3. The outer dimensions are Φ3.2 mm, the diameter of each fiber is Φ12 μmm, and the resolution is 60 lp / mm.

In this example, the display unit C includes a prism lens 26 attached to the hinge 33 side of the handle 31 of the glasses 30 and a HOE sheet 27 provided on the lens 34 in the frame 32 of the glasses. This HOE sheet (holographic combiner: in this example, a photopolymer having a thickness of about 20 μm) 27 is attached along the lens 34 of the spectacles, and a mylar film (polyethylene terephthalate film) is coated thereon. As a result, fixing and moisture resistance are improved. Examples of the material of the HOE sheet 27 include a photopolymer and dichroate gelatin.

The plastic fiber 25 which is the image conducting tube is provided on the handle 31 from the end portion thereof to the prism lens 26 along the handle 31 of the glasses. Reference numeral 28 denotes an earphone attached to the handle 31 for obtaining audio information in addition to image information, and a conductor (not shown) is used for transmission of the audio signal. Reference numeral 35 denotes a spectacle pad.

In the apparatus configured as described above, the video signal (image signal) is converted into an image by the liquid crystal display panel 22 and illuminated by the light source 21. The diffuser plate 23 makes it difficult for an observer to recognize the matrix wiring pattern of the liquid crystal display plate 22, whereby a good image free from liquid crystal pattern noise can be observed. The light emitted from the diffusion plate 23 is reduced to the diameter of the plastic fiber 25 of the image conducting tube B by the reduction optical system 24 and coupled to the fiber.

The image conducted by the plastic fiber 25 is deflected and magnified by the prism lens 26 and then enters the HOE sheet 27. As described above, this HOE sheet has a reflection wavelength selectivity and an

image enlargement function (concave lens function). That is, it has a characteristic that only a specific wavelength is reflected in a certain angle direction and other spectrum is transmitted.

For this reason, the observer can see surrounding visual information at the same time while viewing the image of the liquid crystal display panel (LCD) 22 in a single color (for example, green). (However, green is missing in the spectrum of transmitted light.) Of course, the observer can also see a full-color image by using the R, G, and B colors at the time of hologram production. In this case, the wavelengths of R, G, and B are lost from the transmitted light, but a bright background can be seen with a natural color tone by reducing the respective bandwidths. In addition, reducing the spectral bandwidth is an advantageous condition for obtaining a clear image.

In addition, the image enlargement function, which is another feature of the HOE sheet 27, enlarges the image having only the core size of the plastic fiber 25 to a sufficient visual field by showing a virtual image to the observer. This is shown in FIG. FIG. 5 shows the image enlargement effect of the HOE sheet. The image (image height 3 mm) is magnified twice (image height 6 mm) on a plastic image fiber by a lens, a mirror, etc., and the angle is 60 ° to the HOE sheet. Enter with. With this HOE sheet, the image is magnified as a virtual image at a lateral magnification of 40 times (image height 240 mm), and the position is separated from the HOE by 1000 mm. Since the focal length is 25 mm, the magnifier magnification is 10 times. The exit pupil (EPD) has a diameter of 8 mm or more and is located 15 to 20 mm apart from the HOE sheet.

FIG. 6 shows a state where the user actually wears the information display glasses of FIG. 4 as seen from above. 6, the same parts as those in FIG. 4 are denoted by the same reference numerals. In FIG. 6, 5 is a user's eyeball, 40 is an iris, and 29 is a polymer synthetic membrane. An image fiber (plastic fiber 25) for transmitting an image passes through the inside of the handle 31 of the glasses, and image enlargement (twice) immediately before entering the HOE sheet 27 and light deflection are performed by a prism mirror with a lens (prism lens 26).). The output NA (aperture ratio when the refractive index is n, NA = nsin θ) of this image fiber (plastic fiber 25) is 0.5.

The HOE sheet 27 and the lens are attached by, for example, bonding eyeglass lenses 34a and 34b as shown in FIG. 7, and sandwiching a hologram sheet 27a (thickness of several microns to several tens of microns) between them. A method is conceivable. In this case, the lenses 34a and 34b can be joined by bonding with a UV curing adhesive 41 or the like, or fusion used in a bifocal lens.

Alternatively, the HOE sheet 27 may be formed along the lens, and the HOE sheet may be sandwiched and held between the lens and another member such as a mylar film (polyethylene terephthalate film).

FIG. 8 shows an example of display glasses using a laser diode array 43 as an image output device and a galvanometer (galvanometer mirror) 44 as a scanner optical system. In this case, two sets of image output devices, a display unit, and a HOE sheet 27 are provided independently on the left and right, so that binocular vision is possible. Stereoscopic viewing is also possible by displaying different images on the left and right image output devices. It is possible.

In FIG. 8, the eyeglasses 30 are configured in the same manner as in FIG. 4, and the left and right handles 31, 31 have conductive wires 25b, 25b, drive circuits 42, 42, laser diode arrays (LEDarray) 43, 43, galvanometric scanners. 44, 44 are provided. Further, HOE sheets 27 and 27 are provided on the lenses 34 and 34 for both eyes.

First, image signals are input to the left and right laser diode arrays 43 and 43 and the drive circuits 42 and 42 of the galvanometers 44 and 44, respectively. On the basis of this signal, the light sources of the laser diode arrays 43 and 43 are turned on and off, and the galvanometers 44 and 44 are driven in synchronization therewith. As a result, the scanned image is projected onto the HOE sheets 27 and 27 provided along the lenses 34 and 34 of the spectacles, and the reflected light is incident on the pupil, so that the user can detect the background and the image output device. The magnified virtual image of the output

image can be fused and viewed. The sound signal is directly sent to the earphone 28 and converted into sound. The eyeglass display is provided with a neck chain 45 so that the user can easily remove it.

FIG. 9 shows an example of display glasses using an acousto-optic effector (AOM) 54 as a scanner optical system instead of the galvanometer 44 of FIG. The overall operation principle is the same as that of the example in which the galvanometer 44 is used as the scanner optical system in FIG. The acousto-optic effect element 54 generates a sparse wave having a refractive index by the photoelastic effect when the ultrasonic wave 55 is poured into the medium, and thus exhibits the same function as the diffraction grating. By changing the frequency of the ultrasonic wave, The pitch of the diffraction grating can be varied. When the pitch of the diffraction grating changes, the deflection angle of the diffracted light 56 also changes, so that the light beam can be scanned. The acoustooptic effect element 54 is characterized in that it has no moving parts compared to a galvanometer or a polygon mirror. FIG. 10 shows an example of information display glasses of the HOE sheet removable type. A clip 60 is attached to the HOE sheet 27, and the clip 60 can be attached to and detached from the lens 34 or the frame 32 of the glasses. In this example, the image display device 61 is directly attached to the eyeglass handle 31 without conducting the image through the plastic fiber 25.

The HOE sheet may be held as shown in FIG. In FIG. 11, a hologram sheet (HOE sheet) 27a bonded and formed along the cylindrical (cylindrical) polycarbonate substrate 102 is sandwiched and held between the polycarbonate substrate 102 and the mylar film 101 (or another member). ing.

Next, an example in which the HOE and the image output apparatus are configured to be removable from the spectacle frame is shown in FIG. In FIG. 12, the configuration of the glasses is the same as that in FIGS. Reference numeral 102a denotes a polycarbonate housing to which an HOE and an image output device are attached. One end of the polycarbonate housing is detachably locked to the upper end portion of the spectacle frame 32, and a cylindrical curved surface 102b formed at the other end portion through the bent portion. Is configured to be disposed at a portion facing the frame 32 when mounted on the frame 32. On the surface of the cylindrical curved surface 102 b opposite to the frame 32, HOE 127 is held between the mylar films 101. A liquid crystal display (LCD) 103 that outputs an image to the HOE 127 is provided inside the bent portion of the polycarbonate casing 102a. According to the configuration of FIG. 12, the HOE 127 and the liquid crystal display device 103 are integrally fixed to the polycarbonate casing 102a, so that it is not necessary to position both of them and it is easy to use.

FIG. 13 shows another example in which the HOE and the image output apparatus are configured to be removable from the spectacle frame. In FIG. 13, the configuration of the glasses is the same as in FIGS. One end of the polycarbonate casing 102a is detachably locked to the upper end of the spectacle frame 32, and the other end through the bent portion is formed in a flat shape and faces the frame 32 when mounted on the frame 32. It is comprised so that it may be arrange | positioned in the site | part which does. An HOE 127 is held between the mylar films 101 on the surface of the other end of the polycarbonate casing 102a opposite to the frame 32. Reference numeral 104 denotes a mirror that reflects emitted light from the liquid crystal display device 103 provided inside the bent portion of the polycarbonate casing 102a and guides it to the HOE 127. As described above, in FIG. 13, the mirror 104 is provided to change the angle of the incident light beam to the HOE 127 and the object side distance, and the light once reflected by the mirror 104 is incident on the HOE 127. According to the configuration shown in FIG. 13, the HOE 127, the liquid crystal display device 103, and the mirror 104 are integrally fixed to the polycarbonate casing 102a, so that they do not need to be positioned and are easy to use.

FIG. 14 shows a video camera finder using a HOE sheet as an example of another optical apparatus to which the present invention is applied. In FIG. 14, a liquid crystal display device 103, a diopter adjustment lens 106, and a HOE 127 are provided inside a finder housing 105 made of opaque plastic. The light beam emitted from the liquid crystal display device 103 enters the HOE 127 and is emitted as approximately parallel light. The emitted light is incident on the pupil 5 after the divergence angle is controlled by the diopter adjustment lens 106. In the configuration of FIG. 14, the HOE 127 is attached to the finder housing 105

made of an opaque plastic, and a transmission background image cannot be seen.

As another example to which the present invention is applied, a wristwatch type portable terminal device is shown in FIG. A liquid crystal display device 103 is provided on the display surface of the main body 110, and an HOE 127 is provided on the upper surface of the main body 110 so as to be openable and closable around the hinge 111. Reference numeral 112 denotes an arm band. The liquid crystal display device 103 displays not only time but also various other characters and image information. When the HOE 127 is closed as shown in FIG. 15A, the time displayed on the liquid crystal display device 103 as a transmission background image can be seen. When the HOE 127 is rotated around the hinge 111 and opened as shown in FIG. 15B, an image reflected and magnified by the HOE 127 can be seen. Therefore, even if a fine image is displayed on the liquid crystal display device 103, it can be easily seen.

FIG. 16 shows a wireless information display glasses provided with an image receiving device as another example. In FIG. 16, the eyeglasses 30 are configured in the same manner as in FIGS. 4, 8, and 10. The handle 31 includes an image signal receiving circuit 71, a display drive circuit 72, a field emission display device 73, a battery 74, and an antenna (not shown). Is provided.

In the apparatus configured as described above, an image signal transmitted from an image signal transmission source (not shown) is received by an antenna incorporated in the handle 31 and an image signal receiving circuit 71. The received image signal is decoded by the display drive circuit 72 and sent to the field emission display device 73 to display the image. This display image is magnified and reflected by the HOE sheet 27 provided on a part of the lens 34 to provide visual information to the user. The image signal receiving circuit 71, the display drive circuit 72, and the field emission display device 73 are driven by a battery 74 incorporated in the handle 31. By configuring the wireless information display glasses as described above, usability and portability are further improved.

FIG. 17 shows an example of information display glasses with a binocular width adjustment mechanism. The distance between the optical axis centers of both human eyes varies from person to person, and varies at least about 60 mm to 70 mm. In order to absorb this variation and view a good image, the reflected light from the HOE sheet needs to have an exit pupil diameter of about 15 mm. However, the size of the exit pupil and the image magnification are in a contradictory relationship. When the magnification is high (the HOE object-side distance is short), the exit pupil diameter is usually small. Therefore, in order to obtain good visual characteristics even at a high magnification, it is important to provide a binocular width adjustment mechanism so that the optical axis of each person's eyes and the optical axis of the HOE can be matched. The information display glasses of FIG. 17 are invented for the above purpose.

In FIG. 17, a screw groove 81 and a rotation prevention hole 82a are provided in the upper part of the frame 32, and a rotation prevention shaft 83a and an adjusting screw 84 having the shape shown in the figure are inserted into this. Apart from this, an anti-rotation hole 82b and an anti-rotation shaft 83b are provided in the upper part of the pad 35. The center distance of the optical axis of the HOE sheet 27 can be varied by turning a rotation adjustment knob 85 provided at the center of the adjustment screw 84.

The display glasses of the present invention are devised as follows at the image display position. First, FIGS. 18 and 19 show standard human visual field characteristics in the vertical and horizontal directions, respectively. FIG. 18 shows a standard human visual field characteristic, according to which the normal field of view is 10 ° to 15 ° below the horizontal (shown from the normal line of sight when standing). It can be seen that the range to the normal line of sight when sitting. In FIG. 18, A is the focal length of 20 years (minimum), B is the focal length of 40 years (minimum), C is the minimum acceptable reading distance for the display, D is the normal viewing distance (CRT), E Is the desired minimum distance for the display, F is the maximum distance of the display to be placed, G is the focal length of 60 years (minimum), and H is infinity if the display is designed to fit ing.

FIG. 19 shows a standard human visual field characteristic. According to this figure, it can be seen that the

visual field capable of recognizing characters is about 20 ° (illustrated, range of character recognition limit).

Therefore, in the present invention, as shown in FIG. 20, a display image is not displayed within a solid angle of 20 ° with a normal line of sight (10 ° lower than the horizontal direction) as the center. In this way, the background can be seen without being obstructed by the display image in the normal viewing direction as shown in FIG. 21, and when the user wants to see the display image, the viewing line (in this example, as shown in FIG. 22). By moving upward, the display image (reflected light from the HOE sheet 27) and the background can be fused and viewed. FIG. 21 is an explanatory diagram when only the background image is viewed through the lens, and FIG. 22 is an explanatory diagram when the background image and the display image are viewed.

Alternatively, as shown in FIG. 23, a line-of-sight detection sensor 91 is provided on a frame or lens 90 of spectacles to which an HOE sheet is attached so that an image is displayed only when the line of sight of the user enters a specific range. By doing so, visibility is further improved and usability is improved. In FIG. 23, a liquid crystal shutter 92 and a brightness sensor (light sensor: photodiode) 93 provided opposite to the lens 90 to which the HOE sheet is attached are used, and the brightness of the background is sensed by the sensor 93 and the liquid crystal. By automatically adjusting the transmittance of the shutter 92, it also has a function of keeping the ratio of the brightness within an appropriate range so that the user can easily see the display image and the background together. The liquid crystal shutter 92 is a detachable light shielding member for at least the visible light wavelength range. When this shutter is used, the amount of light transmitted from the background can be attenuated to 10% or less.

In FIG. 23, 94 is a liquid crystal shutter driver that adjusts the transmittance of the liquid crystal shutter 92 according to a command from the microcomputer 95, and 96 is a display driver that drives the display 97 according to an input image signal and a command from the microcomputer 95. The display 97 includes the laser diode array 43, the galvanometer 44 shown in FIG. 8, the acoustooptic effect element 54 shown in FIG. 9, the field emission display device 73 shown in FIG.

FIG. 24 shows a series of operation flowcharts of the apparatus shown in FIG. First, in a state where the image display is OFF and the liquid crystal transmittance is maximum, the microcomputer 95 reads the output of the line-of-sight detection sensor 91. If the detected line of sight is within a specific range, the output of the brightness sensor 93 is read, the transmittance of the liquid crystal shutter 92 is adjusted by the liquid crystal shutter driver 94 according to the brightness, and the image display is turned on. . When the detected line of sight is not within a specific range, the image display is turned off and the transmittance of the liquid crystal shutter 92 is kept at the maximum.

In this case, the brightness of the display image may be directly changed without changing the brightness of the background, or the transmittance may be changed by providing a liquid crystal shutter in front of the display device. Also, if you want to see only the display image temporarily, you can reduce the light from the background by using a sunglasses-like filter on the spectacle lens section, or each optical axis of two polarizing plates provided on the spectacle lens section. The light from the background may be adjusted by changing the crossing angle of.

Note that the display glasses mentioned above may be those for which the refractive power (degree) of the spectacle lens is 0 for a normal person, or of which surface treatment such as color coating or UV reflection coating is applied to the lens.

(Example)

The display unit is not limited to a liquid crystal display (LCD) or a field emission display (FED), but an LED display (LEDD), a laser display (LDD), a digital micromirror display (DMD), or an electroluminescence display (ELD). Also good.

The scanner optical system is not limited to a galvanometer or an acousto-optic effect element, and a polygon mirror or a resonant scanner may be used.

The optical member is not limited to a lens, and a plate glass, a transparent plastic plate, an opaque plastic plate, a reflection attenuation plate, a prism, a half mirror, or a diffraction grating may be used.

In addition, the present invention is not limited to spectacles, cameras, and binoculars. The optical member may be a telescope lens, and the display unit may be provided on a telescope housing or lens. The display unit may be provided on a microscope frame or lens. In this case, the same operation and effect as described above can be obtained.

Explanation of symbols

DESCRIPTION OF SYMBOLS 1 ... Image output device 4, 34, 34a, 34b ... Lens 5 ... Eyeball (pupil)

6, 27 ... HOE sheet 21 ... Light source 22 ... Liquid crystal display plate 23 ... Diffuser plate 24 ... Reduction optical system 25 ... Plastic fiber 26 ... Prism lens 28 ... Earphone 29 ... Polymer composite film 30 ... Glasses 31 ... Pattern 40 ... Iris 41 ... UV curing adhesive 42 ... Drive circuit 43 ... Laser diode array 44 ... Galvanometer 54 ... Acousto-optic effect element 60 ... Clip 61 ... Display device 71 ... Image signal receiving circuit 72 ... Display drive circuit 73 ... Field emission display device 74 ... Battery DESCRIPTION OF SYMBOLS 81 ... Screw groove 82a, 82b ... Anti-rotation hole 83a, 83b ... Anti-rotation shaft 84 ... Adjustment screw 85 ... Rotation adjustment knob 91 ... Gaze detection sensor 92 ... Liquid crystal shutter 93 ... Brightness sensor 94 ... Liquid crystal shutter driver 95 ... Microcomputer 96 ... dis Ray driver 97 ... Display 101 ... mylar film 102 ... cylindrical polycarbonate substrate 103 ... liquid crystal display device 104 ... mirror 105 ... viewfinder housing 106 ... diopter adjustment lens 127 ... HOE

DRAWING DESCRIPTION

[1]The block diagram which shows one Embodiment of this invention. [2]The block diagram which shows other embodiment of this invention. [3]The block diagram which shows embodiment which applied this invention to the single-lens reflex camera or binoculars. [4]The block diagram which shows an example of embodiment which applied this invention and was comprised as information display glasses. [5]Explanatory drawing showing the image expansion effect | action of a HOE sheet | seat. [6]Explanatory drawing showing a mode that the place which the user put on the information display spectacles of this invention was seen from upper direction. [7]The principal part sectional drawing which shows an example of the attachment method of the HOE sheet | seat in this invention. [8]The block diagram which shows the other example of embodiment which applied this invention and was comprised as information display glasses. [9]The principal part block diagram which shows other embodiment of the scanner optical system of this invention. [10]The block diagram which shows embodiment which made the HOE sheet | seat removable in the information display spectacles of this invention. [11]The holding example of the HOE sheet | seat in this invention is shown, (a) is a front view, (b) is a side view. [12]FIG. 6 is a configuration diagram showing another example of the embodiment in which the HOE sheet is detachable in the information display glasses of the present invention. [13]FIG. 6 is a configuration diagram showing another example of the embodiment in which the HOE sheet is detachable in the information display glasses of the present invention. [14]The block diagram of embodiment which applied this invention to the video camera finder. [15]An embodiment of a wristwatch type portable terminal device to which the present invention is applied is shown, (a) is a configuration diagram when the HOE is closed, and (b) is a configuration diagram when the HOE is opened. [16]The block diagram which shows embodiment which made the information display spectacles of this invention wireless. [17]The principal part block diagram which shows embodiment of the information display glasses with a binocular width adjustment mechanism of this invention. [18]Explanatory drawing which shows the visual field characteristic of a normal human perpendicular direction. [19]Explanatory drawing which shows the

visual field characteristic of a standard human horizontal direction. [20]Explanatory drawing which shows the human visual field range which can recognize a display image. [21]Explanatory drawing in the case of showing the relationship between the background and display image in a normal gaze direction, and seeing only a background image through a lens. [22]Explanatory drawing in case the background image and the display image are visible, showing the relationship between the background and the display image when the line of sight is moved upward. [23]The block diagram which shows an example of the apparatus which provided the gaze detection sensor and brightness sensor of this invention. [24]24 is a flowchart in the case of controlling the image display and the transmittance of the liquid crystal shutter by the apparatus of FIG. [25]The block diagram which shows an example of the conventional image display apparatus.

Claims

A display unit that receives an image signal transmitted from an image information transmission source, a drive unit that decodes the image signal received by the reception unit, and an image that is decoded by the drive unit And a power supply unit for supplying power to each of the receiving unit, the drive unit, and the display unit,
The display means converts an electrical or optical image signal into an actual image and outputs the image, and
An optical member;
When the virtual image of the output image of the image output device provided on the optical member is displayed at a predetermined distance from the eye and the optical member transmits at least part or all of the visible light region, the virtual image is displayed. A display unit having a Lippmann Bragg volume hologram for combining with a background image transmitted through the optical member, and guiding the virtual image or a combined image of the virtual image and the transmitted background image to at least one eye. apparatus.
The image display apparatus according to claim 1, wherein the Lippmann Bragg volume hologram is sandwiched and held in the optical member.
The image display apparatus according to claim 1, wherein the Lippmann Bragg volume hologram is provided detachably with respect to the optical member.
The image display apparatus according to claim 1, wherein light emitted from the image output apparatus is incident from the optical member side coated with a reflection attenuation film.
The image display apparatus according to claim 1, wherein the image output apparatus outputs an image distorted in advance so as to cancel out aberrations of the image reproducing optical system.
The said display part has a gaze detection sensor which detects a user's gaze, and performs a virtual image display of an output picture of the above-mentioned image output device, when a user's gaze is in a specific range. 2. The image display device according to 1.
The display unit includes a line-of-sight detection sensor that detects a user's line of sight and a display position controller, and displays a virtual image of an output image of the image output device following the line of sight of the user. 2. The image display device according to 1.
The image display apparatus according to claim 1, wherein the eyeglasses are provided with a binocular width adjustment mechanism that varies an optical axis center distance of a light beam reflected by a Lippmann Bragg volume hologram.

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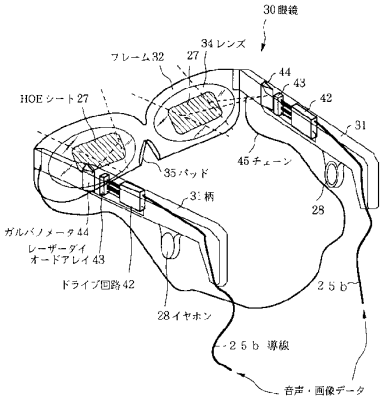
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(54)【発明の名称】画像表示装置

(57)【要約】
【課題】　情報表示眼鏡において、ハーフミラーとレンズまたは凹面鏡等を用いることなく、コンパクトで安価な装置構成とし、且つ眼鏡本来の機能を保持しながら出力画像の虚像と背景透過像を融合して見ることができるようにする。
【解決手段】　眼鏡３０の左右の柄３１に、画像データが導入される導線２５ｂ、ドライブ回路４２、レーザーダイオードアレイ４３、ガルバノメータ４４を各々設ける。レンズ３４にはリップマンブラッグ体積ホログラムシート２７を設ける。左右それぞれに画像信号が入力されると、この信号にもとづいてレーザーダイオードアレイ４３の各光源のｏｎ，ｏｆｆが行われ、それに同期してガルバノメータ４４が駆動される。その結果、前記シート２７上に走査された画像が投影されその反射光が瞳に入射することによって、使用者は背景と画像出力装置からの出力画像の拡大虚像を融合して見ることができる。
【選択図】　図８



【特許請求の範囲】
【請求項１】
眼鏡の柄に、画像情報発信源より送信された画像信号を受信する受信部と、前記受信部で受信された画像信号を解読するドライブ部と、前記ドライブ部で解読された画像を表示する表示手段と、前記受信部、ドライブ部、表示手段に各々電源を供給する電源部とを設け、
前記表示手段は、電気的又は光学的な画像信号を実際の画像に変換して出力する画像出力装置と、
光学部材と、
前記光学部材に設けられ、前記画像出力装置の出力画像の虚像を眼から所定距離隔てた部位に表示し、且つ前記光学部材が少なくとも可視光域の一部あるいは全部を透過する場合、当該虚像を、前記光学部材を透過した背景像と合成するリップマンブラッグ体積ホログラムを有した表示部とを備え、前記虚像又は前記虚像と透過背景像との合成像を少なくとも一眼に導くことを特徴とする画像表示装置。
【請求項２】
前記リップマンブラッグ体積ホログラムは、前記光学部材内に挟み込まれ保持されていることを特徴とする請求項１に記載の画像表示装置。
【請求項３】
前記リップマンブラッグ体積ホログラムは、前記光学部材に対して着脱自在に設けられていることを特徴とする請求項１に記載の画像表示装置。
【請求項４】
前記画像出力装置からの出射光を、反射減衰膜を被覆した前記光学部材側から入射させることを特徴とする請求項１に記載の画像表示装置。
【請求項５】
前記画像出力装置は、画像再生光学系の収差を打ち消すように、予め歪んだ画像を出力することを特徴とする請求項１に記載の画像表示装置。
【請求項６】
前記表示部は、使用者の視線を検出する視線検出センサを有し、使用者の視線が特定の範囲にあるときに前記画像出力装置の出力画像の虚像表示を行うことを特徴とする請求項１に記載の画像表示装置。
【請求項７】
前記表示部は、使用者の視線を検出する視線検出センサおよび表示位置コントローラを有し、前記画像出力装置の出力画像の虚像を使用者の視線に追従させて表示することを特徴とする請求項１に記載の画像表示装置。
【請求項８】
前記眼鏡には、リップマンブラッグ体積ホログラムで反射された光線の光軸中心距離を可変する両眼幅調整機構が設けられていることを特徴とする請求項１に記載の画像表示装置。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明はヘッドマウントディスプレイやヘッドアップディスプレイ等の画像表示装置に係り、特にリップマンブラッグ体積ホログラムシートを眼鏡レンズ内に設けることにより、眼鏡本来の機能を維持したまま拡大表示像と眼鏡レンズ越しの透過背景像とを融合してみることができるディスプレイ眼鏡に関する。
【背景技術】
【０００２】
従来、携帯用ディスプレイ装置としては、個人用携帯端末ディスプレイ（ＰＤＡ）の直視型小型液晶表示器、ヘッドアップディスプレイ（ＨＵＤ）や図２５に示すようなヘッドマウントディスプレイ（ＨＭＤ）等、様々な装置が提案されている。

【０００３】
図２５は、従来のヘッドマウントディスプレイ（ＨＭＤ）を眼鏡をかけた人が使用した場合の光学部品の構成の一例を示している。図２５において、１は電気的又は光学的な画像信号を実際の画像に変換して出力する画像出力装置である。２はハーフミラー、３は凹面ハーフミラー、４は眼鏡のレンズ、５は使用者の瞳（眼球）である。
【０００４】
前記各ハーフミラー２、３の反射率を５０％とすると、画像出力装置１からの出射光はハーフミラー２にて４５°反射され光量の５０％が凹面ハーフミラー３に入射する。この凹面ハーフミラー３の反射により使用者に対して拡大された虚像が無限遠または有限の距離に結像される。ここで再び光量の５０％が反射され、再度ハーフミラー２に入射し光量が５０％に減衰された後使用者のかけている眼鏡のレンズ４に入射する。つまり、画像出力装置１からの出射光は、ハーフミラーを３回透過あるいは反射するため、その光量の１２．５％が有効利用されることになる。背景からの光は、凹面ハーフミラー３とハーフミラー２を透過することにより２５％に減衰されて表示虚像とともに使用者のかけている眼鏡のレンズ４を透過後、瞳５に入射する。
【発明の開示】
【発明が解決しようとする課題】
【０００５】
現在、特定の光学的機能（例えば眼鏡としての機能）を有しながら画像表示装置の出力画像の虚像と背景透過像とを融合して見るためには、例えば図２５のように、画像表示装置以外にこの特定の光学的機能を提供する光学系に少なくとも１つ以上のハーフミラーおよび虚像を提供するためのレンズまたは凹面鏡（虚像光学系）を付加しなくてはならない。
【０００６】
また、ハーフミラーおよびレンズまたは凹面鏡を用いずにホログラフイックオプティカルエレメント（ＨＯＥ）を用いることにより画像表示装置の出力画像の虚像と背景透過像を融合してみることは可能であるが、この場合他の特定の光学的機能を有していない。
【０００７】
例えば、従来のヘッドマウントディスプレイやヘッドアップディスプレイ等の携帯用ディスプレイ装置は、大きさ、重量とも使用者の負担となっており長時間の使用には耐え難い。また公共の場で装着するにも一般的な眼鏡とは形状、大きさがかけ離れているため周囲の使用者に対する容認度が低いことや、あるいは使用者の周囲に対する違和感が大きいなどの理由から、必ずしもいついつでもどこでもといった十分な使い勝手が実現されているわけではない。
【０００８】
これは、一つには目の屈折異常（近視、遠視、老視、乱視など）をもった人は眼鏡をかけた状態でこれらヘッドマウントディスプレイ、ヘッドアップディスプレイを装着しなくてはならないため、このためのクリアランス確保により小型化が困難となっているためである。また、個人の両眼間隔のばらつきを配慮して必要以上の出射瞳径を確保していることも影響している。
【０００９】
それから、一般に画像出力装置の画素数を増していくと、それに伴ってこの装置の面積も大きくなり高精細化と小型化は相反する。また、光路中にハーフミラーを使うことによる弊害としては、枚数が増えるとそのぶん表示虚像、透過背景像とも暗くなって行くということ、および光線の入射角と出射角が等しいため二重像が発生する、光学系の配置の自由度が低下するといったことが挙げられる。
【００１０】
本発明は、特定の光学的機能を保持しながら画像表示装置の出力画像の虚像と背景透過像を融合してみる場合、そのために特別にハーフミラーとレンズまたは凹面鏡などを用いることなく、リップマンブラッグ体積ホログラムシートを元の光学系を構成するレンズな

どの光学部品に敷設することにより、コンパクトにまた安価にこの機能を実現することを目的とする。

【課題を解決するための手段】

【００１１】

（１）本発明は上記課題を解決するために、眼鏡の柄に、画像情報発信源より送信された画像信号を受信する受信部と、前記受信部で受信された画像信号を解読するドライブ部と、前記ドライブ部で解読された画像を表示する表示手段と、前記受信部、ドライブ部、表示手段に各々電源を供給する電源部とを設け、前記表示手段は、電気的又は光学的な画像信号を実際の画像に変換して出力する画像出力装置と、光学部材と、前記光学部材に設けられ、前記画像出力装置の出力画像の虚像を眼から所定距離隔てた部位に表示し、且つ前記光学部材が少なくとも可視光域の一部あるいは全部を透過する場合、当該虚像を、前記光学部材を透過した背景像と合成するリップマンブラッグ体積ホログラム（リップマンブラッグ体積ホログラムシート）を有した表示部とを備え、前記虚像又は前記虚像と透過背景像との合成像を少なくとも一眼に導くように構成した。

【００１２】

以上の構成により、ハーフミラー、レンズ、凹面鏡等を用いることなく、コンパクトにまた安価に特定の光学的機能を有しながら画像出力装置の出力画像の虚像と背景透過像を融合して見ることができる。またより使い勝手、携帯性が向上する。

（２）また前記リップマンブラッグ体積ホログラムシートは、前記光学部材内に挟み込んで保持するように構成した。これにより、薄型化と同時にホログラムの耐候性、特に耐湿性を向上させることができる。

（３）また前記リップマンブラッグ体積ホログラムシートは、前記光学部材に対して着脱自在に設けた。これにより装置の使用目的に応じた選択自由度が増す。

（４）また前記画像出力装置からの出射光を、反射減衰膜を被覆した前記光学部材側から入射させるように構成した。

（５）また前記画像出力装置は、画像再生光学系の収差を打ち消すように、予め歪んだ画像を出力するように構成した。

（６）また前記表示部を、使用者の視線を検出する視線検出センサを有し、使用者の視線が特定の範囲にあるときに前記画像出力装置の出力画像の虚像表示を行うように構成した。

【００１３】

また前記表示部を、使用者の視線を検出する視線検出センサおよび表示位置コントローラを有し、前記画像出力装置の出力画像の虚像を使用者の視線に追従させて表示するように構成した。

【００１４】

以上の構成により、より視認性が向上し使い勝手が良くなる。

（７）また前記光学部材を眼鏡のレンズで構成するとともに、前記表示部を眼鏡の柄に設け、さらに前記眼鏡には、リップマンブラッグ体積ホログラムシートで反射された光線の光軸中心距離を可変する両眼幅調整機構を設けた。これによって使用者の目の光軸とリップマンブラッグ体積ホログラムシートの光軸を一致させることができ、高倍率時にも良好な視認特性を得ることができる。

【発明の効果】

【００１５】

（１）本発明により、ハーフミラーとレンズまたは凹面鏡などを用いることなくリップマンブラッグ体積ホログラムシートを元の光学系を構成するレンズなどの光学部品に付設することにより、コンパクトにまた安価に特定の光学的機能を有しながら画像出力装置の出力画像の虚像と背景透過像を融合してみることができる画像表示装置を実現できる。

（２）また、視野センサを用いることにより使い勝手が非常に良くなる。

（３）リップマンブラッグ体積ホログラムシートをレンズなどに挟み込むことにより、薄型化と同時にホログラムの耐候性（特に耐湿性）を向上させることができる。

（４）眼鏡の柄に、受信部、ドライブ部、表示部、電源部を設け、眼鏡のレンズに、リップマンブラッグ体積ホログラムシートを設けて、ワイヤレス情報表示眼鏡を構成することにより、より使い勝手、携帯性を向上させることができる。
（５）本発明を駆使することにより、従来の眼鏡の機能を併せ持つディスプレイ端末をほとんど従来眼鏡と同一形状および重量で実現できる。
（６）また、従来眼鏡を装着して液晶表示器、ヘッドマウントディスプレイを見なければならなかった人も、屈折異常の矯正という眼鏡本来の機能を合わせ持っているためその必要はなくなり２役をこなす。
（７）両眼幅調整機構を設けることにより、高倍率時にも良好な視認特性が得られるとともに、光学系の出射瞳を小さくすることができ設計の自由度を増すことができる。
（８）また本発明の発展形としては、例えばリアルタイム音声認識装置と組み合わせた聴覚障害者のコミュニケーションツール（話し相手の顔を見ながら相手の言葉が空間に浮かんで表示される）、自動翻訳装置と組み合わせた実時間字幕作成装置（字幕のない外国語映画観賞用など）、カーナビと組み合わせた運転情報表示装置（目標物の表示など）、電子ブックプレーヤーと組み合わせた読書装置（満員電車内や寝転びながらの読書など手で本を持って読むのがつらいとき）等を作り出すことができる。
（９）本発明により、ＰＤＡ表示装置（個人用携帯端末ディスプレイ）として現在一般的に使用されている直視型小型液晶表示器の弱点（小型化と視認性の相反、ユーザーへの低追従性、情報のプライバシー性の低さ）、ならびに現行ＨＭＤの問題点（大きさ、重量、形状、背景の視認性）を一掃した新しい情報端末ディスプレイをほんど従来眼鏡と同一形状及び重量で、しかも低コストで提供することができる。
（１０）本発明を適用した情報表示眼鏡をかけていれば、常時ディスプレイをモニターできるので受信機能状態などのときに非常に便利である。また眼鏡フレームを複数揃えることで、個人個人の好みに応じたよりパーソナルな商品を得ることが可能になる。

【発明を実施するための最良の形態】

【００１６】

以下図面を参照しながら本発明の実施の形態を説明する。図１は図２５の光学部品構成のうち、凹面ハーフミラー３の変わりにリップマンブラッグ体積ホログラムシート（ホログラフィックオプティカルエレメント、以下ＨＯＥシートと称する）６を用い、しかも使用者の眼鏡のレンズ４と一体化したものである。

【００１７】

このＨＯＥシート６は、シート内の屈折率の分布の仕方により、特定の角度で入射した光のうち特定の波長の光のみ反射（回折）しその他は透過するといういわゆる反射波長選択性と像拡大作用といったレンズ機能をもつ。この場合、図２５の凹面ハーフミラー３と機能的には似ているが以下の２点が異なる。

【００１８】

１．波長選択された反射光（回折光）の反射率（回折効率）は、スペクトルのバンド幅が十分小さく（たとえば、ＬＥＤのような光源を使用した場合）、且つ厚さ２０μｍ程度のＨＯＥフィルムを使った場合は９５％以上となる。尚ＨＯＥフィルムの厚さが７μｍ程度の場合は反射率（回折効率）８０％以上となる。

【００１９】

２．凹面ハーフミラーがその形状により光線の偏向（この場合は虚像結像）を実現しているのに対し、ホログラムシート（ＨＯＥシート）はシート内の屈折率の分布の仕方によりこれを実現しているためシート形状は比較的任意に選ぶことができる。

【００２０】

このように、ホログラムシートを使うことにより、１．光の利用効率を上げられる。出力画像＝５０％弱、背景からの透過光＝５０％弱。２．凹面ハーフミラーを使うよりもコストダウンできる。３．眼鏡レンズと一体化することによりヘッドマウントディスプレイ（以下、ＨＭＤと称する）の小型化が可能になる、などの利点がある。

【００２１】

図２は図１の光学部品構成からハーフミラー２を除き、画像出力装置１からの出力画像を直接ＨＯＥシート６に入射させたものである。これは、ハーフミラーと異なりＨＯＥシートによる反射の場合、入射角度と反射角度が必ずしも等しい必要がなく、シート内の屈折率の分布の仕方によりある程度自由に設計できることにより実現できるものである。これにより、画像出力装置１の配置など、光学部品のレイアウトの自由度を増すことができるうえ、ハーフミラーを使ったときにしばしば問題になる裏面での反射による二重像を防止することができる。また、部品点数が一つ削減できるので、小型軽量、コストダウンに非常に有効である。

【００２２】

図３には、本発明を適用した別の光学機器の一例として、画像出力装置１からの出力画像を対物レンズ７を透して入射する背景と融合して見ることができる一眼レフカメラまたは光学部品構成を示す。図３において、ＨＯＥシート６は接眼レンズ１４に設けられている。まず対物レンズ７に入射した背景光ははね上げミラー８（双眼鏡の場合は固定ミラー）で反射され、ペンタプリズム９にて上下反転されたのち接眼レンズ１４に入り、ハーフミラー２を透してその光量の５０％が瞳５に入る。表示虚像は、図１のところで述べたようにこの背景像と合成され光量の５０％が瞳５に入射する。

【００２３】

このような構成により、カメラの場合、シャッタースピード、絞り、露出情報などをファインダー内に見ることができ、また双眼鏡の場合、たとえば観察している方位、仰度などの情報を観察物と一緒に見ることができる。もちろん、この場合図２の例のようにハーフミラー２をなくして構成してもよい。

【００２４】

図４に本発明の他の実施の形態として情報表示眼鏡の全体構成を示す。本システムは大きく３つの要部で構成されている。すなわち、Ａ：電気的もしくは光学的な画像信号を実際の画像に変換する信号／画像変換部（画像出力装置）、Ｂ：その画像出力を表示部まで画像そのものの形で伝送する像伝導管、Ｃ：像伝導管より伝送された画像を適宜画像処理して表示する表示部、である。

【００２５】

信号／画像変換部Ａは本例の場合、光源２１（バックライト）と、液晶表示板（透過型のカラー液晶表示板ＬＣＤ）２２と、拡散板（ｄｉｆｆｕｓｅｒ）２３と、大小の凸レンズ等から成るファイバーカップリング用の縮小光学系２４とで構成されている。

【００２６】

像伝導管Ｂは本例の場合、断面が４：３の長方形をしたコア形状をもつプラスチックファイバ（光ファイバ）２５を使用している。外形寸法はΦ３．２ｍｍ、一本一本のファイバの径はΦ１２μｍｍ、解像度は６０１ｐ／ｍｍとなっている。

【００２７】

表示部Ｃは本例の場合、眼鏡３０の柄３１のヒンジ３３側に取り付けられたプリズムレンズ２６と、眼鏡のフレーム３２内のレンズ３４に設けられたＨＯＥシート２７とで構成されている。このＨＯＥシート（ホログラフィックコンバイナ：本例では、厚さ２０μｍｍ前後のフォトポリマーを使用）２７は眼鏡のレンズ３４に沿って取り付けられており、その上からマイラーフィルム（ポリエチレンテレフタレートフィルム）をコートすることにより固定および耐湿性の向上がはかられている。ＨＯＥシート２７の材質としては、たとえば、フォトポリマー、ダイクロメートゼラチンなどがある。

【００２８】

前記像伝導管であるプラスチックファイバ２５は眼鏡の柄３１に沿って、その端部から前記プリズムレンズ２６に至るまで柄３１に設けられている。尚２８は画像情報に加えて音声情報を得るために柄３１に取り付けられたイヤホンであり、音声信号の伝送には導線（図示省略）を使用している。また３５は眼鏡のパッドを示している。

【００２９】

上記のように構成された装置において、ビデオ信号（画像信号）が液晶表示板２２によ

って画像変換され、光源２１により照らされる。拡散板２３は液晶表示板２２のマトリックス配線パターンを観察者が認識しずらくするものであり、これにより液晶のパターンノイズのない良好な画像が観察できる。拡散板２３を出射した光は、縮小光学系２４によりおおよそ像伝導管Ｂのプラスチックファイバ２５の径まで縮小され、ファイバにカップリングされる。

【００３０】

プラスチックファイバ２５により伝導された画像はプリズムレンズ２６により偏向および像拡大された後、ＨＯＥシート２７に入射する。このＨＯＥシートは前述したように反射波長選択性、像拡大作用（凹レンズ機能）を持ち合わす。すなわちある角度方向に特定の波長のみを反射し、他のスペクトルについては透過するという特徴を持つ。

【００３１】

このため観察者は、液晶表示板（ＬＣＤ）２２の画像を単色（例えば、緑）で見ながら、同時に周囲の視覚情報も見ることができる。（ただし、透過光のスペクトルには緑が欠落している。）もちろん、Ｒ，Ｇ，Ｂ３色をホログラム作製時に用いることにより、観察者はフルカラーの画像を見ることも可能である。この場合には、Ｒ，Ｇ，Ｂそれぞれの波長が透過光からは欠落するが、それぞれのバンド幅を小さくすることにより自然な色調で明るい背景を見ることができる。また、スペクトルの帯域幅を小さくすることは鮮明な像を得るためにも有利な条件となる。

【００３２】

加えて、ＨＯＥシート２７のもう１つの特徴である像拡大作用により、たかだかプラスチックファイバ２５のコアサイズしかない画像を、観察者に虚像を見せることで十分な視野まで拡大する。この様子を図５に示す。図５はＨＯＥシートの像拡大作用を示しており、プラスティックイメージファイバー上に像（像高３ｍｍ）をレンズ、ミラーなどにより２倍（像高６ｍｍ）に拡大しこれをＨＯＥシートに６０°の角度で入射させる。このＨＯＥシートにより、像は横倍率４０倍（像高２４０ｍｍ）に虚像として拡大され、その位置はＨＯＥから１０００ｍｍ隔てた位置となっている。焦点距離は２５ｍｍとなっているためルーペ倍率は１０倍である。出射瞳（ＥＰＤ）は直径８ｍｍ以上あり、ＨＯＥシートから１５～２０ｍｍ隔てて位置している。

【００３３】

図６は、図４の情報表示眼鏡を実際に使用者がかけたところを上方より見た様子を示している。図６において図４と同一部分は同一符号をもって示している。図６において５は使用者の眼球、４０は虹彩、２９は高分子合成膜である。像を伝送するイメージファイバー（プラスチックファイバ２５）は眼鏡の柄３１の内部を通っており、ＨＯＥシート２７に入射する直前の像拡大（２倍）及び光の偏向はレンズ付プリズムミラー（プリズムレンズ２６）によって行われている。なお、このイメージファイバー（プラスチックファイバ２５）の出射ＮＡ（屈折率をｎとしたときの開口率、$NA = n \sin\theta$）は０．５となっている。

【００３４】

前記ＨＯＥシート２７とレンズとの取り付けは、例えば図７に図示するように眼鏡のレンズ３４ａ，３４ｂを貼り合わせることにより行い、その間にホログラムシート２７ａ（厚さ数ミクロン～数十ミクロン）を挟み込むという方法が考えられる。この場合、レンズ３４ａ，３４ｂどうしの接合にはＵＶ硬化接着剤４１などによる接着や、バイフォーカルレンズなどで使用されている融着などが考えられる。

【００３５】

またＨＯＥシート２７をレンズに沿う形に形成し、該ＨＯＥシートをレンズとマイラーフィルム（ポリエチレンテレフタレートフィルム）などの別部材との間に挟み込んで保持するようにしても良い。

【００３６】

図８には、画像出力装置としてレーザーダイオードアレイ４３とスキャナ光学系としてガルバノメータ（ガルバノミラー）４４を使用したディスプレイ眼鏡の一例を示す。この

場合、左右独立して二組の画像出力装置、表示部およびＨＯＥシート２７を備えているため両眼視が可能であり、左右それぞれの画像出力装置に異なる画像を表示することにより立体視も可能となっている。

【００３７】

図８において眼鏡３０は図４と同様に構成されており、左右の柄３１，３１には導線２５ｂ，２５ｂ、ドライブ回路４２，４２、レーザーダイオードアレイ（ＬＥＤａｒｒａｙ）４３，４３、ガルバノメータ（ｇａｌｖａｎｏｍｅｔｒｉｃ　ｓｃａｎｎｅｒ）４４，４４が各々設けられている。また両眼のレンズ３４，３４にはＨＯＥシート２７，２７が設けられている。

【００３８】

まず、左右それぞれのレーザーダイオードアレイ４３，４３とガルバノメータ４４，４４のドライブ回路４２，４２に画像信号が入力される。この信号にもとづいてレーザーダイオードアレイ４３，４３の各光源のｏｎ，ｏｆｆが行われ、それに同期してガルバノメータ４４，４４が駆動される。その結果、眼鏡のレンズ３４，３４に沿って設けられたＨＯＥシート２７，２７上に走査された画像が投影されその反射光が瞳に入射することによって、使用者は背景と画像出力装置からの出力画像の拡大虚像を融合して見ることができる。音声信号は直接イヤホン２８に送られ音声に変換される。なお、この眼鏡ディスプレイには使用者が掛けはずししやすいように首掛け用のチェーン４５が設けられている。

【００３９】

図９は、図８のガルバノメータ４４の代わりに、スキャナ光学系として音響光学効果素子（ＡＯＭ：ａｃｏｕｓｔｏ　ｏｐｔｉｃ　ｍｏｄｕｌａｔｏｒ）５４を使用したディスプレイ眼鏡の一例を示す。全体の動作原理は前記図８のスキャナ光学系としてガルバノメータ４４を使用した例と同じである。音響光学効果素子５４は、超音波５５を媒質中に流し込むと光弾性効果により屈折率の疎密波を生じ、これにより回折格子と同様の働きを示すもので、この超音波の周波数を変えることにより回折格子のピッチを可変できる。回折格子のピッチが変わると、回折光５６の偏向角も変わるので、これにより光線をスキャンすることができる。この音響光学効果素子５４はガルバノメータやポリゴンミラーに比べて可動部がないことが特長である。　また、図１０にはＨＯＥシート取り外し可能タイプの情報表示眼鏡の一例を示す。ＨＯＥシート２７にはクリップ６０が取り付けられており、眼鏡のレンズ３４またはフレーム３２にこのクリップ６０を挟むことにより脱着可能となっている。また、この例では画像を前記プラスチィックファイバ２５にて伝導することなく、直接表示装置６１を眼鏡の柄３１の部分に取り付けている。

【００４０】

またＨＯＥシートは図１１のように保持しても良い。図１１において円筒形（シリンドリカル）ポリカーボネート基板１０２に沿って接着、形成されたホログラムシート（ＨＯＥシート）２７ａは、該ポリカーボネート基板１０２とマイラーフィルム１０１（又は別部材）との間に挟まれて保持されている。

【００４１】

次にＨＯＥと画像出力装置とを、眼鏡フレームに対して脱着可能に構成した例を図１２に示す。図１２において眼鏡の構成は図４、図１０と同様である。１０２ａはＨＯＥと画像出力装置が取り付けられたポリカーボネート筐体であり、その一端は眼鏡のフレーム３２の上端部に脱着自在に係止され、折曲部を経た他端部に形成されたシリンドリカル曲面１０２ｂは、フレーム３２への装着時に該フレーム３２に対向する部位に配置されるように構成されている。前記シリンドリカル曲面１０２ｂのフレーム３２とは反対側の面にはＨＯＥ１２７がマイラーフィルム１０１に挟まれて保持されている。ポリカーボネート筐体１０２ａの前記折曲部内側には、ＨＯＥ１２７に画像を出力する液晶表示装置（ＬＣＤ）１０３が設けられている。図１２の構成によれば、ＨＯＥ１２７と液晶表示装置１０３がポリカーボネート筐体１０２ａに一体的に固定されているため、両者の位置決めを行う必要がなく使い勝手が良い。

【００４２】

図１３は、ＨＯＥと画像出力装置とを眼鏡フレームに対して脱着可能に構成した他の例を示している。図１３において眼鏡の構成は図４、図１０と同様である。ポリカーボネート筐体１０２ａの一端は眼鏡のフレーム３２の上端部に脱着自在に係止され、折曲部を経た他端部は平面状に形成されるとともに、フレーム３２への装着時に該フレーム３２に対向する部位に配置されるように構成されている。前記ポリカーボネート筐体１０２ａの他端部の、フレーム３２とは反対側の面にはＨＯＥ１２７がマイラーフィルム１０１に挟まれて保持されている。１０４は、ポリカーボネート筐体１０２ａの折曲部内側に設けられた液晶表示装置１０３からの出射光を、反射させてＨＯＥ１２７に導くミラーである。このように図１３では、ＨＯＥ１２７への入射光線の角度と、物側距離を変化させるためにミラー１０４を設け、一度ミラー１０４で反射した光をＨＯＥ１２７に入射している。図１３の構成によれば、ＨＯＥ１２７と液晶表示装置１０３とミラー１０４がポリカーボネート筐体１０２ａに一体的に固定されているため、それらの位置決めを行う必要がなく使い勝手が良い。

【００４３】

本発明を適用した他の光学機器の一例としてＨＯＥシートを使ったビデオカメラファインダーを図１４に示す。図１４において不透明なプラスチックから成るファインダー筐体１０５の内側には、液晶表示装置１０３、視度調整レンズ１０６およびＨＯＥ１２７が設けられている。液晶表示装置１０３から出射された光線はＨＯＥ１２７に入射しおおよそ平行光となって出射する。この出射光は視度調整レンズ１０６によって発散角が制御された後、瞳５に入射する。この図１４の構成において、ＨＯＥ１２７は不透明なプラスチックから成るファインダー筐体１０５に取り付けられており、透過背景像を見ることはできない。

【００４４】

また本発明を適用した他の例として、腕時計型の携帯端末装置を図１５に示す。本体１１０の表示面には液晶表示装置１０３が設けられ、その上面にはＨＯＥ１２７がヒンジ１１１を軸として開閉自在に設けられている。１１２は腕用のバンドである。前記液晶表示装置１０３は時刻表示のみならず他の様々な文字、画像情報を表示するものである。前記ＨＯＥ１２７を図１５（ａ）のように閉じると、透過背景像として液晶表示装置１０３に表示された時刻を見ることができる。またＨＯＥ１２７を、ヒンジ１１１を中心に回転して図１５（ｂ）のように開くと、ＨＯＥ１２７により反射拡大された像を見ることができる。このため液晶表示装置１０３により細かな像を表示しても、容易に見ることができる。

【００４５】

図１６には、別例として画像受信装置を備えたワイヤレス情報表示眼鏡を示す。図１６において眼鏡３０は図４、図８、図１０と同様に構成され、柄３１には、画像信号受信回路７１、ディスプレイドライブ回路７２、フィールドエミッション表示装置７３、バッテリ７４およびアンテナ（図示省略）が設けられている。

【００４６】

上記のように構成された装置において、画像信号発信源（図示省略）から送信された画像信号は、柄３１の部分に内臓されたアンテナおよび画像信号受信回路７１により受信される。その受信された画像信号はディスプレイドライブ回路７２によりデコードされ、フィールドエミッション表示装置７３に送られ画像が表示される。この表示像がレンズ３４の一部に設けられたＨＯＥシート２７により拡大反射され、使用者に視覚情報を提供する。なお、これら画像信号受信回路７１、ディスプレイドライブ回路７２、フィールドエミッション表示装置７３は柄３１に内臓されたバッテリ７４により駆動される。このようにワイヤレス情報表示眼鏡を構成することにより、より使い勝手、携帯性が向上する。

【００４７】

図１７には両眼幅調整機構付情報表示眼鏡の一例を示す。人間の両眼の光軸中心間の距離は個人差があり、少なくとも６０ｍｍ～７０ｍｍ位のばらつきをもっている。このばらつきを吸収して良好な画像を見るためにはＨＯＥシートからの反射光が１５ｍｍ程度の出

射瞳径をもつことが必要となるが、出射瞳の大きさと像倍率とは相反する関係にあり、高倍率（ＨＯＥの物側距離が短い）時には、通常出射瞳径は小さくなってしまう。そこで、高倍率時にも良好な視認特性を得るために、各人の目の光軸とＨＯＥの光軸とを一致させられるように、両眼幅調整機構を設けることが重要になる。図１７の情報表示眼鏡は以上の目的のために発明したものである。

【００４８】

図１７において、フレーム３２の上部にはねじ溝８１と回転防止穴８２ａが設けられており、これに回転防止軸８３ａおよび図示形状の調整ねじ８４が挿入されている。またこれとは別にパッド３５の上部に、回転防止穴８２ｂおよび回転防止軸８３ｂが設けられている。調整ねじ８４の中央部に設けられた回転調整つまみ８５を回すことにより、ＨＯＥシート２７の光軸中心距離を可変するように構成している。

【００４９】

また本発明のディスプレイ眼鏡には像表示の位置に次のような工夫がされている。まず図１８、１９に標準的な人間の視野特性を垂直、水平方向それぞれについて示す。図１８は標準的な人間の垂直方向の視野特性を示し、この図によれば通常の視野は水平方向より１０°～１５°下方に向いている（図示、立っているときの通常の視線から座っているときの通常の視線までの範囲）ことがわかる。図１８において、Ａは２０オの焦点距離（最小）、Ｂは４０オの焦点距離（最小）、Ｃはディスプレイ用の容認される最小の読み取り距離、Ｄは通常の見る距離（ＣＲＴ）、Ｅはディスプレイ用の望ましい最小距離、Ｆは配置されるディスプレイの最大距離、Ｇは６０オの焦点距離（最小）、Ｈはもしディスプレイが適合して設計される場合無限遠となること、を各々示している。

【００５０】

また図１９は標準的な人間の水平方向の視野特性を示し、この図によれば、文字を認識できる視野は約２０°（図示、文字認識限界の範囲）であることがわかる。

【００５１】

そこで本発明では図２０に示すように、通常の視線（水平方向より１０°下方とする）を中心として立体角２０°以内には表示像を表示しないようにする。こうすることにより、図２１に示すように通常の視線方向では表示像に妨げられることなく背景を見ることができ、表示像を見たい場合には図２２に示すように視線を（この例では上方に）移動することにより、表示像（ＨＯＥシート２７からの反射光）と背景とを融合して見ることができる。尚図２１は背景像のみレンズを通して見る場合の説明図であり、図２２は背景像と表示像を見る場合の説明図である。

【００５２】

あるいは、図２３に示すように、ＨＯＥシートが取り付けられた眼鏡のフレームまたはレンズ９０に視線検出センサ９１を設け、使用者の視線が特定の範囲に入ったときのみ画像表示がなされるように構成することにより、より視認性を向上させ使い勝手が良いものとなる。また図２３では、ＨＯＥシートが取り付けられた前記レンズ９０に対向して設けた液晶シャッター９２と明るさセンサ（光センサ：フォトダイオード）９３を用い、背景の明るさを前記センサ９３で感知し液晶シャッター９２の透過率を自動的に調節することにより、使用者が容易に表示画像と背景を融合して見られるようにこれらの明るさの比率を適当な範囲に保つ機能も有している。前記液晶シャッター９２は、着脱可能な少なくとも可視光波長域に対する遮光部材であり、このシャッター使用時には背景からの光の透過量を１０％以下に減衰できる。

【００５３】

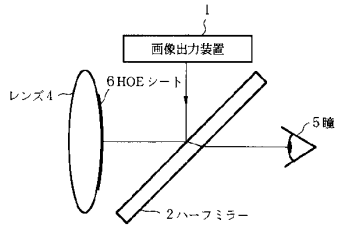
図２３において、９４はマイクロコンピュータ９５の指令により液晶シャッター９２の透過率を調節する液晶シャッタードライバ、９６は入力される画像信号とマイクロコンピュータ９５の指令によりディスプレイ９７を駆動するディスプレイドライバである。尚前記ディスプレイ９７は前記図８のレーザーダイオードアレイ４３、ガルバノメータ４４、図９の音響光学効果素子５４、図１６のフィールドエミッション表示装置７３等で構成されている。

【００５４】
図２３の装置の一連の動作フローチャートを図２４に示す。まず画像表示ＯＦＦ、液晶透過率最大である状態において、マイクロコンピュータ９５が視線検出センサ９１の出力を読み込む。そして検出された視線が特定の範囲以内であれば、明るさセンサ９３の出力を読み込み、その明るさに応じて液晶シャッター９２の透過率を液晶シャッタードライバ９４によって調整し、画像表示をＯＮとする。また前記検出された視線が特定の範囲以内でないときは、画像表示をＯＦＦとし、液晶シャッター９２の透過率は最大のままとする。
【００５５】
この場合、背景の明るさは変えずに表示画像の明るさを直接可変するか、もしくは表示装置の前に液晶シャッターを設けこの透過率を可変することにより行ってもよい。また、一時的に表示画像だけを見たいときには、眼鏡レンズ部にサングラス風のフィルタをして背景からの光を減らしたり、同じく眼鏡レンズ部に設けられた２枚の偏光板のそれぞれの光軸の交差角度を可変することにより背景からの光を調整してもよい。
【００５６】
なお、以上に挙げたディスプレイ眼鏡は正視の人用として眼鏡レンズの屈折力（度）を０としたものでも、レンズにカラーコーティング、ＵＶ反射コートなどの表面処理を施したものでももちろん良い。
【００５７】
（実施例）
前記表示部は、液晶ディスプレイ（ＬＣＤ）やフィールドエミッションディスプレイ（ＦＥＤ）に限らず、ＬＥＤディスプレイ（ＬＥＤＤ）、レーザーディスプレイ（ＬＤＤ）、デジタルマイクロミラーディスプレイ（ＤＭＤ）、エレクトロルミネッセンスディスプレイ（ＥＬＤ）を用いても良い。
【００５８】
また前記スキャナ光学系としては、ガルバノメータや音響光学効果素子に限らず、ポリゴンミラー又はリゾナントスキャナを用いても良い。
【００５９】
また前記光学部材はレンズに限らず、板ガラス、透明プラスチック板、不透明プラスチック板、反射減衰プレート、プリズム又はハーフミラー又は回折格子を用いても良い。
【００６０】
また本発明は眼鏡、カメラ、双眼鏡に適用するに限らず、前記光学部材を望遠鏡のレンズで構成し、前記表示部を望遠鏡の筐体またはレンズに設けても良く、また前記光学部材を顕微鏡のレンズで構成し、前記表示部を顕微鏡のフレームまたはレンズに設けても良い。この場合も前記同様の作用、効果が得られる。
【図面の簡単な説明】
【００６１】
【図１】本発明の一実施形態を示す構成図。
【図２】本発明の他の実施形態を示す構成図。
【図３】本発明を一眼レフカメラ又は双眼鏡に適用した実施形態を示す構成図。
【図４】本発明を適用し、情報表示眼鏡として構成した実施形態の一例を示す構成図。
【図５】ＨＯＥシートの像拡大作用を表す説明図。
【図６】本発明の情報表示眼鏡を使用者がかけたところを上方より見た様子を表す説明図。
【図７】本発明におけるＨＯＥシートの取り付け方法の一例を示す要部断面図。
【図８】本発明を適用し、情報表示眼鏡として構成した実施形態の他の例を示す構成図。
【図９】本発明のスキャナ光学系の他の実施形態を示す要部構成図。
【図１０】本発明の情報表示眼鏡において、ＨＯＥシートを着脱可能とした実施形態を示す構成図。
【図１１】本発明におけるＨＯＥシートの保持例を示し、（ａ）は正面図、（ｂ）は側面

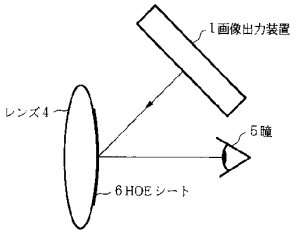
図。
【図１２】本発明の情報表示眼鏡において、ＨＯＥシートを着脱可能とした実施形態の他の例を示す構成図。
【図１３】本発明の情報表示眼鏡において、ＨＯＥシートを着脱可能とした実施形態の他の例を示す構成図。
【図１４】本発明をビデオカメラファインダーに適用した実施形態の構成図。
【図１５】本発明を適用した腕時計型携帯端末装置の実施形態を示し、（ａ）はＨＯＥを閉じたときの構成図、（ｂ）はＨＯＥを開いたときの構成図。
【図１６】本発明の情報表示眼鏡をワイヤレス化した実施形態を示す構成図。
【図１７】本発明の両眼幅調整機構付情報表示眼鏡の実施形態を示す要部構成図。
【図１８】標準的な人間の垂直方向の視野特性を示す説明図。
【図１９】標準的な人間の水平方向の視野特性を示す説明図。
【図２０】表示像を認識できる人間の視野範囲を示す説明図。
【図２１】通常の視線方向における背景と表示像の関係を表し、背景像のみレンズを通して見える場合の説明図。
【図２２】視線を上方に移動したときの背景と表示像の関係を表し、背景像と表示像が見える場合の説明図。
【図２３】本発明の視線検出センサおよび明るさセンサを設けた装置の一例を示す構成図。
【図２４】図２３の装置によって画像表示および液晶シャッターの透過率を制御する場合のフローチャート。
【図２５】従来の画像表示装置の一例を示す構成図。
【符号の説明】
【００６２】
１…画像出力装置
４，３４，３４ａ，３４ｂ…レンズ
５…眼球（瞳）
６，２７…ＨＯＥシート
２１…光源
２２…液晶表示板
２３…拡散板
２４…縮小光学系
２５…プラスチックファイバ
２６…プリズムレンズ
２８…イヤホン
２９…高分子合成膜
３０…眼鏡
３１…柄
４０…虹彩
４１…ＵＶ硬化接着剤
４２…ドライブ回路
４３…レーザーダイオードアレイ
４４…ガルバノメータ
５４…音響光学効果素子
６０…クリップ
６１…表示装置
７１…画像信号受信回路
７２…ディスプレイドライブ回路
７３…フィールドエミッション表示装置
７４…バッテリ

８１…ねじ溝
８２ａ，８２ｂ…回転防止穴
８３ａ，８３ｂ…回転防止軸
８４…調整ねじ
８５…回転調整つまみ
９１…視線検出センサ
９２…液晶シャッター
９３…明るさセンサ
９４…液晶シャッタードライバ
９５…マイクロコンピュータ
９６…ディスプレイドライバ
９７…ディスプレイ
１０１…マイラーフィルム
１０２…円筒形ポリカーボネート基板
１０３…液晶表示装置
１０４…ミラー
１０５…ファインダー筐体
１０６…視度調整レンズ
１２７…ＨＯＥ

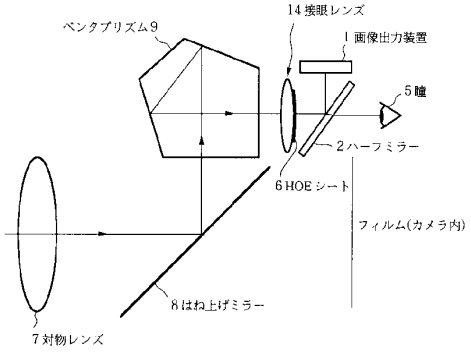
【図１】



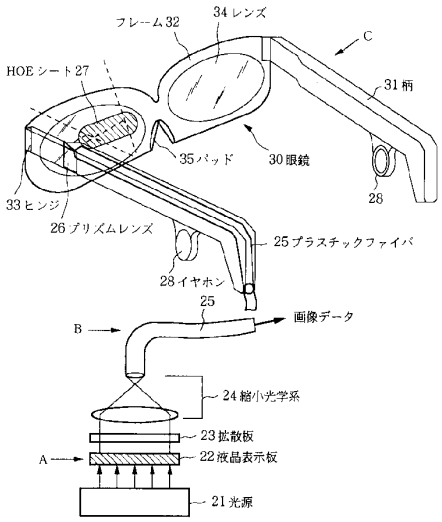
【図２】



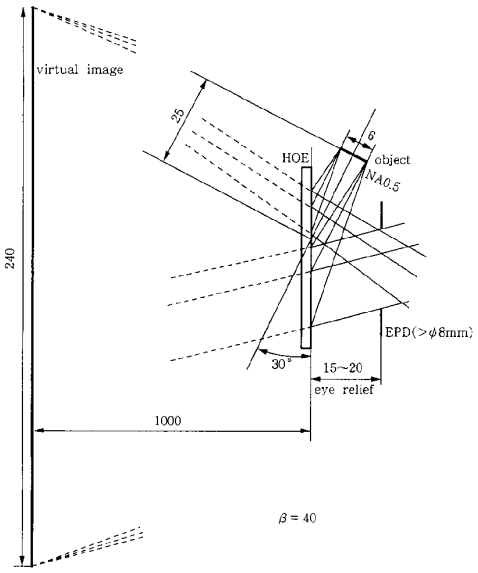
【図３】



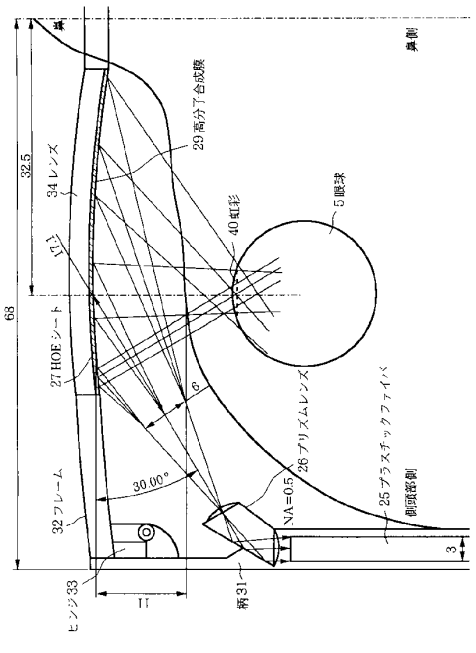
【図４】


フレーム32
34 レンズ
C
HOE シート27
31 柄
35 パッド
30 眼鏡
28
33 ヒンジ
26 プリズムレンズ
25 プラスチックファイバ
23 イヤホン
25
画像データ
B
24 縮小光学系
23 拡散板
A
22 液晶表示板
21 光源

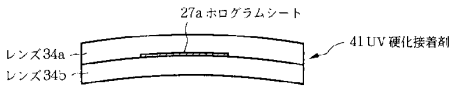
【図５】


virtual image
240
25
HOE
6
object
NA0.5
EPD(>φ8mm)
30°
15~20
eye relief
1000
β = 40

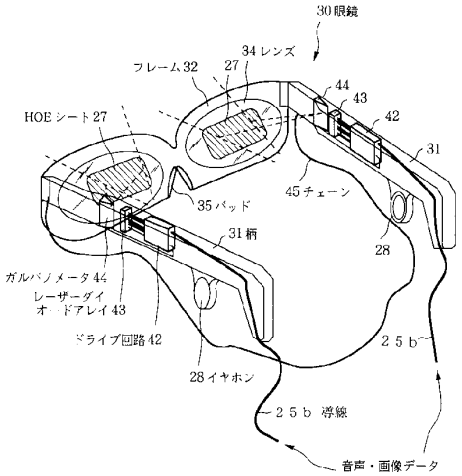
【図６】


68
32.5
34 レンズ
11.5
29 高分子合成膜
40 虹彩
5 眼球
27 HOE シート
6
30.00°
26 プリズムレンズ
NA=0.5
25 プラスチックファイバ
側頭部側
32 フレーム
3
ヒンジ33
11
柄31

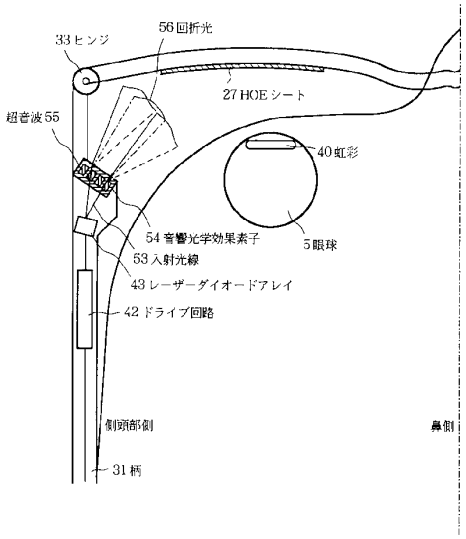
【図７】


27a ホログラムシート
41 UV 硬化接着剤
レンズ34a
レンズ34b

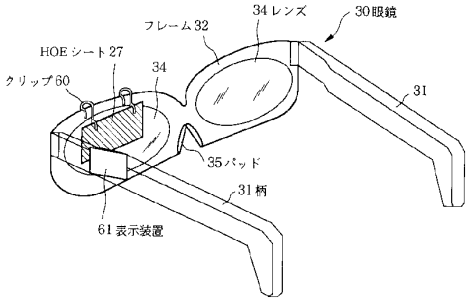
【図８】


30 眼鏡
34 レンズ
フレーム32
27
44
43
42
HOE シート27
31
45 チェーン
35 パッド
31 柄
28
ガルバノメータ44
レーザーダイオードアレイ43
ドライブ回路42
25 b
28 イヤホン
25 b 導線
音声・画像データ

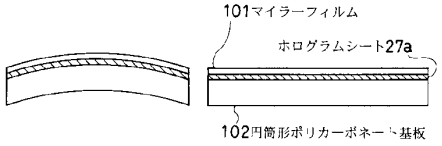
【図９】



【図１０】



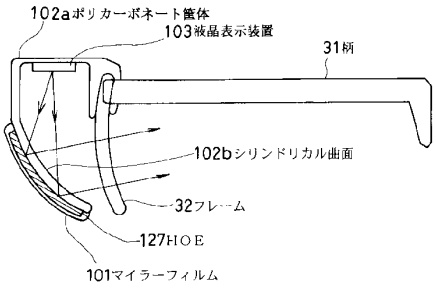
【図１１】



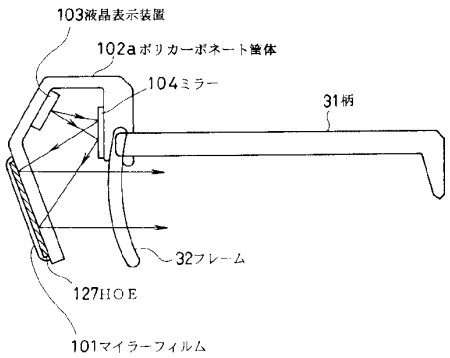
正面図　　側面図

(a)　　(b)

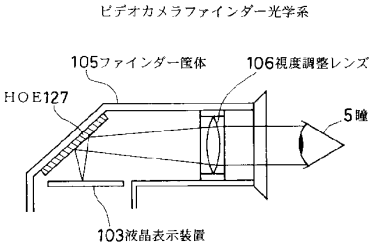
【図１２】



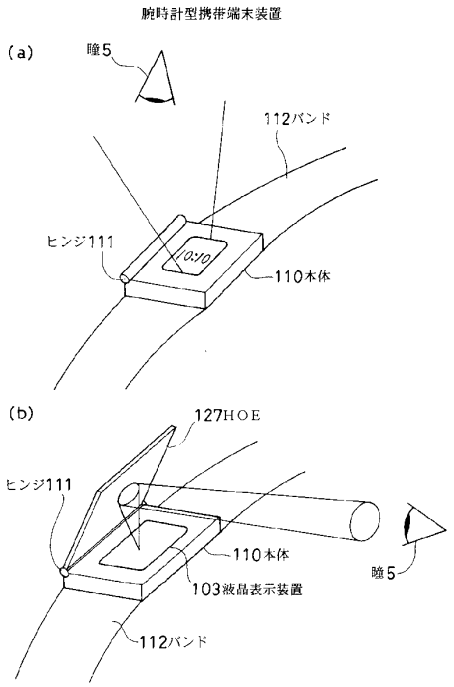
【図１３】



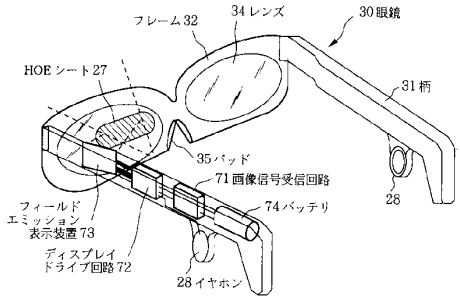
【図１４】



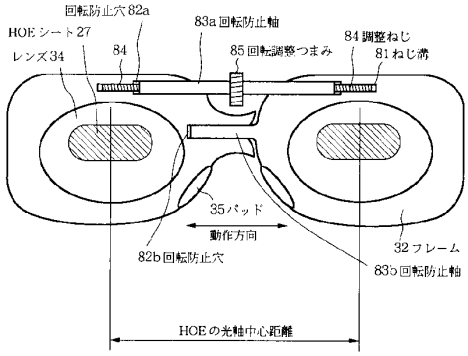
【図１５】



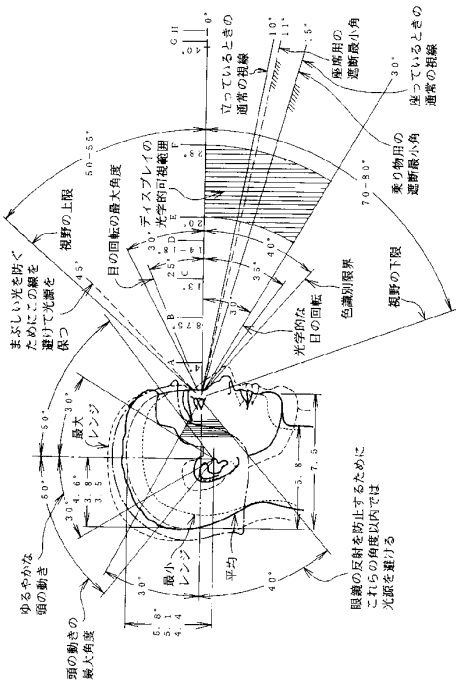
【図１６】



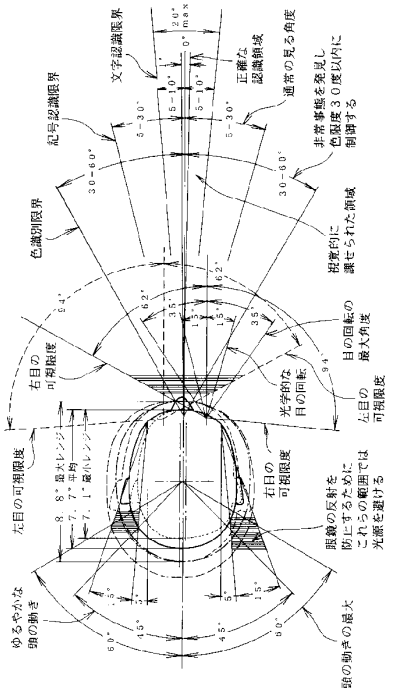
【図１７】



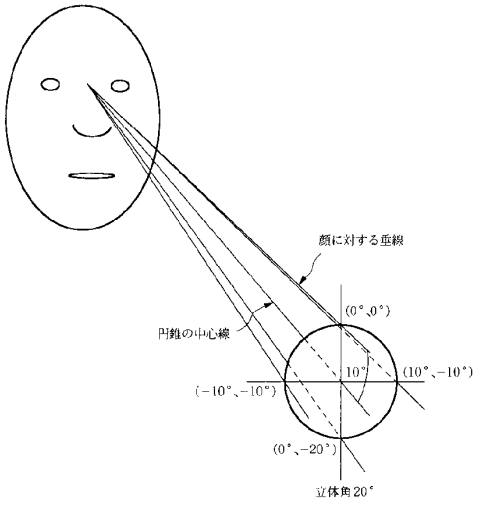
【図１８】



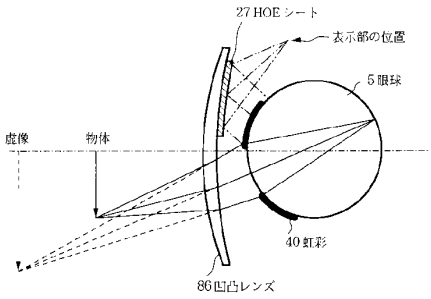
【図１９】



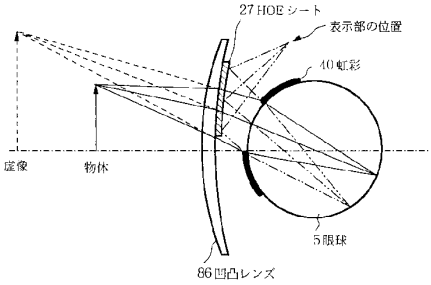
【図２０】



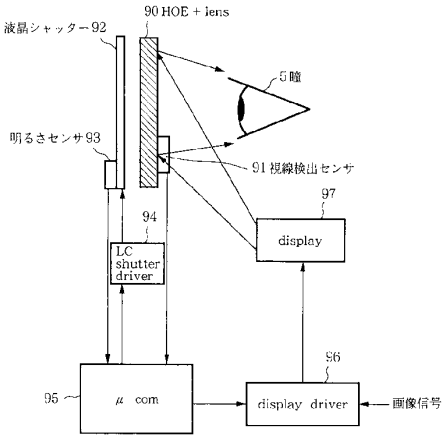
【図２１】



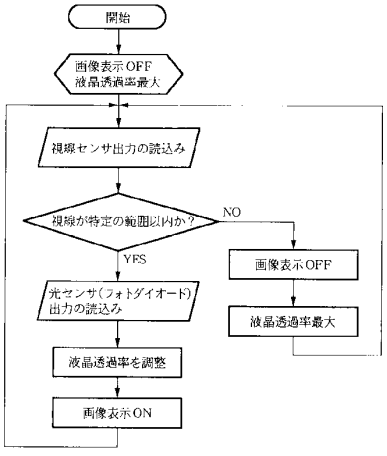
【図２２】



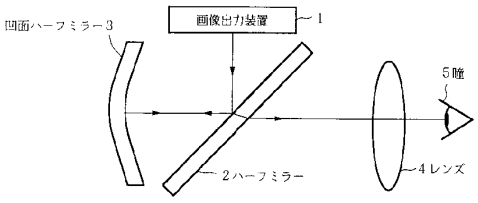
【図２３】



【図２４】



【図２５】



Form 1449 (Modified)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
Information Disclosure Statement By Applicant	Applicant	HOWELL et al.
	Filing Date	March 6, 2024
	Group	2872
(Use Several Sheets if Necessary)		Page 1 of 2

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	2.	2004/0040948 A1	Mar-04	Mandell et al.			
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	4.	2007/0049103 A1	Mar-07	Kashi et al.			
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							Translation	
Init.		Document No.	Date	Country	Class	Subclass	Yes	No
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		JP 2004-297256A	Oct-04	Japan			X	
		JP 2006-209144A	Aug-06	Japan			X	
		WO 86/05891	Oct-86	WIPO				

Other Documents (Including Author, Title, Date, Pertinent Pages, etc.)

	A	Notice of Allowance for U.S. Patent Application No. 17/484,080, dated June 18, 2024.
	B	Office Action for U.S. Patent Application No. 18/594,662, dated May 21, 2024.

Examiner	Date Considered

Examiner: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form 1449 (Modified) **Information Disclosure Statement By Applicant** (Use Several Sheets if Necessary)	Atty. Docket No.	IPVCP003X1C4X1C2
	Application No.:	18/597,874
	Applicant	HOWELL et al.
	Filing Date	March 6, 2024
	Group	2872
		Page 2 of 2

	C	Office Action for U.S. Patent Application No. 18/594,662, dated July 3, 2024.
	D	Advisory Action for U.S Patent Application No. 18/594,662, dated July 31, 2024.
	E	Notice of Allowance for U.S. Patent Application No. 18/238,467, dated August 7, 2024.
	F	Notice of Allowance for U.S. Patent Application No. 18/237,467, dated November 18, 2024.
	G	Notice of Allowance for U.S. Patent Application No. 16/182,969, dated July 1, 2024.
	H	Office Action for U.S. Patent Application No.18/541,367, dated May 30, 2024.
	I	Office Action for U.S. Patent Application No. 18/541,367, dated August 6, 2024.
	J	Notice of Allowance for U.S. Patent Application No. 18/541,367, dated October 28, 2024.
	K	Office Action for U.S. Patent Application No. 18/680,434, dated August 14, 2024.
	L	Notice of Allowance for U.S. Patent Application No. 18/680,434, dated November 5, 2024.

Examiner	Date Considered

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JP,2004-297256,A
Application refused (Application deemed to be withdrawn, abandoned or lapsed.)

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3. In the drawings, any words are not translated.

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(54) [Title of the invention] WIRELESS HEADSET AND WIRELESS COMMUNICATION CONNECTION CONTROL METHOD FOR WIRELESS HEADSET

Apple Inc. Exhibit 1015 Page 1553

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H04R 1/10 101B
H04R 5/033 C

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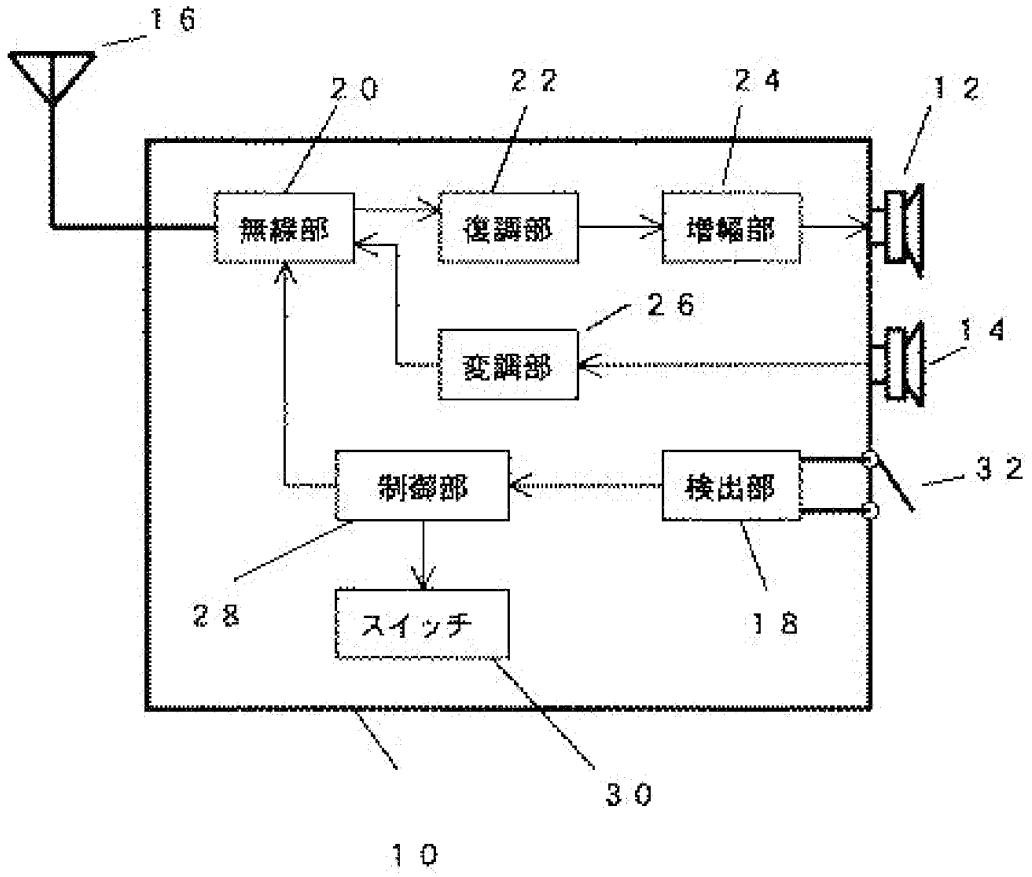
[Theme code (reference)]
5D005
[F-term (reference)]
5D005BB02

Overview Close

(57) [Overview]
PROBLEM TO BE SOLVED: To solve a problem of a conventional connection type communicatio n system such as Bluetooth(R) that consumes much power because transmission reception op erations should be executed even when no voice signal is transmitted to maintain logical conn ection.
SOLUTION: A headset 10 is provided with a mount detection section 18 and the mount detecti on section 18 detects whether or not the headset 10 is mounted on a user to automatically ex

Apple Inc. Exhibit 1015 Page 1554

ecute the establishment and disconnection control of wireless communication connection betw een the headset 10 and a music reproducing apparatus 40 being an opposite party of wireless communication in response to the operating state of the headset 10. By this processing, when the headset 10 is not in use, the wireless connection between the headset 10 and the music r eproducing apparatus 40 is automatically disconnected to save power.



Scope of Claims Close

[Patent Claims]

[Claim 1]

A wireless headset for receiving an audio signal transmitted from a music reproducing device by wireless communication, comprising:

Apple Inc. Exhibit 1015 Page 1555

A wireless unit configured to receive an audio signal from outside;
A speaker unit that outputs the audio signal received by the wireless unit; and
A detection unit configured to detect whether or not the headset is worn by a user; and
A control unit configured to establish a wireless communication connection with the music dev ice when the detection unit detects that the headset is worn by the user, and disconnects the wireless communication connection with the music playback device when the detection unit de tects that the headset is removed from the user.
The wireless headset according to claim 1, wherein
[Claim 2]
When the detection unit detects that the headset is worn by the user The wireless headset acc ording to claim 1, further comprising: a switch for turning on a power supply, and turning off t he power supply after disconnecting a wireless communication connection with the music repr oducing device when it is detected that the headset is removed from the user.
[Claim 3]
The wireless head set according to claim 1, wherein the control unit transmits a connection re quest signal required for establishing a wireless communication connection to the music repro ducing device when establishing the wireless communication connection with the music reprod ucing device.
[Claim 4]
The wireless head set according to claim 1, wherein when a connection request signal necessa ry for a process of establishing a wireless communication connection is transmitted from the music reproducing device, the control unit controls the wireless unit to wait for reception of th e connection request signal when the detection unit detects that the wireless head is worn by the user.
[Claim 5]
A wireless headset for receiving an audio signal transmitted from a music reproducing device by wireless communication, comprising:
Detecting, by a detector, whether or not the headset is worn by a user;
Automatically establishing a wireless communication connection with the music playback devic e when the detection unit detects that the headset is worn by the user; and
Automatically disconnecting the wireless communication connection with the music playback d evice when the detection unit detects that the headset has been removed from the user.

Detailed Description Close —

Apple Inc. Exhibit 1015 Page 1556

[Detailed description of the invention]

[0001]

[Technical field of invention]

The present invention relates to a wireless headset that is attached to a human body and transmits and receives an audio signal by wireless communication, and a method for controlling wireless communication connection of the wireless headset.

[0002]

[Prior art]

In the related art, when electronic information communication devices are connected for communication, a wired method is generally used. However, in recent years, an attempt to improve usability by applying a wireless method instead of the wired method has been made.

[0003]

With the advent of personal area wireless technologies such as Bluetooth and HomeRF, the adoption of these wireless interfaces for electronic information communication devices such as personal computers and mobile phones has been studied and started to be put into practical use. Further, in the future, wireless interfaces are expected to be applied to various fields, and application to AV devices such as music playback devices is also under consideration.

[0004]

Transmission of AV data such as an audio signal to a wireless headset is considered as one of the applications to the AV device. In this case, by wirelessly connecting the wireless headset to the audio player, a conventional connection cable becomes unnecessary, and a more comfortable audio reproduction environment is expected. Conventionally, in the field of wireless headsets, those using infrared rays, high-frequency radio, and the like have been put into practical use. Further, in recent years, development of a wireless headset using Bluetooth technology has also been advanced (see Patent Document 1).

[0005]

In the case of such a wireless headset using wireless communication, in order to improve usability for a user, it is essential to enable long-time driving by a battery, and it is necessary to prevent consumption of the battery as much as possible.

[0006]

As one method for solving this problem, in an audio signal device such as a headset or a hearing aid which is assumed to be used while being attached to a human body, it is considered to automatically turn on a power source only when the audio signal device is used while being attached to the human body and turn off the power source when the audio signal device is not used while being not attached to the human body, thereby preventing battery consumption (Patent Document 2).

[0007]

[Patent document 1]

Apple Inc. Exhibit 1015 Page 1557

JP 2002-112383A

[Patent document 2]

JP 2002-305785A

[0008]

[Problem to be solved by the invention]

However, in the case of a wireless headset using wireless communication, it is necessary to es tablish a wireless communication connection between the headset and a music reproducing de vice such as an audio player or the like to the headset) such as an audio player to be connect ed.

[0009]

In order to establish a wireless communication connection with the headset, it is necessary for the user to operate the headset or the music reproducing apparatus to be connected to the he adset. Further, even when the use of the headset is stopped, the user needs to disconnect the wireless communication connection by operating the headset or the music reproducing device to which the headset is connected. Therefore, if the user fails to perform the operation of stop ping the use of the headset, the wireless communication connection is continued, and the batt ery of the headset is wastefully consumed.

[0010]

In addition, in the case of a connection-type wireless communication method such as Bluetoot h, various data is transmitted and received in a state in which a logical connection is maintain ed, and thus application to many devices is achieved. In order to maintain a logical connectio n, a transmission / reception operation must be executed even during a period in which an au dio signal is not transmitted, and a large amount of power is always consumed. In such a situ ation, if the state in which the wireless communication connection is established continues, th ere is a problem in that the remaining battery level of the apparatus significantly decreases.

[0011]

Therefore, when a connection-type wireless communication method such as Bluetooth is appli ed to a wireless headset, the problem of power saving control must be solved in order to enab le long-time driving.

[0012]

In order to solve the above-described problems, an object of the present invention is to provid e a wireless headset which is used while being attached to a human body and which is capabl e of improving operability of a user and realizing reduction in power consumption with respect to control of establishment and disconnection of a wireless communication connection state.

[0013]

[Means for solving the problem]

In order to achieve the above object, a wireless headset for receiving an audio signal transmit ted from a music reproducing device by wireless communication, comprising: A wireless unit t

Apple Inc. Exhibit 1015 Page 1558

hat receives an audio signal from outside; a speaker unit that outputs the audio signal receive d by the wireless unit; a detection unit that detects whether or not the headset is worn by a u ser; And a control part for establishing the radio communication connection with the music re producing device when it is detected that the headset is mounted on the user, and for disconn ecting the radio communication connection with the music reproducing device when it is detec ted that the headset is removed from the user.

[0014]

With the above configuration, it is possible to improve the operability of the user and reduce t he power consumption with respect to the control of the establishment and the disconnection of the wireless communication connection state of the wireless headset.

[0015]

[Embodiment of invention]

Hereinafter, embodiments of the present invention will be described with reference to the dra wings.

[0016]

FIG. 1 shows a system configuration using a wireless headset 10 for receiving music informati on or the like by wireless communication and a music reproducing apparatus 40 such as a per sonal computer for reproducing music information or the like according to an embodiment of t he present invention.

[0017]

In FIG. 1, a wireless headset 10 has wireless communication means of the Bluetooth system, and performs wireless communication according to a system determined by the Bluetooth sta ndard. In the Bluetooth standard, an AV profile standard for wirelessly transmitting and receiv ing HiFi audio data is defined, and music data wirelessly communicated by Bluetooth can be re ceived and reproduced according to the AV profile.

[0018]

The music reproducing device 40 is, for example, a personal computer that reproduces music data stored in a storage medium (such as an MD, a memory card, or a hard disk) and outputs the music data as an analog audio signal from a headphone terminal. As a general use metho d, it is possible to listen to music by connecting a wired normal headphone to the headphone t erminal. However, in the embodiment of the present invention, it is possible to listen to music by wirelessly transmitting an audio signal to the wireless headset 10.

[0019]

The wireless headset 10 includes a speaker 12 as an audio output unit, a microphone 14 as an audio input unit, and an antenna 16 as a wireless communication unit, and performs wireless communication of an audio signal with the music reproducing device 40 via the antenna 16.

[0020]

Further, the wireless headset 10 is provided with a wearing detection unit 18 for detecting tha t the wireless headset 10 is worn on the body of the user. When the wearing detection unit 18

Apple Inc. Exhibit 1015 Page 1559

detects that the wireless headset 10 is worn on the head of the user, the power of the headset 10 is turned on, and a wireless communication connection is automatically established betwee n the headset 10 and the music reproduction device 40, so that audio data can be transmitted and received between the headset 10 and the music reproduction device 40.

[0021]

When the wearing detection unit 18 detects that the headset 10 is removed from the user (no n-wearing state), the headset 10 automatically disconnects the wireless communication conne ction with the music reproduction device 40, stops transmission and reception of audio data b etween the headset 10 and the music reproduction device 40, and turns off the power.

[0022]

Next, an internal configuration of the headset 10 and an internal structure of the music reprod ucing device 40 will be described with reference to FIGS. 2 and 3.

[0023]

FIG. 2 shows the internal structure of the headset 10. The headset 10 includes a wireless unit 20 to which an audio signal such as music information wirelessly transmitted from the music r eproducing device 40 via the antenna 16 is input, a demodulating unit 22 that demodulates th e audio signal from the wireless unit 20, and an amplifying unit 24 that amplifies the audio sig nal demodulated by the demodulating unit 22 and transmits the amplified audio signal to the speaker 12.

[0024]

The wireless unit 20 includes, for example, a Bluetooth wireless communication unit, and perf orms wireless communication based on a method defined by the Bluetooth standard. The Blue tooth standard defines an AV profile standard for wirelessly transmitting and receiving HiFi au dio data, and music data wirelessly communicated by Bluetooth is received and reproduced in accordance with the AV profile.

[0025]

An audio signal such as a voice of a user wearing the headset 10 input through a microphone i s input to the headset 10. The audio signal modulated by the modulating unit 26 is input to th e radio unit 20, and is transmitted to the music reproducing device 40 via the radio unit 20 an d the antenna 16.

Further, the headset 10 is provided with a control unit 28 for controlling the entire headset 10, a switch 30 for controlling on / off of a power source of the headset 10, and a wearing detecti on unit 18 for detecting that the headset 10 is worn on a human body.

[0026]

The attachment detection unit 18 is provided with a pressure-sensitive switch 32, and when th e headset 10 is attached to the head of the user, the pressure-sensitive switch 32 becomes co nductive, thereby detecting that the headset 10 is attached to the user. When the attachment detection unit 18 detects that the headset 10 is attached to the user by the pressure-sensitive

Apple Inc. Exhibit 1015 Page 1560

switch 32, the detection result is transmitted to the control unit 28, and the control unit 28 turns on the switch 30 to turn on the power of the headset 10. Further, the control unit 28 automatically establishes a wireless communication connection with the music reproduction device 40 via the wireless unit 20, and enables transmission and reception of audio data between the headset 10 and the music reproduction device 40.

[0027]

When the headset 10 is removed from the head of the user, the pressure-sensitive switch 32 loses the conductive state, thereby detecting that the headset 10 has been removed by the user. At this time, the control unit 28 automatically disconnects the wireless communication connection with the music reproducing device 40 via the wireless unit 20. Further, the control unit 28 turns off the switch 30 to turn off the power of the headset 10.

[0028]

Next, with reference to FIG. 3, 40 will be described with reference to FIG. 3.

[0029]

The music playback device 40 is provided with an antenna 42 for transmitting and receiving audio signals to and from the headset 10, and a wireless unit 44 for transmitting audio signals such as music information to the antenna 42 and receiving audio signals of the wearer of the headset 10 received from the antenna 42. Similarly to the wireless unit 42 of the headset 10, the wireless unit 44 has, for example, Bluetooth wireless communication means, and performs wireless communication in accordance with a method determined by the Bluetooth standard.

[0030]

Further, the music reproducing device 40 is provided with an audio processing part 46 for reproducing music data stored in a storage medium (MD, memory card, hard disk, etc.), a modulating part 48 for modulating an audio signal reproduced by the audio processing part and sending it to the radio part 44, and a demodulating part 50 for demodulating an audio signal received by the radio part 44. The audio signal demodulated by the demodulation unit 50 is sent to the audio processing unit 48 to be reproduced as audio data.

[0031]

Next, in the wireless headset 10 and the music reproducing device 40 shown in FIGS. 1 to 3, a process of establishing a wireless communication connection when the wireless headset 10 is worn by the user and a process of disconnecting the wireless communication connection when the wireless headset 10 is removed from the user will be specifically described.

[0032]

First, a process when the wireless headset 10 is worn by the user will be described.

[0033]

The headset 10 is provided with a wearing detection part 18 for detecting a wearing state of a user. When the head 10 is attached to the head of the user, the pressure sensitive switch 30 attached to the attachment detection unit 18 is turned on, so that the attachment detection uni

Apple Inc. Exhibit 1015 Page 1561

t 18 detects that the headset 10 is attached to the human body of the user and transmits the detection signal to the control unit 28. When the headset 10 is attached to the body of the us er, the control unit 28 automatically turns on the power of the headset 10 by turning on the s witch 30.

[0034]

Further, when the wearing detection section 18 detects that the headset 10 is worn on the bod y of the user and the detection signal is transmitted to the control section 28, the control secti on 28 automatically executes wireless communication connection processing with the music re production apparatus 40 to be connected via the wireless section 20.

[0035]

In this case, when the identification address of the specific music reproduction device 40 to be connected is not registered in advance, the control unit 20 transmits a signal for searching for a wireless communication device in the vicinity from the antenna 16 via the wireless unit 20, and transmits a wireless connection request signal again to a wireless communication device t hat has responded to the signal. A process of automatically establishing a wireless communica tion connection between the headset 10 and the wireless communication device that has resp onded to the signal (in this case, the wireless communication device is assumed to be the mus ic reproduction device 40) is executed. This processing procedure will be described in detail wi th reference to FIG. 4.

[0036]

When the wireless communication system is the Bluetooth system, the wireless headset 10 tr ansmits (STEP1) an Inquiry signal to the wireless communication devices (including the music reproducing device 40 and the other wireless communication devices M) around the headset 1 0. The wireless communication devices (the music reproduction device 40 and the wireless co mmunication device M) that have received the Inquiry signal return a signal including an FHS packet to the headset 10 (STEP2). The FHS packet includes identification addresses (hereinaft er referred to as BD _ ADDR) of the wireless communication devices (the music playback devi ce 40 and the wireless communication device M). In addition, information (Classof Device (h ereinafter referred to as CoD) information) indicating what function the wireless communicatio n device (the music reproduction device 40 or the wireless communication device M) has is inc luded.

[0037]

The headset 10 that has received the FHS packet With reference to the CoD information includ ed in the FHS packet, a connection request is transmitted using the BD _ ADDR included in th e FHS packet to the music reproducing device 40 (a device that reproduces music data stored in a storage medium such as an HDD) that performs wireless communication connection with the headset 10. In this case, the headset 10 transmits the connection request signal LMP_host _connection_req including the BD _ ADDR of the music reproducing device 40 to the music re producing device 40 (STEP3).

Apple Inc. Exhibit 1015 Page 1562

[0038]
In the music reproducing device 40 having received the connection request signal LMP_host_connection_req from the headset 10 In response to a connection request signal LMP_host_connection_req from the headset 10, a response signal LMP_accepted indicating to respond to the connection request is transmitted to the headset 10 (STEP4).
[0039]
Next, the headset 10 which received reply signal LMP_accepted from the music reproduction equipment 40 transmits connection establishment signal LMP_setup_complete to the music reproduction equipment 40 (STEP5), and is this connection establishment signal LMP_setup_complete further.

Upon receiving the connection establishment signal LMP_setup_complete , the music reproducing device 40 transmits the connection establishment signal STEP6 to the headset 10 (SL). The headset 10 receives the connection establishment signal LMP_setup_complete from the music reproduction device 40 (the connection establishment signal LMP_setup_complete is exchanged between the headset 10 and the music reproduction device 40). A wireless communication connection in the Bluetooth system is automatically established between the headset 10 and the music reproducing device 40.
[0040]
In the example described in the above embodiment, the case where the identification address of the device to be wirelessly connected is not registered in the control unit 28 of the headset 10 has been described, but the identification address of the music reproducing device 40 to be connected may be registered in the control unit 28 in advance. In this case, the control unit 28 transmits, via the wireless unit 20, a wireless connection request signal to the music playback device 40 to be wirelessly connected so as to start a wireless connection. Upon receiving the wireless connection request signal, the wireless connection request signal, the audio processing unit 48 generates a response signal in response to the wireless connection request signal and returns the response signal to the headset 10 via the wireless unit 44, thereby establishing a wireless communication connection between the headset 10 and the music reproducing device 40.
[0041]
After the wireless communication connection is established between the headset 10 and the music reproducing device 40 as described above, transmission and reception of audio signals between the headset 10 and the music reproducing device 40 become possible.
[0042]
When the wireless communication connection is established, in the music reproducing device 40, the audio data generated by the audio processing unit 48 is modulated by the modulating unit 46, sent to the wireless unit 44, and transmitted as an audio signal to the outside via the antenna 42. The transmitted audio signal is received by the wireless unit 20 via the antenna 1

Apple Inc. Exhibit 1015 Page 1563

6 of the headset 10 that has established a wireless communication connection with the music playback device 40. In a headset 10, a voice signal received by a radio section 20 is demodulated by a demodulation section 22, amplified by an amplifier 24 and sent to a speaker 12. The user wearing the headset 10 can listen to music data or the like transmitted from the music reproducing device 40 through the speaker 12.

[0043]

In one embodiment of the present invention, it is also possible to send information such as a voice uttered by the user wearing the headset 10 to the music reproducing device 40 by wireless communication and reproduce the information in the music reproducing device 40.

[0044]

The voice uttered by the user wearing the headset 10 is input to the microphone 14, and is further modulated by the modulator 26. The modulated audio signal is transmitted from the radio unit 20 to the outside via the antenna 16. At this time, the music reproducing device 40 with which the wireless communication connection with the headset 10 is established receives the audio signal transmitted from the headset 10 by the wireless unit 44 via the antenna 42. The audio signal received by the radio unit 44 is demodulated by the demodulator 50 and sent to the audio processor 48. The voice processing unit 48 has a well-known voice recognition processing function, and the voice data transmitted from the headset 10 is subjected to voice recognition processing in the voice processing unit 48, whereby the voice uttered by the user wearing the headset 10 can be reproduced.

[0045]

As described above, in the embodiment of the present invention, when the headset 10 is worn on the head of the user, the wearing state is detected by the wearing detection unit 18, thereby turning on the power of the wireless headset 10. Further, by automatically establishing a wireless communication connection between the headset 10 and the music reproducing device 40, it is possible to transmit and receive audio signals between the headset 10 and the music reproducing device 40. By this processing, the user can listen to the music data or the like reproduced by the music reproducing device 40 by automatically establishing the wireless connection processing with the music reproducing device 40 only by wearing the headset 10 without performing a special operation.

[0046]

Next, a method of disconnecting the wireless connection process when the wireless headset 10 is removed from the user will be described.

[0047]

When the user removes the headset 10 from the head, the pressure-sensitive switch 32 of the wearing detection unit 18 of the headset 10 is cut off, whereby the wearing detection unit 18 detects that the headset 10 has been removed from the user, and transmits this detection signal to the control unit 28. When the control unit 28 receives the detection signal, the control u

Apple Inc. Exhibit 1015 Page 1564

nit 28 automatically executes a process of disconnecting the wireless connection with the musi c reproducing device 40 with which the wireless connection has been established.

[0048]

When the Bluetooth system is used as the wireless system, as shown in FIG. 5, a disconnectio n request signal LMP_detach for requesting disconnection of the wireless connection is transmi tted from the headset 10 to the music reproducing device 40 via the wireless unit 20 and the antenna 16 (STEP7). In the case of the Bluetooth system, a response to the disconnection req uest signal LMP_detach is not required, and the music reproduction apparatus 40 receives the disconnection request signal LMP_detach from the headset 10, whereby the wireless connectio n with the headset 10 is disconnected. Further, in the headset 10, after the wireless connectio n with the music reproducing device 40 is disconnected, the switch 30 is turned off by the con trol unit 28 to turn off the power.

[0049]

By executing these processes, the wireless headset 10 according to the embodiment of the pr esent invention automatically disconnects the wireless connection with the music reproducing device 40 when the user detaches the headset 10. With this configuration, when the headset 10 is not in use, wireless connection with the music reproducing device 40 is not performed, a nd even in the headset 10 employing a connection-type wireless communication system such as Bluetooth, power saving is achieved and long-time driving is possible.

[0050]

As described above, the wireless headset 10 according to the embodiment of the present inve ntion includes: When it is detected that the headset 10 is mounted on the user, the wireless c ommunication connection with the music reproducing device 40 is established, and when the user removes the headset 10, the wireless communication connection with the music reproduc ing device 40 is automatically disconnected.

[0051]

That is, in the headset 10, the user can listen to the music or the like reproduced by the musi c reproducing device 40 only by wearing the headset 10 without performing a special operatio n because the wireless connection with the music reproducing device 40 is established. Furthe r, when the user detaches the headset 10, the headset 10 detects that the headset 10 is in th e unused state and automatically disconnects the wireless connection with the music reproduc ing device 40. Therefore, wireless communication with the music reproducing device 40 is not established in the unused state, and thus it is possible to suppress wasteful power consumptio n and improve usability. In addition, even when the user fails to perform the operation of stop ping the use of the wireless headset 10, the wireless communication connection is disconnecte d, so that the wireless headset 10 can be driven for a long time by saving power.

[0052]

In the above-described embodiment of the present invention, the case where the wireless con nection request is transmitted from the headset 10 side has been described, but as for the wir

Apple Inc. Exhibit 1015 Page 1565

eless connection request, it is also effective to transmit the connection request from the music reproducing device 40 side to establish the wireless connection.

[0053]

In this case, the music playback device 40 issues a wireless connection request signal to the h eadset 10 when, for example, the power is turned on, but since the headset 10 does not know when the wireless connection request signal is transmitted from the music playback device 4 0, it is necessary to always operate the wireless unit 20 of the headset 10. Therefore, the hea dset 10 needs to be powered on and the wireless unit 20 needs to be able to receive the wirel ess connection request signal from the music reproducing device 40, thereby consuming unne cessary power.

[0054]

In order to solve this problem, in another embodiment of the present invention When a pressu re-sensitive switch 32 of a wearing detection part 18 is cut off, a headset 10 determines that t he headset 10 is not worn by a user, and a control part 28 controls a radio part 20 so as not t o wait for reception of a radio connection request signal from a music reproduction device 40. In this case, when the pressure-sensitive switch 32 of the wearing detection unit 18 is turned on, the headset 10 determines that the headset 10 is worn on the user's body, and the control unit 28 controls the wireless unit 20 to wait for a wireless connection request signal from the music playback device 40. In this state, a wireless connection request signal is transmitted fro m the wireless unit 44 to the headset 10 via the antenna 42 by, for example, turning on the p ower of the music playback device 40, and the wireless unit 20 receives the wireless connectio n request signal via the antenna 16. In the wireless unit 20, a response signal to the received wireless connection request signal is transmitted to the music reproducing device 40 via the a ntenna 16, and the response signal is received by the wireless unit 44 of the music reproducin g device 40, whereby the wireless connection between the headset 10 and the music reproduc ing device 40 is established.

[0055]

As described above, in the headset 10 of the present invention, the use or non-use state of th e headset 10 is detected by detecting the wearing state on the human body of the user, and t he control of the establishment and disconnection of the wireless communication connection w ith the music reproducing device 40 as the wireless communication partner is automatically ex ecuted based on the detection result. With this configuration, it is possible to provide a user-fr iendly headset 10 and to suppress wasteful power consumption in an unused state.

[0056]

The present invention is not limited to the above-described embodiment, and various modifica tions can be made within the scope of the present invention.

[0057]

For example, in the wearing detection unit 18 provided in the headset 10, whether or not the

Apple Inc. Exhibit 1015 Page 1566

headset 10 is worn on the human body of the user is detected using the pressure-sensitive switch 32, but the present invention is not limited thereto, and whether or not the user wears the headset 10 can be similarly detected using an infrared sensor or the like.

[0058]

[Effect of the Invention]

As described above in detail, according to the present invention, in a wireless headset for receiving audio data by wireless communication, convenience in use and reduction in power consumption can be realized.

[Brief Description of the Drawings]

[Fig. 1]FIG. 1 is a diagram showing a system configuration using an audio input / output device and a music playback device according to an embodiment of the present invention.

[Fig. 2]FIG. 10 is a block diagram showing an example of the configuration of a wireless headphone which is the audio input / output device shown in FIG. 1.

[Fig. 3]FIG. 10 is a block diagram showing an example of the configuration of the music reproducing apparatus shown in FIG. 1.

[Fig. 4]It is not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching.

[Fig. 5]FIG. 10 is a that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

[Explanation of letters or numerals]

10 wireless headset

12 -- Loudspeaker

16 -- Antenna

18: attachment detection unit

20 wireless unit

28 control unit

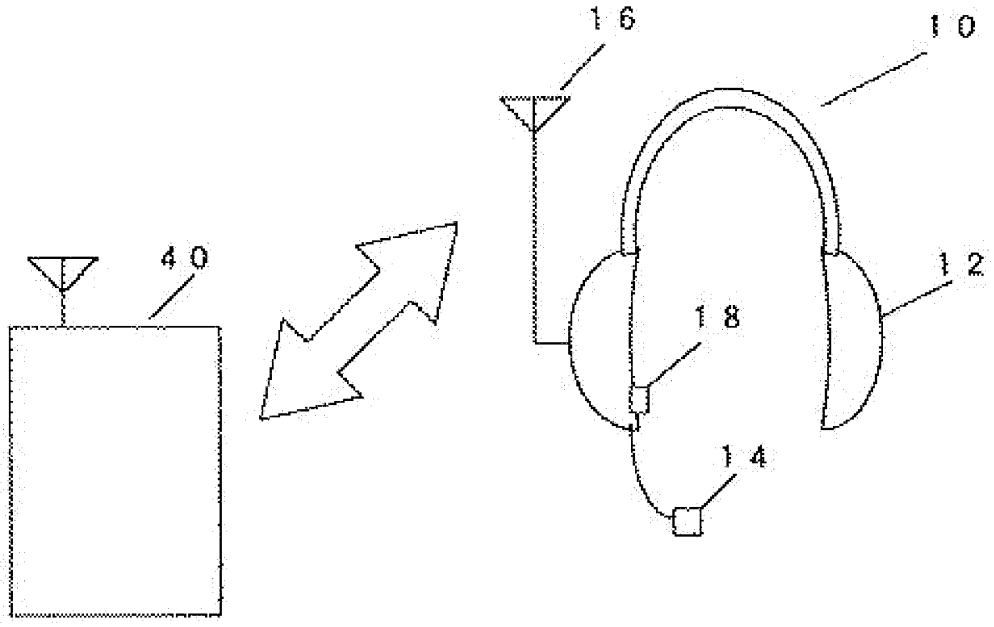
30 -- Switch

40 -- Music Reproduction Equipment

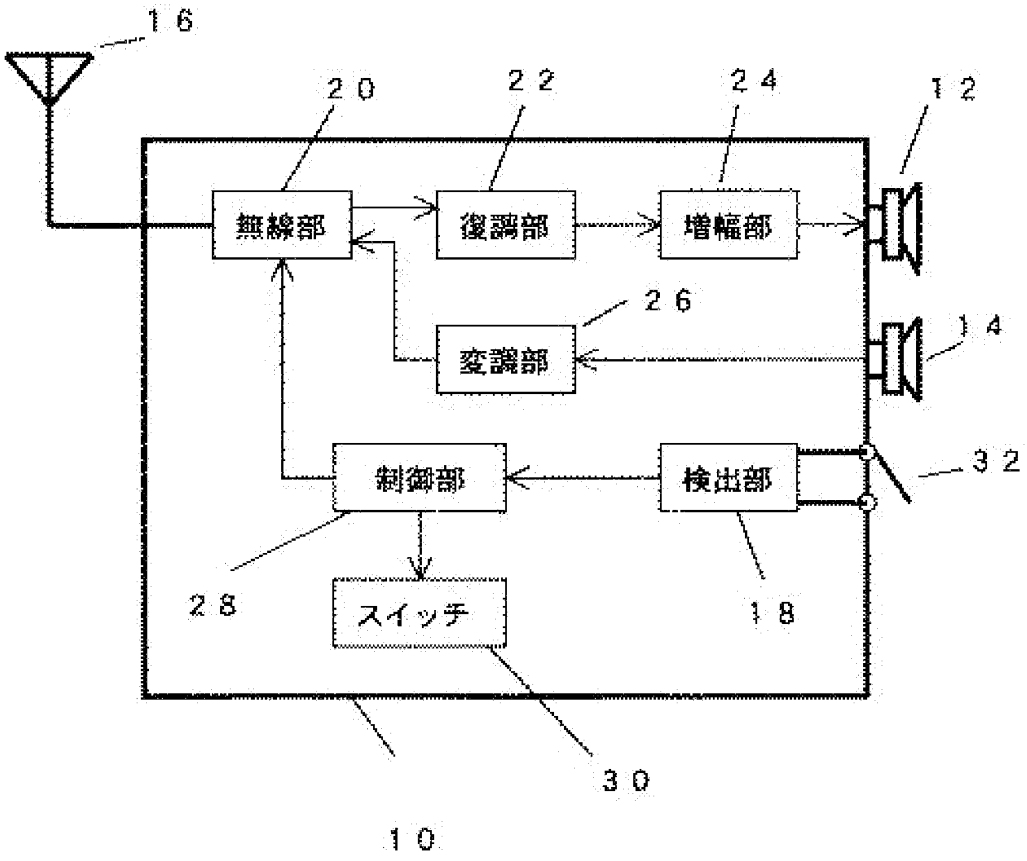
Drawings Close

Apple Inc. Exhibit 1015 Page 1567

[FIG.1]

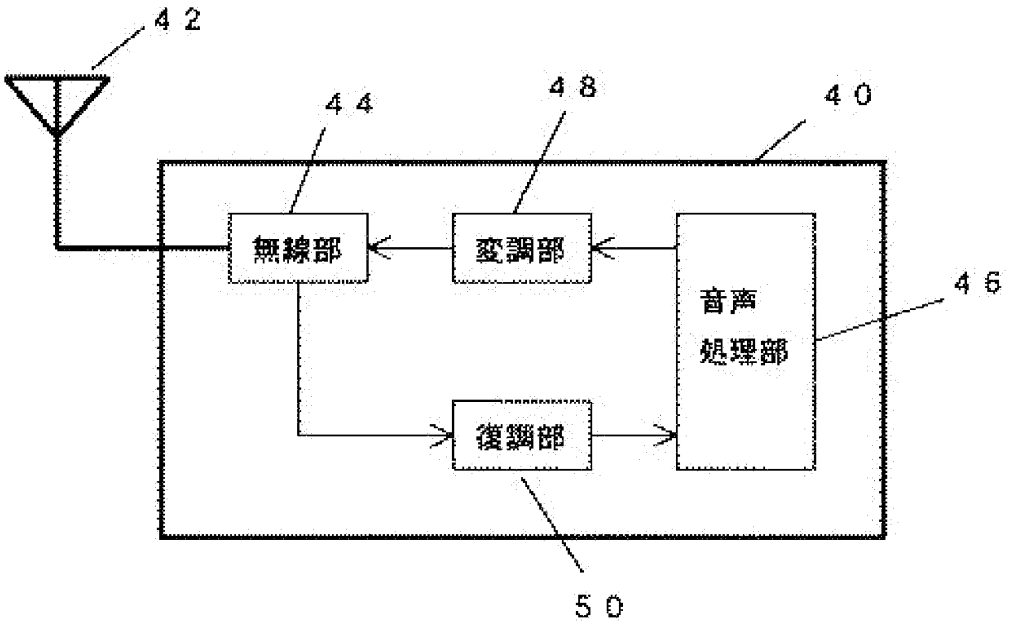


[FIG.2]



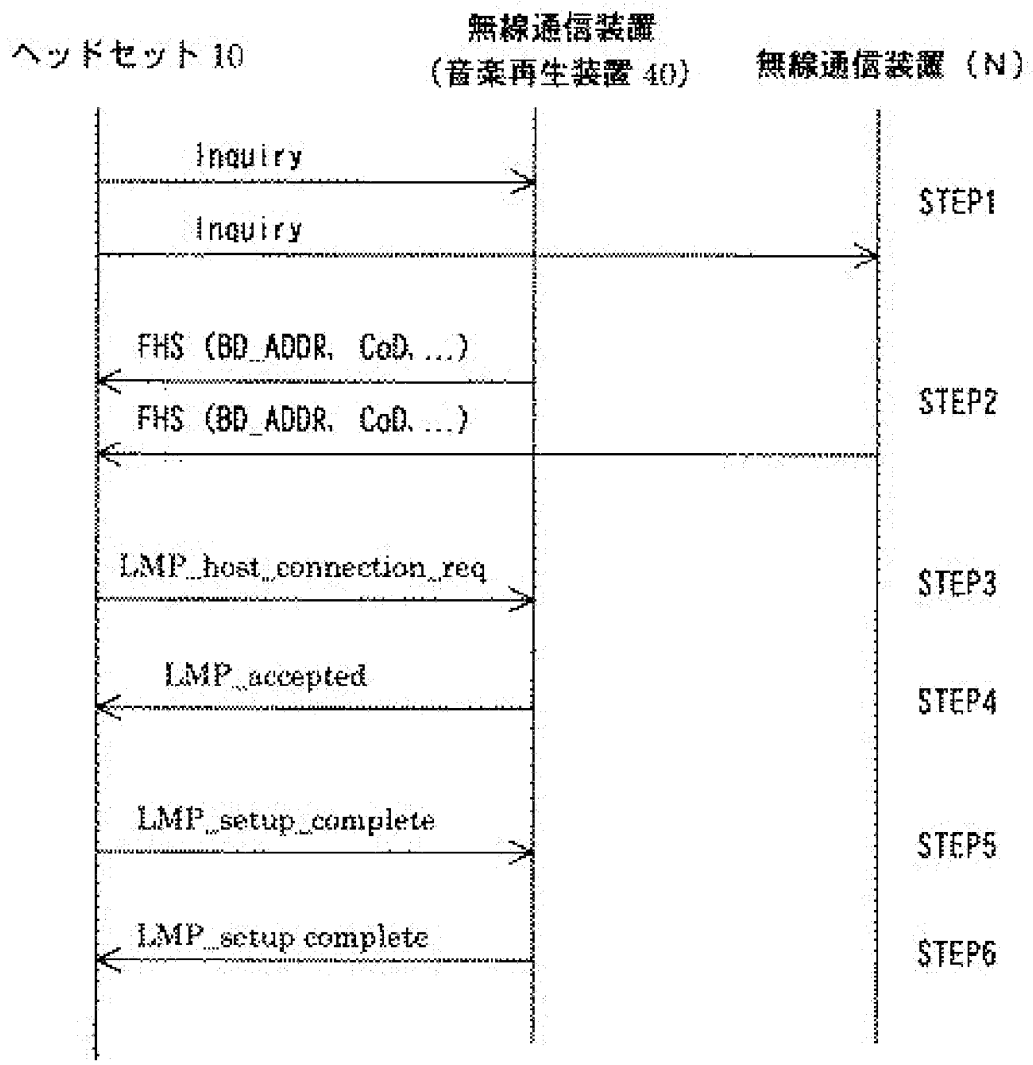
[FIG.3]

Apple Inc. Exhibit 1015 Page 1568

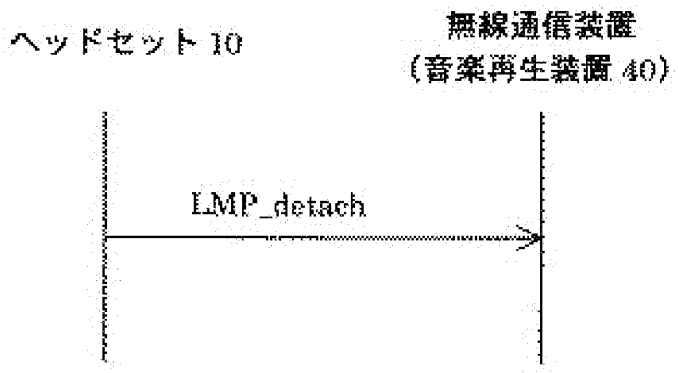


[FIG.4]

Apple Inc. Exhibit 1015 Page 1569



[FIG.5]

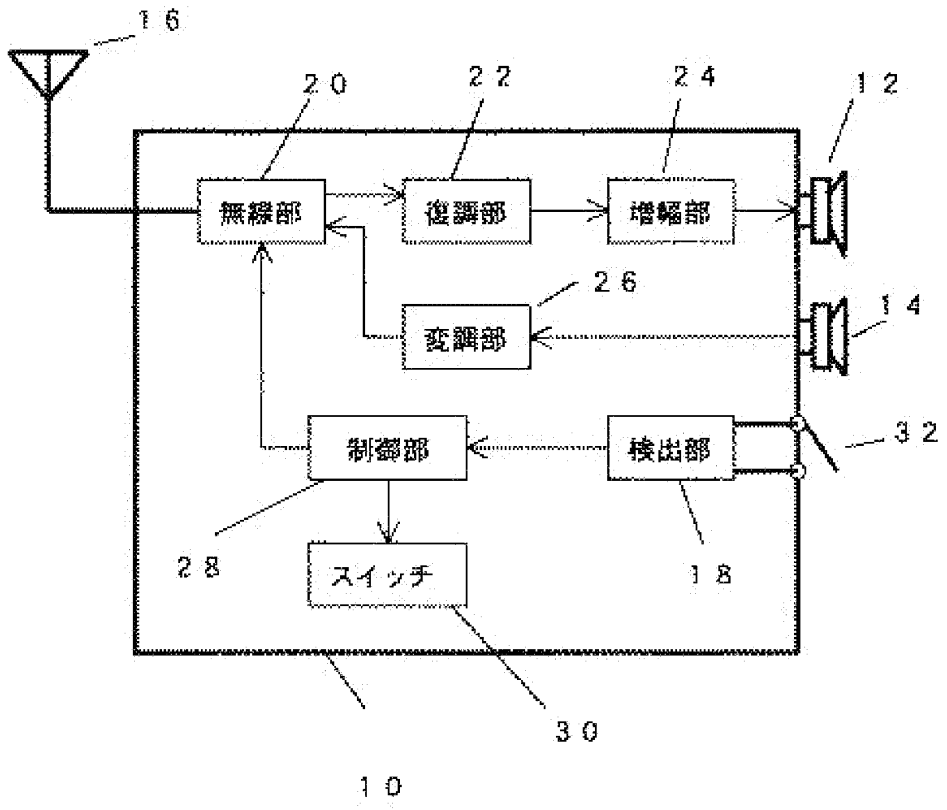


Drawings Close

Apple Inc. Exhibit 1015 Page 1570

Representative drawing | 1 | 2 | 3 | 4 | 5

Enlarge and Rotate



Representative drawing

2 of 2 Display

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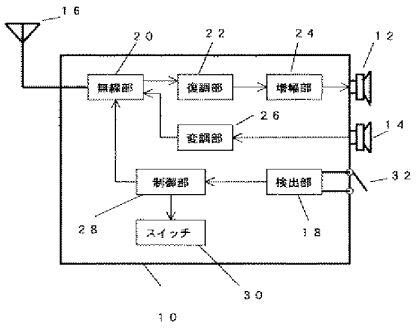
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(54)【発明の名称】ワイヤレスヘッドセット及びワイヤレスヘッドセットの無線通信接続制御方法

(57)【要約】
【課題】Ｂｌｕｅｔｏｏｔｈのようなコネクション型の通信方式では、論理的なコネクションを維持するために音声信号を伝送していない間も送受信動作を実行していなければならず、大きな電力が消費されているという問題があった。
【解決手段】本発明では、ヘッドセット１０には、装着検出部１８が設けられ、この装着検出部１８にてヘッドセット１０が使用者に装着されているか否かを検出することで、ヘッドセット１０の使用状態に応じて、無線通信の相手となる音楽再生装置４０との間の無線通信接続の確立及び切断の制御を自動的に実行する。この処理により、未使用状態時には、ヘッドセット１０は、音楽再生装置４０との間の無線接続が自動的に切断されることで省電力が図られる。
【選択図】　図２



【特許請求の範囲】
【請求項1】
音楽再生装置から無線通信により送信される音声信号を受信するワイヤレスヘッドセットにおいて、
外部からの音声信号を受信する無線部と、
この無線部で受信した音声信号を出力するスピーカ部と、
当該ヘッドセットが使用者に装着されているか否かを検出する検出部と、
この検出部により、当該ヘッドセットが使用者に装着されたことを検出した際、前記音楽再生装置との間の無線通信接続の確立を行い、当該ヘッドセットが使用者から取外されたことを検出した際、前記音楽再生装置との間の無線通信接続を切断する制御部と
を具備することを特徴とするワイヤレスヘッドセット。
【請求項2】
前記検出部により当該ヘッドセットが使用者に装着されたことを検出した際に、電源をオンし、当該ヘッドセットが使用者から取外されたことを検出した際に、前記音楽再生装置との間の無線通信接続を切断した後、電源をオフするスイッチをさらに具備したことを特徴とする請求項１記載のワイヤレスヘッドセット。
【請求項3】
前記制御部は、前記音楽再生装置との間で無線通信接続の確立処理を行う際に、無線通信接続の確立処理に必要な接続要求信号を前記音楽再生装置に送信することを特徴とする請求項１記載のワイヤレスヘッドセット。
【請求項4】
前記音楽再生装置から無線通信接続の確立処理に必要な接続要求信号が発信される場合には、前記制御部は、前記検出部により当該ワイヤレスヘッドが使用者に装着されたことを検出した際に、前記無線部にて前記接続要求信号を受信待ち受けするように制御する請求項１記載のワイヤレスヘッドセット。
【請求項5】
音楽再生装置から無線通信により送信される音声信号を受信するワイヤレスヘッドセットにおいて、
当該ヘッドセットが使用者に装着されているか否かを検出部にて検出し、
この検出部により、当該ヘッドセットが使用者に装着されたことを検出した際、前記音楽再生装置との間の無線通信接続の自動的に確立し、
前記検出部により、当該ヘッドセットが使用者から取外されたことを検出した際、前記音楽再生装置との間の無線通信接続を自動的に切断することを特徴とするワイヤレスヘッドセットの無線通信接続制御方法。

【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、人体に装着して音声信号を無線通信で送受信するワイヤレスヘッドセット並びに当該ワイヤレスヘッドセットの無線通信接続の制御方法に関する。
【０００２】
【従来の技術】
従来、電子情報通信機器間を通信接続する場合、有線方式で行うのが一般的であるが、最近では、これに変えて無線方式を適用することでユーザビリティを高める試みがなされている。
【０００３】
また、Ｂｌｕｅｔｏｏｔｈ やＨｏｍｅＲＦ等のパーソナルエリアの無線技術の出現により、パーソナルコンピュータ、携帯電話等の電子情報通信機器に対して、これら無線インターフェースの採用が検討され、実用化され始めている。さらに、今後、無線インターフェースに関しては、色々な分野への適用が期待されており、音楽再生装置等のＡＶ機器への応用も検討されている。

【０００４】
このＡＶ機器への応用の一つとして考えられているのが、ワイヤレスヘッドセットへの音声信号等のＡＶデータの伝送である。この場合、ワイヤレスヘッドセットをオーディオプレイヤと無線接続することにより、従来の接続ケーブルが不要となり、より快適なオーディオ再生環境が期待されている。従来から、ワイヤレスヘッドセットの分野では、赤外線、高周波無線などを用いたものが実用化されている。また、最近では、Ｂｌｕｅｔｏｏｔｈ技術を用いたワイヤレスヘッドセットの開発も進められている（特許文献１参照）。
【０００５】
このような無線通信を利用したワイヤレスヘッドセットの場合、ユーザの使い勝手を向上させるためには、バッテリによる長時間駆動を可能とすることが必須となり、電池の消耗を可能な限り防ぐことが必要となる。
【０００６】
この問題を解決する一つの方法として、人体に装着して使用されることが前提となるヘッドセット、補聴器等の音声信号装置で、人体に装着した使用時にのみ電源を自動的にＯＮし、非装着時の不使用時には電源をＯＦＦし、電池の消耗を防ぐことが考えられている（特許文献２）。
【０００７】
【特許文献１】
特開２００２－１１２３８３号公報
【特許文献２】
特開２００２－３０５７８５号公報
【０００８】
【発明が解決しようとする課題】
しかしながら、無線通信を利用したワイヤレスヘッドセットの場合には、このヘッドセットと接続対象となるオーディオプレイヤ等の音楽再生装置（音楽データ等をヘッドセットに送信）との間で無線通信接続を確立する必要がある。
【０００９】
このヘッドセットとの間で無線通信接続を確立するためには、使用者がヘッドセットまたはその接続対象となる音楽再生装置を操作する必要がある。さらに、ヘッドセットの使用を停止する場合でも、使用者は、ヘッドセットまたはその接続対象となる音楽再生装置を操作して無線通信接続を切断する必要があった。そのため、使用者が、ヘッドセットの使用停止の操作を怠った場合には、無線通信接続が継続され、ヘッドセットの電池を無駄に消費するという問題があった。
【００１０】
また、Ｂｌｕｅｔｏｏｔｈのようなコネクション型の無線通信方式の場合には、論理的なコネクションを保った状態で各種データを送受信することにより、多くの機器への適用を図っているため、論理的なコネクションを維持するために音声信号を伝送していない期間でも送受信動作を実行していなければならず、常に大きな電力が消費されている状態となっている。このような状況では、無線通信接続を確立した状態が継続していると、装置のバッテリ残量の低下が著しくなるという問題がある。
【００１１】
そこで、Ｂｌｕｅｔｏｏｔｈのようなコネクション型の無線通信方式をワイヤレスヘッドセットへの適用を考えた場合、長時間駆動を可能とするためにも、省電力制御の問題を解決しなければならない。
【００１２】
本発明においは、上記問題を解決するために、人体に装着した用いるワイヤレスヘッドセットにおいて、無線通信接続状態の確立、切断の制御に関して、使用者の操作性を改善し、かつ消費電力の低減を実現することができるワイヤレスヘッドセットを提供することを目的とする。
【００１３】

【課題を解決するための手段】
上記目的を達成するために、音楽再生装置から無線通信により送信される音声信号を受信するワイヤレスヘッドセットにおいて、外部からの音声信号を受信する無線部と、この無線部で受信した音声信号を出力するスピーカ部と、当該ヘッドセットが使用者に装着されているか否かを検出する検出部と、この検出部により、当該ヘッドセットが使用者に装着されたことを検出した際に、音楽再生装置との間の無線通信接続の確立を行い、当該ヘッドセットが使用者から取外されたことを検出した際に、音楽再生装置との間の無線通信接続を切断する制御部とを具備することを特徴とするものである。
【００１４】
上記構成により、ワイヤレスヘッドセットの無線通信接続状態の確立、切断の制御に関して、使用者の操作性を改善し、かつ消費電力の低減を実現することができる。
【００１５】
【発明の実施の形態】
以下、図面を参照して本発明の実施の形態について説明する。
【００１６】
図１は、本発明の一実施形態に係わる無線通信により音楽情報等を受信するワイヤレスヘッドセット１０と音楽情報等を再生するパーソナルコンピュータ等の音楽再生装置４０とを用いたシステム構成を示すものである。
【００１７】
図１において、ワイヤレスヘッドセット１０は、Ｂｌｕｅｔｏｏｔｈ方式の無線通信手段をもったものであり、Ｂｌｕｅｔｏｏｔｈ規格で決められた方式にそって無線通信を行うものである。Ｂｌｕｅｔｏｏｔｈ規格ではＨｉＦｉオーディオデータを無線で送受信するためのＡＶプロファイル規格が定められており、このＡＶプロファイルに準拠して、Ｂｌｕｅｔｏｏｔｈによって無線通信された音楽データを受信し、再生することができるものである。
【００１８】
音楽再生装置４０は、例えば、記憶媒体（ＭＤ、メモリカード、ハードディスクなど）に記憶された音楽データを再生し、ヘッドフォン端子からアナログ音声信号として出力するパーソナルコンピュータで構成される。一般的な使用方法としては、このヘッドフォン端子に有線方式の通常のヘッドフォンを接続して、音楽を聴くことができるものであるが、本発明の一実施形態では、音声信号をワイヤレスヘッドセット１０に無線送信することで音楽を聴くことを可能とする。
【００１９】
ワイヤレスヘッドセット１０は、音声出力手段であるスピーカ１２、音声入力手段であるマイク１４、無線通信手段であるアンテナ１６とを備え、このアンテナ１６を介して音楽再生装置４０との間で音声信号の無線通信を行う。
【００２０】
さらに、このワイヤレスヘッドセット１０には、使用者の人体に装着されていることを検出する装着検出部１８が設けられている。この装着検出部１８によりワイヤレスヘッドセット１０が使用者の頭部に装着されていることが検出された場合、ヘッドセット１０は、電源をＯＮ状態とし、さらに音楽再生装置４０との間で無線通信接続を自動的に確立し、ヘッドセット１０と音楽再生装置４０との間の音声データの送受信が可能となる。
【００２１】
また、装着検出部１８によりヘッドセット１０が使用者から取外されたこと（非装着状態）を検出した場合には、ヘッドセット１０は音楽再生装置４０との間の無線通信接続を自動的に切断し、ヘッドセット１０と音楽再生装置４０との間の音声データの送受信を停止するとともに、電源をＯＦＦ状態とする。
【００２２】
次に、図２並びに図３を参照して、ヘッドセット１０の内部構成並びに音楽再生装置４０の内部構造につき説明する。

【００２３】
図２はヘッドセット１０の内部構成を示すものである。ヘッドセット１０は、アンテナ１６を介して音楽再生装置４０から無線送信されてくる音楽情報等の音声信号が入力される無線部２０、この無線部２０からの音声信号を復調する復調部２２、並びに復調部２２で復調された音声信号を増幅したスピーカ１２に送る増幅部２４とが備えられている。
【００２４】
無線部２０は、例えばＢｌｕｅｔｏｏｔｈ方式の無線通信手段をもったものであり、Ｂｌｕｅｔｏｏｔｈ規格で決められた方式に基づいて無線通信を行うものである。Ｂｌｕｅｔｏｏｔｈ規格ではＨｉＦｉオーディオデータを無線で送受信するためのＡＶプロファイル規格が定められており、このＡＶプロファイルに準拠して、Ｂｌｕｅｔｏｏｔｈによって無線通信された音楽データを受信し再生する。
【００２５】
また、ヘッドセット１０には、マイクを介して入力されるこのヘッドセット１０を装着したユーザの音声等の音声信号が入力され、当該音声信号を変調する変調部２６を有し、この変調部２６で変調された音声信号は、無線部２０に入力され、この無線部２０、アンテナ１６を介して音楽再生装置４０に送信される。
さらに、ヘッドセット１０には、当該ヘッドセット１０全体を制御する制御部２８、当該ヘッドセット１０の電源をオン／オフ制御するスイッチ３０及び当該ヘッドセット１０が人体に装着されたことを検出する装着検出部１８とが設けられている。
【００２６】
装着検出部１８には、感圧スイッチ３２が設けられており、ヘッドセット１０が使用者の頭部に装着された場合に、この感圧スイッチ３２が導通することにより、ヘッドセット１０が使用者に装着されたことを検出する。この感圧スイッチ３２により装着検出部１８がヘッドセット１０が使用者に装着されたことを検出した場合、この検出結果が制御部２８に伝えられ、制御部２８は、スイッチ３０をＯＮとすることでヘッドセット１０の電源をＯＮ状態とする。さらに、制御部２８は、無線部２０を介して音楽再生装置４０との間で無線通信接続を自動的に確立し、ヘッドセット１０と音楽再生装置４０との間の音声データの送受信を可能とする。
【００２７】
また、ヘッドセット１０が使用者の頭部から取り外された場合には、この感圧スイッチ３２の導通状態がなくなることで、ヘッドセット１０が使用者に取り外されたことを検出する。この際、制御部２８は、無線部２０を介して、音楽再生装置４０との間での無線通信接続を自動的に切断する。さらに、制御部２８は、スイッチ３０をＯＦＦしてヘッドセット１０の電源をＯＦＦ状態とする。
【００２８】
次に、図３を用いて、音楽再生装置４０の内部構成につき説明する。
【００２９】
音楽再生装置４０は、ヘッドセット１０との間で音声信号を送受信するアンテナ４２、並びにこのアンテナ４２に音楽情報等の音声信号を送信し、かつアンテナ４２から受信したヘッドセット１０の装着者の音声信号を受信する無線部４４が設けられている。この無線部４４は、ヘッドセット１０の無線部４２と同様に、例えばＢｌｕｅｔｏｏｔｈ方式の無線通信手段をもったものであり、Ｂｌｕｅｔｏｏｔｈ規格で決められた方式にそって無線通信を行うものである。
【００３０】
さらに、音楽再生装置４０は、記憶媒体（ＭＤ、メモリカード、ハードディスクなど）に記憶された音楽データを再生する音声処理部４６、この音声処理部で再生された音声信号を変調して無線部４４に送る変調部４８及び無線部４４によって受信した音声信号を復調する復調部５０とが設けられており、この復調部５０で復調された音声信号は音声処理部４８に送り音声データとして再生処理される。
【００３１】

次に、図１乃至図３に示したワイヤレスヘッドセット１０と音楽再生装置４０とにおいて、ワイヤレスヘッドセット１０が使用者に装着された場合の無線通信接続の確立処理、並びにワイヤレスヘッドセット１０が使用者から取り外された場合の無線通信接続処理の切断処理に関して具体的に説明する。

【００３２】

まず、ワイヤレスヘッドセット１０が使用者から装着された場合の処理につき説明する。

【００３３】

ヘッドセット１０には、使用者の装着状態を検出する装着検出部１８が設けられている。この装着検出部１８では、ヘッド１０が使用者の頭部に取り付けられた場合には、装着検出部１８に取付けられた感圧スイッチ３０が導通することで、ヘッドセット１０が使用者の人体に装着されたことを検出し、この検出信号を制御部２８に伝える。制御部２８では、ヘッドセット１０が使用者の人体に装着されたとき、スイッチ３０をＯＮすることでヘッドセット１０の電源を自動的にＯＮ状態とする。

【００３４】

さらに、装着検出部１８により、ヘッドセット１０が使用者の人体に装着されたことを検出し、この検出信号が制御部２８に伝えられた場合、制御部２８は、無線部２０を介して、接続対象となる音楽再生装置４０との間の無線通信接続処理を自動的に実行する。

【００３５】

この場合、制御部２０は、接続対象となる特定の音楽再生装置４０の識別アドレスが予め登録されていない場合には、無線部２０を介して周辺にある無線通信装置を探索するための信号をアンテナ１６から発信し、その信号に応答してきた無線通信装置に対して、改めて無線接続要求信号を発信することで、ヘッドセット１０と信号に応答してきた無線通信装置（この場合、無線通信装置を音楽再生装置４０とする）との無線通信接続を自動的に確立する処理を実行する。この処理手順を図４を用いて詳細に説明する。

【００３６】

無線通信方式がＢｌｕｅｔｏｏｔｈ方式である場合に、ワイヤレスヘッドセット１０は、このヘッドセット１０の周囲にある無線通信装置（音楽再生装置４０と他の無線通信装置Ｍを含む）に対し、Ｉｎｑｕｉｒｙ信号を送信する（ＳＴＥＰ１）。このＩｎｑｕｉｒｙ信号を受信した無線通信装置（音楽再生装置４０並びに無線通信装置Ｍ）は、ＦＨＳパケットを含む信号をヘッドセット１０に返信する（ＳＴＥＰ２）。このＦＨＳパケットには、無線通信装置（音楽再生装置４０、無線通信装置Ｍ）の識別アドレス（以下ＢＤ＿ＡＤＤＲ）、並びに当該無線通信装置（音楽再生装置４０、無線通信装置Ｍ）がどのような機能を有するものであるかを示す情報（Ｃｌａｓｓｏｆ　Ｄｅｖｉｃｅ（以下ＣｏＤ）情報）が含まれている。

【００３７】

このＦＨＳパケットを受信したヘッドセット１０は、ＦＨＳパケットに含まれているＣｏＤ情報を参照して、当該ヘッドセット１０と無線通信接続を行う音楽再生装置４０（ＨＤＤ等の記憶媒体に記憶された音楽データを再生する装置）に対して、ＦＨＳパケットに含まれていたＢＤ＿ＡＤＤＲを用いて接続要求を発信する。この場合、ヘッドセット１０は、音楽再生装置４０のＢＤ＿ＡＤＤＲを含む接続要求信号ＬＭＰ＿ｈｏｓｔ＿ｃｏｎｎｅｃｔｉｏｎ＿ｒｅｑを音楽再生装置４０に対して送信する（ＳＴＥＰ３）。

【００３８】

ヘッドセット１０から接続要求信号ＬＭＰ＿ｈｏｓｔ＿ｃｏｎｎｅｃｔｉｏｎ＿ｒｅｑを受けた音楽再生装置４０では、ヘッドセット１０からの接続要求信号ＬＭＰ＿ｈｏｓｔ＿ｃｏｎｎｅｃｔｉｏｎ＿ｒｅｑに対して、接続要求に応じることを示す応答信号ＬＭＰ＿ａｃｃｅｐｔｅｄをヘッドセット１０に送信する（ＳＴＥＰ４）。

【００３９】

次に、音楽再生装置４０からの応答信号ＬＭＰ＿ａｃｃｅｐｔｅｄを受信したヘッドセット１０は、接続確立信号ＬＭＰ＿ｓｅｔｕｐ＿ｃｏｍｐｌｅｔｅを音楽再生装置４０へ送信し（ＳＴＥＰ５）、さらに、この接続確立信号ＬＭＰ＿ｓｅｔｕｐ＿ｃｏｍｐｌｅｔｅ

を受信した音楽再生装置４０では、接続確立信号ＬＭＰ＿ｓｅｔｕｐ＿ｃｏｍｐｌｅｔｅをヘッドセット１０へ送信する（ＳＴＥＰ６）。ヘッドセット１０は、この接続確立信号ＬＭＰ＿ｓｅｔｕｐ＿ｃｏｍｐｌｅｔｅを音楽再生装置４０から受信することにより（ヘッドセット１０と音楽再生装置４０との間で接続確立信号ＬＭＰ＿ｓｅｔｕｐ＿ｃｏｍｐｌｅｔｅのやり取りを行う）、ヘッドセット１０と音楽再生装置４０との間では、Ｂｌｕｅｔｏｏｔｈ方式での無線通信接続が自動的に確立される。

【００４０】

上記の実施形態で説明した例では、ヘッドセット１０の制御部２８に無線接続対象となる装置の識別アドレスが登録されていない場合につき説明したが、制御部２８に予め接続対象となる音楽再生装置４０の識別アドレスが登録されている場合もある。この場合には、制御部２８は、無線部２０を介して、無線接続の対象となる音楽再生装置４０に対して無線接続を開始するように無線接続要求信号を発信する。この無線接続要求信号を受信した音楽再生装置４０では、音声処理部４８にて無線接続要求信号に応答する応答信号を生成し、無線部４４を介してヘッドセット１０に応答信号を返すことで、ヘッドセット１０と音楽再生装置４０との間の無線通信接続が確立される。

【００４１】

このようにヘッドセット１０と音楽再生装置４０との間で無線通信接続が確立された後、ヘッドセット１０と音楽再生装置４０との間での音声信号の送受信が可能となる。

【００４２】

無線通信接続が確立された状態の場合、音楽再生装置４０では、音声処理部４８で生成された音声データは、変調部４６で変調され無線部４４に送られて、アンテナ４２を介して外部に音声信号として送信される。この送信された音声信号は、音楽再生装置４０と無線通信接続が確立されたヘッドセット１０のアンテナ１６を介して無線部２０で受信する。ヘッドセット１０では、無線部２０で受信した音声信号は復調部２２で復調され、さらに増幅器２４で増幅されてスピーカ１２に送られる。このヘッドセット１０を装着した使用者は、このスピーカ１２から音楽再生装置４０から送信される音楽データ等を聴くことが可能となる。

【００４３】

また、本発明の一実施形態では、ヘッドセット１０を装着した使用者が発声した音声等の情報を無線通信により音楽再生装置４０に送り、音楽再生装置４０で再生することも可能である。

【００４４】

ヘッドセット１０を装着した使用者が発した音声は、マイク１４に入力され、さらに変調部２６により変調される。この変調された音声信号は無線部２０からアンテナ１６を介して外部に送信される。この際、ヘッドセット１０と無線通信接続が確立されている音楽再生装置４０は、ヘッドセット１０から送信された音声信号をアンテナ４２を介して無線部４４で受信する。無線部４４で受信した音声信号は、復調部５０で復調され、音声処理部４８に送る。この音声処理部４８は、周知の音声認識処理機能を備えており、ヘッドセット１０から送信されてきた音声データが音声処理部４８で音声認識処理を行うことで、ヘッドセット１０を装着した使用者が発した音声の再生が可能となる。

【００４５】

以上のように、本発明の一実施形態においては、ヘッドセット１０を使用者の頭部に装着した際に、この装着した状態を装着検出部１８で検出することで、ワイヤレスヘッドセット１０の電源をＯＮとする。さらに、ヘッドセット１０と音楽再生装置４０との間の無線通信接続の確立を自動的に実行することで、ヘッドセット１０と音楽再生装置４０との間の音声信号の送受信を可能とする。この処理により、使用者はヘッドセット１０を装着するだけで、特別な操作を行うことなく、音楽再生装置４０との間の無線接続処理が自動的に確立することで、音楽再生装置４０で再生された音楽データ等を聴くことが可能となる。

【００４６】

次に、ワイヤレスヘッドセット１０が使用者から取り外された場合の無線接続処理の切断方法について説明する。

【００４７】

使用者がヘッドセット１０を頭部から取外すと、ヘッドセット１０の装着検出部１８の感圧スイッチ３２が遮断されることで、装着検出部１８がヘッドセット１０が使用者から取外されたことを検出し、この検出信号を制御部２８に伝える。制御部２８では、この検出信号を受けると、無線接続が確立されている音楽再生装置４０との無線接続の切断処理を自動的に実行する。

【００４８】

無線方式としてＢｌｕｅｔｏｏｔｈ方式を用いる場合、図５に示す通り、ヘッドセット１０から無線部２０、アンテナ１６を介して、無線接続の切断要求を行う切断要求信号ＬＭＰ＿ｄｅｔａｃｈを音楽再生装置４０に送信する（ＳＴＥＰ７）。Ｂｌｕｅｔｏｏｔｈ方式の場合では、この切断要求信号ＬＭＰ＿ｄｅｔａｃｈに対する応答は必要とせず、音楽再生装置４０はヘッドセット１０から切断要求信号ＬＭＰ＿ｄｅｔａｃｈを受信することで、ヘッドセット１０との無線接続は切断される。さらに、ヘッドセット１０では、音楽再生装置４０との無線接続が切断された後、制御部２８によりスイッチ３０をＯＦＦすることで電源をＯＦＦ状態とする。

【００４９】

本発明の一実施形態のワイヤレスヘッドセット１０では、これらの処理を実行することで、使用者がヘッドセット１０を取外した場合には、自動的に音楽再生装置４０との間の無線接続を切断する。この構成により、ヘッドセット１０が使用状態でないときには、音楽再生装置４０との間の無線接続を行わず、Ｂｌｕｅｔｏｏｔｈのようなコネクション型の無線通信方式を採用したヘッドセット１０においても、省電力が図られ長時間駆動を可能である。

【００５０】

以上説明した通り、本発明の一実施形態であるワイヤレスヘッドセット１０は、当該ヘッドセット１０が使用者に装着されたことを検出した際に、音楽再生装置４０との間の無線通信接続を確立し、さらに、使用者がヘッドセット１０を取外した際には、音楽再生装置４０との間の無線通信接続を自動的に切断する。

【００５１】

すなわち、このヘッドセット１０では、使用者は、特別の操作を行うことなく、単にヘッドセット１０を装着するだけで、音楽再生装置４０との間の無線接続が確立するので、音楽再生装置４０で再生される音楽等を聴くことが可能となる。さらに、このヘッドセット１０では、使用者が取外した際に、未使用状態であることを検出して自動的に音楽再生装置４０との間の無線接続を切断するので、未使用状態で音楽再生装置４０と無線通信が確立していることはなく、無駄な電力消費を抑えることができ、さらに使い勝手も向上する。また、使用者が、ワイヤレスヘッドセット１０の使用停止の操作を怠った場合でも、無線通信接続が切断されることで、省電力を図ることで長時間駆動が可能となる。

【００５２】

上記本発明の一実施形態では、ヘッドセット１０側から無線接続要求を送信する場合について説明したが、無線接続要求に関しては、音楽再生装置４０側から接続要求を発信して無線接続を確立することも有効である。

【００５３】

この場合には、音楽再生装置４０は、例えば電源投入などの際にヘッドセット１０への無線接続要求信号を発行することとなるが、ヘッドセット１０では、いつ音楽再生装置４０からの無線接続要求信号が発信されてくるかがわからないので、常にヘッドセット１０の無線部２０を動作させておく必要がある。そのため、ヘッドセット１０では、電源をＯＮ状態とし、かつ無線部２０が音楽再生装置４０からの無線接続要求信号を受信できる状態にしておかなければならないため、不要な電力を消費することとなる。

【００５４】

この問題を解消するため、本発明の別の実施形態では、ヘッドセット１０は、装着検出部１８の感圧スイッチ３２が遮断されている場合には、当該ヘッドセット１０が使用者に装着されていないと判断し、制御部２８は、音楽再生装置４０からの無線接続要求信号の受信待ち受けをしないように無線部２０を制御する。この場合、ヘッドセット１０は、装着検出部１８の感圧スイッチ３２が導通した場合には、使用者の人体に当該ヘッドセット１０が装着されたと判断し、制御部２８は、音楽再生装置４０からの無線接続要求信号を待ち受けるように無線部２０を制御する。この状態にて、音楽再生装置４０の電源投入等により、無線部４４からアンテナ４２を介して、ヘッドセット１０に対して無線接続要求信号が送信され、この無線接続要求信号をアンテナ１６を介して無線部２０が受信する。無線部２０では、音楽再生装置４０に対して、受信した無線接続要求信号に対する応答信号をアンテナ１６を介して送信し、この応答信号を音楽再生装置４０の無線部４４にて受信することで、ヘッドセット１０と音楽再生装置４０との間の無線接続が確立される。

【００５５】

以上説明した通り、本発明のヘッドセット１０では、使用者の人体への装着状態を検出することで、当該ヘッドセット１０の使用、非使用状態を検出し、この検出結果に基づいて、無線通信の相手となる音楽再生装置４０との間の無線通信接続の確立及び切断の制御を自動的に実行する。この構成により、使い勝手の良いヘッドセット１０を提供し、かつ未使用状態での無駄な電力消費を抑えることができる。

【００５６】

尚、本発明は上記実施の形態に限定されるものではなく、その要旨の範囲で種々変形して実施することが可能である。

【００５７】

例えば、ヘッドセット１０に設けられた装着検出部１８では、感圧スイッチ３２を用いて使用者の人体に装着されているか否かを検出したが、これに限ることはなく、赤外線センサなどを用いても同様に使用者がヘッドセット１０を装着しているか否かを検出することができる。

【００５８】

【発明の効果】

以上詳述した通り、本発明においては、無線通信により音声データを受信するワイヤレスヘッドセットにおいて、使い勝手の良く、かつ消費電力の低減を実現することができる。

【図面の簡単な説明】

【図１】本発明の一実施形態に係わる音声入出力装置と音楽再生装置とを用いたシステム構成を示す図である。

【図２】図１に示される音声入出力装置であるワイヤレスヘッドフォンの一構成例を示すブロック図である。

【図３】図１に示される音楽再生装置の一構成例を示すブロック図である。

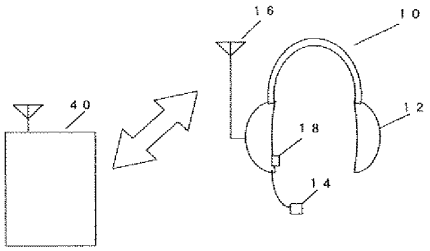
【図４】図１に示される音声入出力装置と音楽再生装置との間の無線接続を確立するための処理を示す図である。

【図５】図１に示される音声入出力装置と音楽再生装置との間の無線接続を切断するための処理を示す図である。

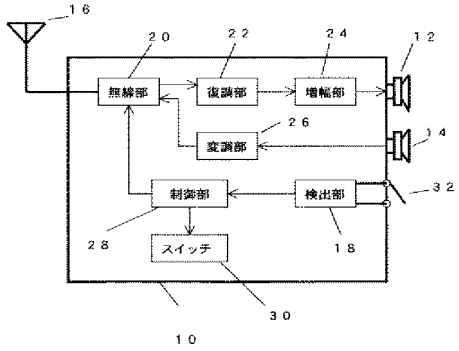
【符号の説明】

１０　…　ワイヤレスヘッドセット
１２　…　スピーカ
１６　…　アンテナ
１８　…　装着検出部
２０　…　無線部
２８　…　制御部
３０　…　スイッチ
４０　…　音楽再生装置

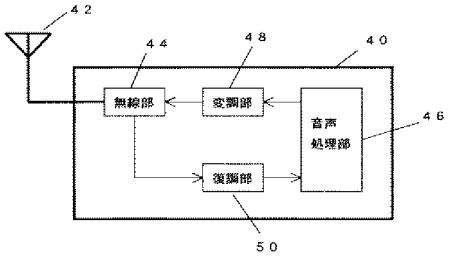
【図1】


１６
１０
４０
１８
１２
１４

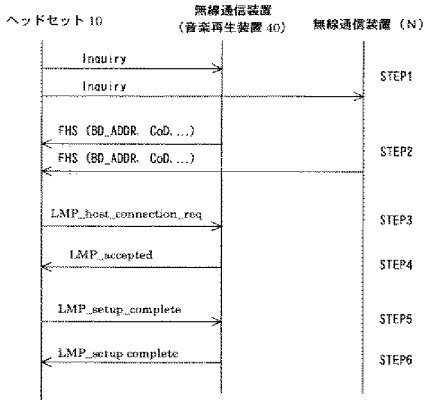
【図2】


１６
２０
２２
２４
１２
無線部
復調部
増幅部
２６
変調部
１４
制御部
検出部
３２
２８
スイッチ
１８
３０
１０

【図3】


４２
４４
４８
４０
無線部
変調部
音声
処理部
４６
復調部
５０

【図4】


ヘッドセット10
無線通信装置
（音楽再生装置40）
無線通信装置（N）
Inquiry
Inquiry
STEP1
FHS (BD_ADDR, CoD, ...)
FHS (BD_ADDR, CoD, ...)
STEP2
LMP_host_connection_req
STEP3
LMP_accepted
STEP4
LMP_setup_complete
STEP5
LMP_setup_complete
STEP6

【図5】


ヘッドセット10
無線通信装置
（音楽再生装置40）
LMP_detach

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: HOWELL et al.

Attorney Docket No.: IPVCP003X1C4X1C2

Application No.: 18/597,874

Examiner: LEI, JIE

Filed: March 6, 2024

Group: 2872

Title: SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

AMENDMENT B TRANSMITTAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith is an Amendment in the above-identified application.

The fee has been calculated as shown below.

	Claims After Amendment		Highest Previously Paid For	Present Extra	Small Entity Rate Fee	Large Entity Rate Fee
Total Claims	119	MINUS	20	99	x 40 =	x 100 = 9,900
Independent Claims	6	MINUS	3	03	x 192 =	x 480 = 1440
Multiple Dependent Claim Present and Fee Not Previously Paid					$	$
				Total	$0.00	$11,340.00

☐ Applicant(s) hereby petition for a _____- month extension(s) of time to respond to the aforementioned Office Action.

☒ Applicant(s) believe that no (additional) Extension of Time is required; however, if it is determined that such an extension is required, Applicant(s) hereby petition that such an extension be granted and authorize the Commissioner to charge the required fees for an Extension of Time under 37 CFR 1.136 to Deposit Account No. 50-3874 (Order No. IPVCP003X1C4X1C2).

☒ Any fees due are being paid electronically herewith.

☒ Please charge any additional fees required to facilitate filing the enclosed response, to Deposit Account No. 50-3874 (Order No. IPVCP003X1C4X1C2).

Respectfully submitted,

/C. Douglass Thomas/

C. Douglass Thomas
Reg. No. 32,947

PCT WELTORGANISATION FÜR GEISTIGES EIGENTUM
Internationales Büro

INTERNATIONALE ANMELDUNG VERÖFFENTLICHT NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)

(51) Internationale Patentklassifikation 4 : G02C 7/10, A61F 9/02

A1

(11) Internationale Veröffentlichungsnummer: WO 86/ 05891

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(21) Internationales Aktenzeichen: PCT/EP86/00180

(22) Internationales Anmeldedatum: 26. März 1986 (26.03.86)

(31) Prioritätsaktenzeichen: P 35 11 263.8

(32) Prioritätsdatum: 28. März 1985 (28.03.85)

(33) Prioritätsland: DE

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(72) Erfinder; und
(75) Erfinder/Anmelder *(nur für US) :* MÜLLER, Gerhard [DE/DE]; Hohenzollerndamm 123, D-1000 Berlin 33 (DE).

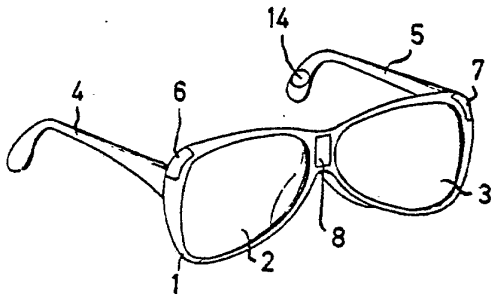
(74) Anwalt: SCHILL, Walter; Firma Carl Zeiss, Postfach 1369/1380, D-7082 Oberkochen (DE).

(81) Bestimmungsstaaten: AT (europäisches Patent), BE (europäisches Patent), CH (europäisches Patent), DE (europäisches Patent), FR (europäisches Patent), GB (europäisches Patent), IT (europäisches Patent), JP, LU (europäisches Patent), NL (europäisches Patent), SE (europäisches Patent), US.

Veröffentlicht
Mit internationalem Recherchenbericht.

(54) Title: RADIATION PROTECTION GLASSES

(54) Bezeichnung: STRAHLUNGSSCHUTZBRILLE



(57) Abstract

The glasses are fitted with filters (2, 3) mounted in the glass frame (1) which absorb harmful rays. They are also fitted with sensors (6, 7, 8) for invisible rays. Connected downstream to the sensors is an adjustable threshold value discriminator with a warning device (14) connected to it. No sooner does the user of the glasses arrive in an area where there are invisible rays than the sensors deliver a signal which triggers a warning signal. If the intensity of the harmful rays exceeds a value which can no longer be reduced to a harmless value by the filter lenses, a second warning signal is released which is easily distinguishable from the first.

(57) Zusammenfassung

Eine Stahlungsschutzbrille mit in einer Brillenfassung (1) angeordneten Filtern (2, 3), die schädliche Strahlung absorbieren, ist mit Sensoren (6, 7, 8) für unsichtbare Strahlung ausgestattet. Diesen Sensoren ist ein einstellbarer Schwellwert-Diskriminator mit angeschlossener Warnvorrichtung (14) nachgeschaltet. Sobald der Benutzer der Brille in den Bereich unsichtbarer Strahlung gelangt, liefern die Sensoren ein Signal, das ein Warnsignal auslöst. Überschreitet die Intensität der schädlichen Strahlung einen Wert, der durch die Filterlinsen nicht mehr auf einen unschädlichen Wert herabgesetzt werden kann, so wird ein zweites, vom ersten leicht unterscheidbares Warnsignal ausgelöst.

LEDIGLICH ZUR INFORMATION

Code, die zur Identifizierung von PCT-Vertragsstaaten auf den Kopfbögen der Schriften, die internationale Anmeldungen gemäss dem PCT veröffentlichen.

AT	Österreich	**FR**	Frankreich	**ML**	Mali
AU	Australien	**GA**	Gabun	**MR**	Mauritanien
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CH	Schweiz	**LI**	Liechtenstein	**SN**	Senegal
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Strahlungsschutzbrille

Die Erfindung betrifft eine Strahlungsschutzbrille mit in einer Brillenfassung angeordneten Filtern, die schädliche Strahlung absorbieren.

Die für das menschliche Auge schädliche Strahlung liegt meist im nicht sichtbaren Spektralbereich, d.h. also im UV oder im IR. Auch im sichtbaren Bereich liegende Strahlung kann schädlich sein, wenn ihre Intensität einen bestimmten Schwellwert übersteigt.

Menschen, die einer solchen schädlichen Strahlung ausgesetzt sind tragen zur Vermeidung von Schädigungen eine Strahlungsschutzbrille, die entweder die schädliche Strahlung nicht durchläßt oder diese doch zumindest auf unschädliche Intensitätswerte schwächt.

Besonders gefährlich ist das Arbeiten mit schädlicher Strahlung im nicht sichtbaren Spektralbereich, da der Benutzer nicht weiß und nicht feststellen kann ob eine solche Strahlung vorhanden ist und ob sie gegebenenfalls gefährliche Werte erreicht. Der Benutzer kann deshalb leicht in Versuchung kommen die Schutzbrille vorzeitig oder z.B. zum Ausführen feinerer Arbeiten abzunehmen obwohl die schädliche Strahlung unzulässig hohe Werte aufweist. Außerdem ist es möglich daß die schädliche Strahlung eine so hohe Intensität hat, daß die in der Brillenfassung verwendeten Filter nicht ausreichen um die durchgelassene Strahlung auf unschädliche Werte herabzusetzen. Der Träger einer Strahlungsschutzbrille fühlt sich in einem solchen Fall geschützt, ist dies jedoch in Wahrheit nicht.

In der Wehrtechnik finden in zunehmendem Umfang Laser-Entfernungsmesser Verwendung, die zur Anmessung des Ziels sehr kurze Impulse im nahen oder mittleren Infrarot ausstrahlen. Es ist deshalb für den Einzelnen nicht möglich zu erkennen, ob er und seine Umgebung sich im Zielbereich befinden.

Es ist nun die Aufgabe der vorliegenden Erfindung eine Strahlungsschutzbrille zu schaffen, die ihrem Benutzer verläßlich anzeigt ob er sich im Bereich unsichtbarer Strahlung befindet. Besonders vorteilhaft

soll diese Brille so ausgebildet sein, daß sie ihren Benutzer warnt wenn die Intensität dieser Strahlung einen Wert übersteigt, der durch die Filter der Brille nicht mehr auf unschädliche Werte herabgesetzt werden kann.

Diese Aufgabe wird durch eine Strahlungsschutzbrille mit den im kennzeichnenden Teil des Anspruchs 1 angegebenen Merkmalen gelöst.

Eine solche Brille bietet die Möglichkeit den Schwellwert-Diskriminator auf zwei unterschiedliche Signalpegel einzustellen. Beim Überschreiten des ersten Signalpegels wird ein Warnsignal erzeugt, daß dem Benutzer der Brille anzeigt, daß er sich im Bereich der unsichtbaren Strahlung befindet. Beim Überschreiten des zweiten Signalpegels wird ein, vom ersten verschiedenes Warnsignal erzeugt, daß dem Benutzer der Brille anzeigt daß deren Schutzwirkung nicht mehr ausreicht.

Im militärischen Bereich ist die Strahlungsschutzbrille zweckmäßig so ausgebildet, daß der Sensor in Verbindung mit den nachgeschalteten elektrischen Gliedern Bandpaß- oder Hochpaßcharakteristik aufweist, und daß der Schwellwert-Diskriminator zur Detektierung verschieden schneller Anstiegszeiten eingestellt ist. Dies ermöglicht es die typischen kurzen Impulse eines Laser-Entfernungsmessers zu erfassen und den Benutzer zu warnen.

Aus der EP-OS 00 78 473 ist eine Brille bekannt, deren Fassung mit einem Sensor zur Messung der Beleuchtungsstärke im sichtbaren Spektralbereich verbunden ist. Die Gläser dieser Brille sind mit einer elektrochromen Schicht versehen und dem Sensor ist eine Auswerteelektronik nachgeschaltet, die den Absorptionsgrad der elektro-chromen Schichten in Abhängigkeit von der gemessenen Beleuchtungsstärke verändert.

Diese Brille ist sehr komfortabel, sie ist jedoch nicht in allen infrage kommenden Spektralbereichen einsetzbar und sie liefert keine Warnsignale.

Bei der Strahlungsschutzbrille nach der Erfindung wird die Transmission nicht automatisch der Bestrahlungsstärke angepaßt, sondern der Benutzer

wird auf die unsichtbare Strahlung hingewiesen und muß selbst die geeigneten Maßnahmen ergreifen. Eine solche Brille ist natürlich ganz wesentlich billiger als die bekannte Brille mit elektro-chromen Schichten; die schützt den Benutzer genauso verläßlich und ist zudem für jeden gewünschten Spektralbereich herstellbar.

Weitere zweckmäßige Ausgestaltungen der Strahlungsschutzbrille nach der Erfindung sind Gegenstand der Unteransprüche 2-7, während Unteranspruch 8 eine besonders vorteilhafte Verwendung der Strahlungsschutzbrille angibt.

Die Erfindung wird im folgenden anhand der Figuren 1-4 der beigefügten Zeichnungen näher erläutert. Es zeigen:

Fig. 1 eine perspektivische Darstellung eines Ausführungsbeispiels;

Fig. 2 einen Brillenbügel der Brille nach Fig. 1;

Fig. 3 die Vorderansicht eines anderen Ausführungsbeispiels;

Fig. 4 ein weiteres Ausführungsbeispiel in Seitenansicht.

Die in Fig. 1 dargestellte Strahlungsschutzbrille enthält in einer Fassung 1 zwei Strahlungsschutzfilter 2 und 3. Die Bügel der Brillenfassung sind mit 4 und 5 bezeichnet.

In die Fassung 1 sind in der Nähe der Klappscharniere für die Bügel 4,5 zwei Sensoren 6 und 7 für unsichtbare Strahlung integriert. Diese Sensoren sprechen auf Strahlung an, die durch die Filter 2 und 3 abgeschwächt werden. Anstelle, oder zusätzlich zu den Sensoren 6,7 kann auch auf dem Nasenbügel der Fassung 1 ein Sensor 8 angeordnet sein.

In Fig. 2 ist beispielsweise der Brillenbügel 5 so dargestellt, daß die in ihn integrierten Bauteile sichtbar sind. Diese bestehen aus einer Leitung 9, die das vom Sensor 7 erzeugte Signal einem Verstärker 10 und von dort einen Schwellwert-Diskriminator 11 zuleiten. Dieser, sowie der Verstärker 10 werden über eine Leitung 12 von einer Knopfzellen-Batte-

rie 13 versorgt.

Sobald der Benutzer der Brille in den Bereich unsichtbarer Strahlung, beispielsweise einer Laserstrahlung gelangt liefert der Sensor 7 ein Signal das bei Überschreiten des ersten, am Diskriminator 11 eingestellten Signalpegels ein Warnsignal auslöst. Dieses wird beispielsweise als Dauerton erzeugt der über den Summer 14 dem Benutzer hörbar wird.

Überschreitet die Intensität der Strahlung einen Wert, der von den Filtern 2 und 3 nicht mehr auf eine für den Benutzer unschädliche Intensität abgeschwächt werden kann, so überschreitet das am Diskriminator 11 anliegende Signal den zweiten eingestellten Pegel und über den Summer 14 wird ein, beispielsweise intermittierendes Warnsignal hörbar. Dies ist für den Benutzer der Brille das Zeichen den schädlichen Strahlungsbereich unverzüglich zu verlassen.

Die Sensoren 6,7,8 können als photoelektrische oder thermoelektrische Empfänger ausgebildet sein, die mit einem entsprechend dem Schutzbereich ausgewählten Kantenfilter versehen sind. Dieses ist also so ausgebildet, daß es nur denjenigen Spektralbereich der Strahlung durchläßt der durch die Filter 2,3 absorbiert wird. Diese Strahlung kann beispielsweise im UV- oder Infrarotbereich liegen.

Im Ausführungsbeispiel der Fig. 3 ist in die Fassung 1 eine optische Faser 15 eingelassen, welche die Filtergläser 2,3 umgibt und deren Enden mit einem Sensor 16 gekoppelt sind. Beim Auftreffen von Strahlung aus dem Schutzbereich fluoresziert die Faser 15 und der Sensor 16 wird mit der Fluoreszenz-Strahlung beaufschlagt. Die Brille der Fig. 3 ist zweckmäßig mit Ohrbügeln entsprechend Fig. 2 ausgerüstet, wobei dann das Signal des Sensors 16 über die Leitung 9 den nachfolgenden Schaltelementen zugeführt wird. Die Faser 15 kann beispielsweise auch zusätzlich in den Ohrbügeln verlaufen.

Die optische Faser 15 ist in Ausnehmungen der Brillenfassung 1 eingelegt die danach mit einem Material verschlossen sind, das die Wirkung des weiter oben beschriebenen Kantenfilters hat.

In Fig. 4 ist ein Ausführungsbeispiel dargestellt, bei dem die Fassung 17 für die Filterlinsen augenbrauenseitig mit einem Scharnier 18 versehen ist. In diesem Scharnier ist eine Filterlinse 19 klappbar befestigt. Ein Sensor für die gefährliche Strahlung ist mit 20 bezeichnet.

Diese Brille kann so ausgebildet sein, daß die Fassung 17 keine Filterlinsen enthält. Der Benutzer arbeitet zunächst mit hochgeklappter Filterlinse 19. Sobald der Sensor 20 ein Signal liefert, das über den Summer 14 im Bügel 5 hörbar wird, klappt der Benutzer die Filterlinse 19 nach unten, so daß jetzt seine Augen geschützt sind.

Diese Ausführungsform eignet sich besonders für den Einsatz im militärischen Bereich. Die Sensoren 6,7,8 weisen in Verbindung mit dem nachgeschalteten Verstärker 10 Bandpaß- oder Hochpaßcharakteristik auf und der Diskriminator 11 ist zur Diskriminierung verschieden schneller Signal-Anstiegszeiten eingestellt. Dies ermöglicht es die Impulse von Laser-Entfernungsmessern zu detektieren, die typischerweise mit sehr kurzen Impulsen mit Pulsbreiten im Bereich von einigen Nano-Sekunden und Pulsanstiegszeiten von einigen hundert Pico-Sekunden arbeiten.

Es ist auch möglich in der Fassung 17 von vornherein Filterlinsen fest anzuordnen. Es wird zunächst mit hochgeklappter Filterlinse 19 gearbeitet. Sobald das Warnsignal der zweiten Stufe ertönt, das signalisiert, daß die Filterwirkung der Gläser nicht mehr ausreicht, klappt der Benutzer die zusätzliche Filterlinse 19 nach unten. Es ist zweckmäßig die Filterlinse 19 so auszubilden, daß nach dem Einklappen ein Teil dieser Linse auch vor dem oder den Sensoren 20 angeordnet ist. Nach dem Einklappen der Filterlinse 19 hört dann auch das Warnsignal der zweiten Stufe auf.

Die dargestellte und beschriebene Strahlungsschutzbrille findet neben ihrem Einsatz im militärischen Bereich mit besonderem Vorteil als Laser-Schutzbrille Verwendung.

Patentansprüche:

1. Strahlungsschutzbrille mit in einer Brillenfassung angeordneten Filtern, die schädliche Strahlung absorbieren, dadurch gekennzeichnet, daß in die Brillenfassung (1) ein Sensor (6,7,8) für die schädliche Strahlung integriert ist und daß diesem ein einstellbarer Schwellwert-Diskriminator (11) mit angeschlossener Warnvorrichtung (14) nachgeschaltet ist.

2. Strahlungsschutzbrille nach Anspruch 1, dadurch gekennzeichnet, daß der Schwellwert-Diskriminator (11) auf zwei unterschiedliche Signalpegel einstellbar ist und beim Überschreiten des ersten Signalpegels ein erstes und beim Überschreiten des zweiten Signalpegels ein zweites, deutlich unterscheidbares Warnsignal erzeugt.

3. Strahlungsschutzbrille nach Anspruch 1, dadurch gekennzeichnet, daß der Sensor (6,7,8) in Verbindung mit nachgeschalteten elektrischen Gliedern Bandpaß- oder Hochpaßcharakteristik aufweist, und daß der Schwellwert-Diskriminator (11) zur Detektierung verschieden schneller Anstiegszeiten eingestellt ist.

4. Strahlungsschutzbrille nach Anspruch 1 und 2 oder 3, dadurch gekennzeichnet, daß mindestens ein Sensor (8) auf dem Nasenbügel der Brillenfassungen (1) angeordnet ist.

5. Strahlungsschutzbrille nach Anspruch 1 und 2 oder 3, dadurch gekennzeichnet, daß in der Nähe der Klappscharniere der Brillenfassung (1) jeweils ein Sensor (6,7) angeordnet ist.

6. Strahlungsschutzbrille nach Anspruch 1 und 2 oder 3, dadurch gekennzeichnet, daß in Teile der Brillenfassung (1) eine optische Faser (15) eingelassen ist, die beim Auftreffen schädlicher Strahlung fluoresziert, und daß an den Enden dieser Faser (15) ein Sensor (16) angeordnet ist.

7. Strahlungsschutzbrille nach Anspruch 1 und einem der Ansprüche 2-6, dadurch gekennzeichnet, daß als Warnvorrichtung mindestens ein in einem Ohrbügel (5) der Brillenfassung (1) angeordneter Summer (14) verwendet ist.

8. Strahlungsschutzbrille nach Anspruch 1 und einem oder mehreren der folgenden, gekennzeichnet durch ihre Verwendung als Laser-Schutzbrille.

1/2

Fig. 1

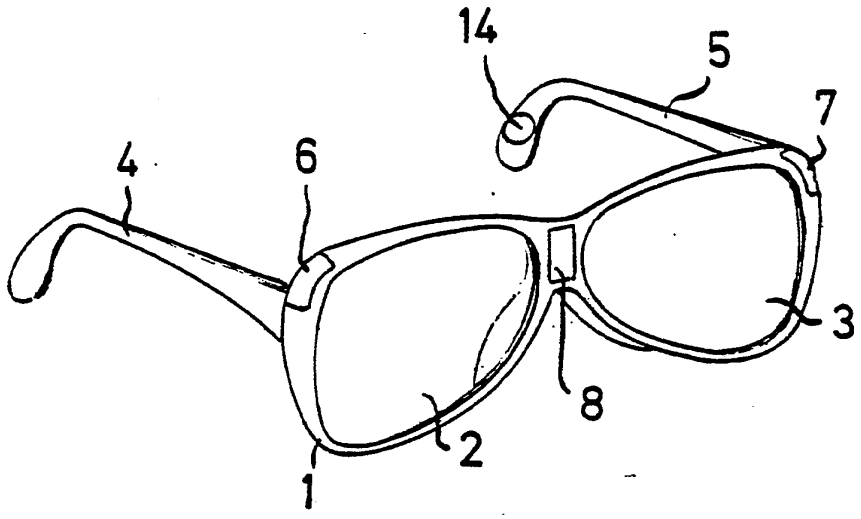
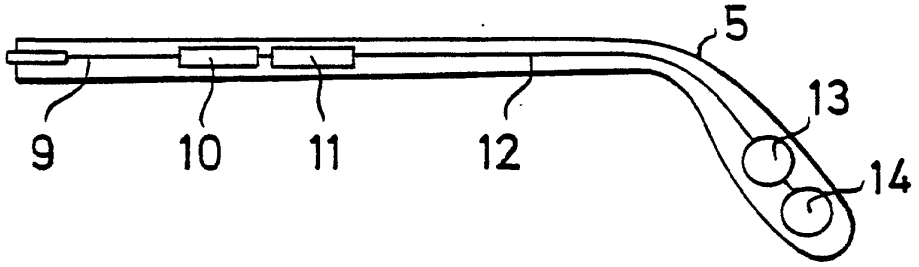


Fig. 2



2/2

Fig.3

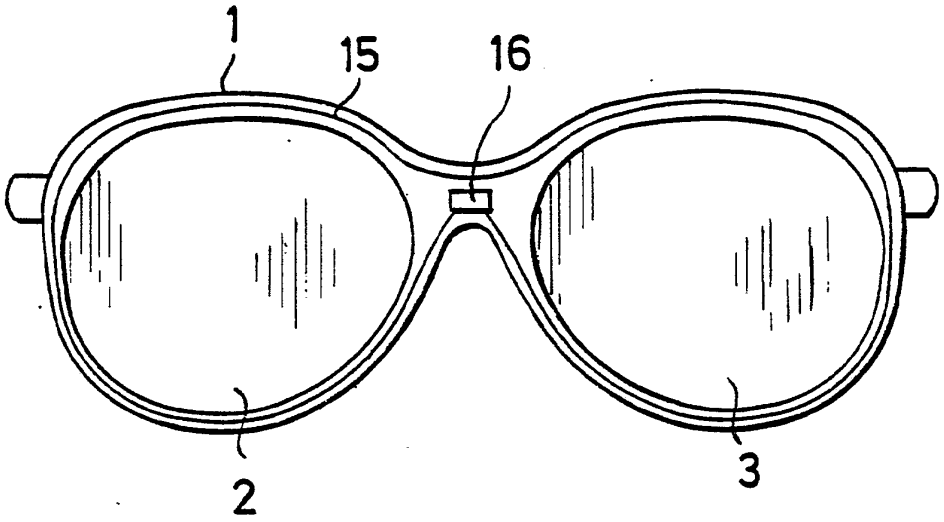
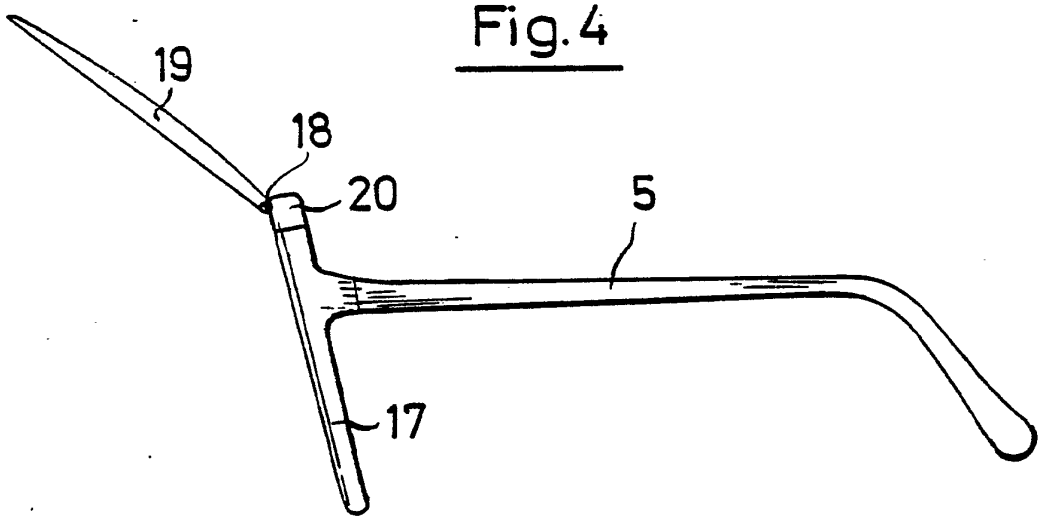


Fig.4



INTERNATIONAL SEARCH REPORT

International Application No PCT/EP86/00180

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl.4 G 02 C 7/10; A 61 F 9/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
Int.Cl.4	G 02 C 7/10; A 61 F 9/02

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	FR, A, 2530039 (A. CUVELIER) 13 January 1984, see pages 6-12	1
A	DE, A, 2841484 (P. TROESTER) 3 April 1980, see pages 8-11	1
A	FR, A, 2551224 (FARRANO OPTICAL) 1st March 1985, see abstract; claims	1
A	US, A, 3597054 (P. McGOWIN WINTER) 3 August 1971, see the whole document	1
A	US, A, 3519339 (T.J. HUTCHINSON) 7 July 1970, see the whole document	1
A	EP, A, 0078463 (CARL ZEISS) 11 May 1983, see the whole document (Cited in the application)	

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24 June 1986 (24.06.86)	23 July 1986 (23.07.86)
International Searching Authority	**Signature of Authorized Officer**
European Patent Office	

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/EP 86/00180 (SA 12628)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 09/07/86

The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
FR-A- 2530039	13/01/84	None		
DE-A- 2841484	03/04/80	None		
FR-A- 2551224	01/03/85	DE-A-	3430781	11/04/85
		JP-A-	60084504	13/05/85
		GB-A-	2148027	22/05/85
US-A- 3597054	03/08/71	None		
US-A- 3519339	07/07/70	None		
EP-A- 0078463	11/05/83	DE-A-	3142909	11/05/83
		JP-A-	58083820	19/05/83
		US-A-	4529275	16/07/85

For more details about this annex :
see Official Journal of the European Patent Office, No. 12/82

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen PCT/EP 86/00180

I. KLASSIFIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)[6]

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

Int. Cl 4. G 02 C 7/10; A 61 F 9/02

II. RECHERCHIERTE SACHGEBIETE

Recherchierter Mindestprüfstoff[7]

Klassifikationssystem	Klassifikationssymbole
Int. Cl.4	G 02 C 7/10; A 61 F 9/02

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen[8]

III. EINSCHLÄGIGE VERÖFFENTLICHUNGEN[9]

Art*	Kennzeichnung der Veröffentlichung[11], soweit erforderlich unter Angabe der maßgeblichen Teile[12]	Betr. Anspruch Nr.[13]
A	FR, A, 2530039 (A. CUVELIER) 13. Januar 1984, siehe Seiten 6-12	1
A	DE, A, 2841484 (P. TROESTER) 3. April 1980, siehe Seiten 8-11	1
A	FR, A, 2551224 (FARRANO OPTICAL) 1. März 1985, siehe Zusammenfassung; Patentansprüche	1
A	US, A, 3597054 (P.McGOWIN WINTER) 3. August 1971, siehe das ganze Dokument	1
A	US, A, 3519339 (T.J. HUTCHINSON) 7. Juli 1970, siehe das ganze Dokument	1
A	EP, A, 0078463 (CARL ZEISS) 11. Mai 1983, siehe das ganze Dokument (In der Anmeldung erwähnt)	1

* Besondere Kategorien von angegebenen Veröffentlichungen[10]:

"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist

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"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
24. Juni 1986	23 JUL 1986
Internationale Recherchenbehörde: Europäisches Patentamt	Unterschrift des bevollmächtigten Bediensteten: M. VAN MOL

Formblatt PCT/ISA/210 (Blatt 2) (Januar 1985)

ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT ÜBER DIE

INTERNATIONALE PATENTANMELDUNG NR. PCT/EP 86/00180 (SA 12628)

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am 09/07/86

Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
FR-A- 2530039	13/01/84	Keine		
DE-A- 2841484	03/04/80	Keine		
FR-A- 2551224	01/03/85	DE-A-	3430781	11/04/85
		JP-A-	60084504	13/05/85
		GB-A-	2148027	22/05/85
US-A- 3597054	03/08/71	Keine		
US-A- 3519339	07/07/70	Keine		
EP-A- 0078463	11/05/83	DE-A-	3142909	11/05/83
		JP-A-	58083820	19/05/83
		US-A-	4529275	16/07/85

Für nähere Einzelheiten zu diesem Anhang :
siehe Amtsblatt des Europäischen Patentamts, Nr. 12/82

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (01-22)
Approved for use through 05/31/2024. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	18597874	Filing Date	2024-03-06	Docket Number (if applicable)	IPVCP003X1C4X1C2	Art Unit	2872
First Named Inventor	HOWELL et al.			Examiner Name	LEI, JIE		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☒ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 503874

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (01-22)
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Signature of Registered U.S. Patent Practitioner			
Signature	/C. Douglass Thomas/	Date (YYYY-MM-DD)	2024-12-03
Name	C. Douglass Thomas	Registration Number	32947

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

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

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT

In re application of: HOWELL et al.	Attorney Docket No.: IPVCP003X1C4X1C2
Application No.: 18/597,874	Examiner: LEI, JIE
Filed: March 6, 2024	Group: 2872
Title: SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS	

INFORMATION DISCLOSURE STATEMENT
37 CFR §§1.56 AND 1.97(b)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The references listed in the attached PTO Form 1449, copies of which are attached, may be material to examination of the above-identified patent application. Applicants submit these references in compliance with their duty of disclosure pursuant to 37 CFR §§1.56 and 1.97. The Examiner is requested to make these references of official record in this application.

This Information Disclosure Statement is not to be construed as a representation that a search has been made, that additional information material to the examination of this application does not exist, or that these references indeed constitute prior art.

This Information Disclosure Statement is: (i) filed within three (3) months of the filing date of the above-referenced application, (ii) believed to be filed before the mailing date of a first Office Action on the merits, or (iii) believed to be filed before the mailing of a first Office Action after the filing of a Request for Continued Examination under §1.114.

Accordingly, it is believed that no fees are due in connection with the filing of this Information Disclosure Statement. However, if it is determined that any fees are due, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-3874 (Order No. IPVCP003X1C4X1C2).

Respectfully submitted,

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Apple Inc. Exhibit 1015 Page 1603

Noise cancellation apparatus

DOCUMENT ID	DATE PUBLISHED
CN-1234895-A	1999-11-10

INVENTOR INFORMATION

NAME	CITY	STATE	ZIP CODE	COUNTRY
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CPCI	G10K11/17885	2018-01-01
CPCI	H04R1/10	2013-01-01
CPCI	G10K11/17873	2018-01-01
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CPCA	H04R29/006	2013-01-01
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CPCA	H04R2201/403	2013-01-01
CPCA	H04R3/005	2013-01-01
CPCA	H04R1/1008	2013-01-01
CPCA	H04R2201/107	2013-01-01
CPCA	H04B1/12	2013-01-01
CPCA	H04R3/005	2013-01-01
CPCA	H04R5/0335	2013-01-01
CPCA	H04R29/006	2013-01-01
CPCA	H04R2201/107	2013-01-01
CPCA	H04R1/1008	2013-01-01
CPCA	H04R2201/403	2013-01-01

Abstract

The invention claims a connected to suspension with the headset or microphone device of suspension type headset, method and device for reducing environmental noise. The apparatus may include a sensing microphone for detecting background noise signal, the desired input sound transmission, and used for eliminating the noise signal to generate the phase noise signal in the sound wave guide adjacent to the earphone of the headset signal processing device. The noise reduction method of the invention is provided by an open loop circuit, the circuit allows the operator or caller of the input audio signal is not affected by unwanted ambient noise disturbance is transmitted to the ear of a user. the method for adjusting for the gain and/or phase of the noise signal of the noise component detected in the sound wave guide, so as to generate a dead zone is the desired speech to be transmitted. The device can further comprises a de-noising microphone emitter system, the first and second microphones in the system is voice input such that the first microphone receives a desired and background noise existing in the vicinity of the speech, and the second microphone receives substantially only the background noise. background noise of the second microphone is converted into a corresponding electrical signal and from the signal corresponding to the speech and background noise of the first microphone is subtracted, so as to produce mainly represents the voice signal. the active side sound channel noise and noise reduction system by having the following functions is enhanced by detecting the voice automatic audio microphone transmission ("VOX" circuit), the gain is increased for a portion of the microphone signal to the ear speaker ("sidetone"), and by removing the voice microphone from the circuit design and increasing the gain of the noise microphone amplifier active noise microphone is converted into a standard omnidirectional microphone. According to the invention, when needing to far field response, the first and second microphones may be used as a directional microphone. The method of the invention also relates to a double-end microphone structure of application.

Description

INVENTION-TITLE

This application is 1994 11, 14 entitled to review U.S. patent application 08 /339126 number of continuing application related application, the former and subsequent application of 1992 10, 29 entitled America patent application 968180 (now U.S. Patent US5381473, 1995 December 1, 10 grant), the two parts of citations to the patent application is as a reference. also referred to 1993 year 10 month 5 day authorization of American patent 5251263, which is also referenced to as the reference.

When the invention background field of the invention relates to when the headset or freely-retractable headset for use, unwanted by the attenuation of the environment noise so as not to reach the tympanic membrane and eliminating background noise from freely-telescopic microphone or directional microphone to

perform noise cancellation and noise reduction method and device.

The invention further relates to a headset, used especially near the earphone of the active noise reduction system, the system uses the sensing microphone detecting unwanted background noise. This noise signal output by the sensing microphone is electro-acoustic device to generate an inverse signal, so that the acoustic waveguide between the output transducer and eardrum formed in quiet. so the needed of the original sound signal when transmitted to the ear of the user will not be interfered by noise. any sound (sound prevents feedback) waveguide absorption returned from the ear microphone and eliminating return to lugs of any sound from the microphone.

The invention also relates to use with headset, freely-telescopic microphone or directional microphone in a noise cancellation device, wherein the system uses two microphones for receiving a voice of the first voice and background noise microphone, and a second microphone for receiving mainly comprises background noise sound combined, for subtracting the second signal from the first signal.

In the noise cancellation system of the invention using double ends of the microphone system, wherein the voice and driving circuit used for driving the system power support input of the output audio signal is sent on the one end, and the second end is grounded.

noise eliminating equipment of the present invention also relate to a directional microphone in the far microphone used by the device, it can better receive sound in a certain direction than other directions.

noise and noise reduction system of the invention can be to improve the performance by including the following characteristics: automatic audio microphone transmission characteristic, the part of signal to the earphone speaker side sound characteristics, and by removing the voice microphone from the circuit and improve the gain of the noise microphone amplifier to the active noise microphone is converted into a standard omni-directional characteristics of the microphone. This property is improved so that the sidetone path gain can be all the sound transmission outside of the earphone speaker (speaker), does not need to add any other microphone member.

the existing technology description will see the undesired background noise exists in many cases. one example is to consider the operator is intended and on the noise area of such a telephone or similar device of the telephone conversation. In this case, the sound of background noise is received by microphone in the telephone handset and is converted into an electric signal, the electric signal is transmitted to the telephone of the call with the telephone operator in it is converted to sound signal. Therefore the person talking with the operator continuously hear the background noise. In addition, when the person is speaking, voice and background noise of the other mixed together, which makes other people difficult to understand. Therefore the operator may have to loud shout of mike-telephone. and represents the background noise of the signal also as side-tone speaker from the microphone to the telephone handset telephone operator in the mobile phone. Therefore attendant background noise of the loudspeaker is continuously heard from the handset, once the other person is speaking, this background noise will understand what.

As another example, considering the driver of the unmanned helicopter wants to use radio frequency (RF) communication with other human communication. In this case, the driver usually faces connected with the radio transmission/receiving device called suspension type microphone or hanging a handset speaker, voice is converted into an RF signal, the RF signal is transmitted to the second receiving/transmitting device, in which device is converted into voice to be heard by other people. like the above situation of the telephone in the noise region is the same, background noise of helicopter suspended type microphone or a headset device is received and is converted into electric signal and then transmits it to the receiving device. Therefore, with the driver call response of background noise. The driver on the unmanned helicopter and the radio transmission/reception device is " on " (microphone) is in operation position, especially boring.

As another example, consider voice verification and/or identification system, operator required the system to

access an actual facility or operation of computer or machine, for example. background noise will hinder access (due to background noise and cannot identify or verify) or due to the error caused by the error to enter.

in an attempt to reduce background noise to improve the noise environment such as microphone or headset of the telephone or hanging performance, it can use the differential pressure type microphone. Generally, the pressure difference microphone responds to the pressure difference of the two spaced point close to. electric signal when the pressure difference of the background noise is used in an isotropic environment, differential pressure type headset generated because of the background noise is substantially zero. However, in most practical situations, the pressure difference of the background noise is not isotropic, so in such cases, performance of pressure-difference microphone being adversely affected. electric signal in addition, because voice or sound propagation along more than one direction, so the response of the microphone to voice or sound generated is deteriorated. Therefore, even in the telephone handset or suspended microphone using the pressure-difference microphone, the expected background noise amount is not large enough, the performance can not satisfy the requirement.

Also, as described above, because of the relative two sides of the pressure difference microphone facing the sound pressure response, so necessary to greatly change the hands of existing telephone handset so that the microphone of the two sides can respond to sound pressure. Moreover, because the telephone handset using this microphone, the electric signal generated by the microphone is amplified. Therefore, the traditional microphone pressure difference microphone for replacing existing telephone in the telephone handset generally will need to replace the telephone handset with a new handheld handset, doing so would be very expensive.

As an alternative solution to using differential pressure type microphone may use acoustic feedback system. Such a system generally comprises an output transducer for equalizing transfer function of the compensation filter. Because the characteristics of the speaker by these filters is strictly controlled, so the cost of the filter is very high. Thus the acoustic feedback system generally are also very expensive.

a plurality of microphones for use with noise and noise reduction device is the non-directional or omnidirectional, such as electrostatic, piezoelectric, magnetic and carbon particle of the microphone. for all to a small microphone, at low frequency in the vicinity of the microphone has enough sound diffraction, so the membrane moving direction of the sound is not sensitive. at high frequency, correspondingly at a relatively short wavelength, a microphone for sound wave becomes larger, exhibits good reaches the sound membrane along the vertical direction. Therefore, the smaller the size of the microphone, it remains isotropic at a higher frequency. Thus full compared to the microphone and the wavelength is small, and keep the back of the diaphragm of the microphone housing, so that it can not receive some sound wave with different angles. Accordingly, since the pressure is scalar quantity, not the vector, so the existing technology of microphone is called a sound pressure microphone. Thus for the microphone device in the active noise removing system, can improve needed along each direction of the directional microphone response sensitivity of sound in the far-field region. That is to say, the omni-directional directional diagram and bidirectional or 8 shaped directional diagram of adding the output to realize directional microphone response and only adjusts amplitude and phase of the output signal are summed to generate the required pattern. 8-shaped pattern is also called a cosine pattern, expressed as $P=\cos\theta$ using polar coordinates on mathematics. in the directional microphone, the distance is a factor. the distance factor capable of measuring directional microphone relative to omni-directional directional diagram, the same ratio from the sound source more remote use and still keeps the acquisition of directly obtaining a reflection. Thus the existing technology can provide directional microphone of the active noise reducing device based on omni-directional directional diagram and the heart-shaped pattern, in this device, reaches the determined sound pressure at a position vector.

When the circuit design and active de-noising device of suspension type microphone device comprises at least two microphone or directional microphone device, for use with known three-end microphone structure

can be used. That is, it has two or more than two noise removing system is connected to the microphone amplifier, for example, is required to have three ends of circuit power supply input end and the audio signal output end and a ground end. In order to reduce the complexity and cost of the denoising system can optionally for use with a headset microphone or hanging microphone noise reduction device such as used in the microphone structure, it is desirable that with two ends. expected a microphone structure, direct-current voltage wherein the power supplying end of the microphone output AC audio signal one and the same end is input, whereby the AC signal is superimposed on the DC signal. Thus current technology can provide for active denoising device of double-end microphone structure, therein power supply and signal is superimposed on the first end and the second end is grounded.

when further trying to reduce background noise in order to improve the definition of the electro-acoustic communication using a microphone of the headset, which has been developed is called active noise reduction technology, this technology uses the speaker and microphone sensing the sound field in the ear speaker, the sensing microphone sensing background noise and programmable audio. For the head-wear earphone device of active type, using the negative feedback loop, the phase inverter feedback from the microphone unit of external noise from the electric signal conversion so as to reduce the head noise near the earphone unit. shown in the existing technology, adopts the closed-loop mode of feedback circuit provides a "dead zone" between the speaker and ear, which eliminates the background noise. This is because in a noisy environment, the ear not only detects that the output of the receiver, and also the detected due to background noise.

As a document providing closed-loop active noise reduction system, the document is referenced to as the reference: Hawley et al U.S. patent US2972018, Horner U.S. patent US3098121, Carme et al U.S. patent US4833719, Kimura et al U.S. patent US5138664, Saeki of Japanese patent abstract JP-3-161999.

patent referenced above describes various de-noising device. For example, the Hawley et al patent refers to the noise reduction system of the earphone, the earphone has plastic shell located between the receiver and transmitter; Wadsworth provides an earphone of the microphone of the top of headset (headband); the Carme et al patent for a located at the earphone of hollow annular part between the speaker and microphone, Kimura et al patent relates to a noise reducing earphone with cup-shaped member is located between the speaker and microphone; Patent Saeki relates to the wear-type noise cancelling earphone of the microphone between two speakers facing each other.

However, normal active noise reduction system has various disadvantages. the existing de-noising system such as closed-loop circuit is related by the following formula: P=S (H1H2 + H21 + BH1H2) + N (11 + BH1H2)] wherein P is equal to the output S = standard audio signal direct transmission gain (1 + BH1H2) noise component (N) H1 = high-pass filter H2 = headset speaker noise component B in a variable gain/phase control for the output (P) is reduced to zero to very large. Therefore, normal closed loop noise reduction system is not ideal. This system has the problem of unstable. This causes the defect of the oscillation, namely speaker feedback microphone and the change of the transfer function of the acoustic cavity comprises the components and user headset unstable loop caused by howling sound caused by the condition. the normal closed loop noise generated by the noise reduction degree at any frequency is directly related to the direct transmission gain of the frequency. However, the higher the gain, the device is not stable.

normal active noise reducing headset telephone receiver device further has a deficiency, that is, when the mechanical vibration (shock-like connecting wire, the friction of the vibration, the user gripping device moving into vibration, etc.) is transmitted to the feedback microphone noise, the vibration noise by the microphone into an electric signal. These signals are amplified, causing instability and other nonlinear effects, such as audio interruption, large impact noise or sound. normal active noise reducing headset sending the other one is not sufficient in order to avoid elimination of desired audio signal due to the complexity of the device increases, the electrical signal as the audio signal is input by the telephone device. of common device desired audio signal (S) is input to two summing nodes to generate the signal transmitted to the ear of a

user. the microphone signal with a desired negative feedback input audio signal added by the first addition node. However, in the normal closed-loop feedback device, comprising the desired audio signal from microphone feedback signal and necessary environmental noise cancellation. the feedback signal is subtracted from the desired input audio signal generated does not contain the wanted audio signal component of the anti-noise signal. then using the second node to a desired audio signal is added back into the loop, so as to be transmitted to the output transducer. This kind of method for generating the desired audio signal increases the complexity and cost of the common noise reducing device. an additional node in the common device processing also increases the chance of producing distortion in the desired audio signal and increases the possibility of the stability.

In addition, further developing the various other prior art headset structure to form the active noise reducing device, wherein the input and output transducer to set relative to the ear, such as the following three documents, which are referenced to as the reference.

Moseley of America patent US5134659, American patent US5117461 of Moseley, American patent US5001763 of Moseley.

Moseley of America patent US5133659 relates to a baffle, two receivers and two microphone headset noise reduction system, the baffle is formed by forcing the noise around the barrier travelling a longer distance and force the noise disturbing noise source by foam barrier layer directly to the input transducer. US Patent US5117461 of Moseley for the headset comprises the function of acoustic noise, the headphone is fixed on the ear-hole facing to the same direction of the microphone. Moseley of America patent US5001763 relates to de-noising system with headphone speaker, microphone and a baffle.

Therefore, typically, patent Moseley relates to the output transducer of the speaker and the microphone as an input transducer. In fact, the patent to the speaker and microphone on the same plane or substantially in the same plane. Also, the patent also teaches signal output of processed basically with the original sound wave in the same time domain, namely signal are in phase.

different from the patent of Moseley, the invention is not exclusively relates to the speaker and microphone in the same plane is set (although this is not definitely is excluded out). in an open loop active noise reduction system of the present invention using the output transducer and the microphone can be perpendicular, tangential or at any position of the same plane (or in the same plane). The invention claims that the original input audio signal to the speaker, not adding the noise reduction system to the input audio signal. This is because the sensing microphone as the open loop of the control part relative to the setting of the audio signal so that the audio signal is not detected by the pickup or microphone sensing the. That is to say, in an open loop system of the present invention, a desired audio signal is independently transmitted to the loudspeaker and ambient noise detected by the microphone. Furthermore, in the present invention, sound-absorbing material can be placed between the tympanic membrane of the output transducer and the user, transmits the audio signal to the ear of the user to form an acoustic waveguide of the transducer. the output function of sound material attack filter transducer and the microphone on the passage of the pickup microphone and the output transducer form an acoustic barrier to reduce open loop gain. the acoustic material of the original input audio signal desired to be pickup microphone detection and noise cancelling separated. background noise signal detected by the pickup microphone is generating electric-acoustic processing device of anti-noise signal to invert, the anti-noise signal is transmitted to generate a dead zone to the acoustic waveguide. the dead zone located between the tympanic membrane of the output transducer and a user.

Therefore, the existing technology fails to provide in the communication system using the background noise reduction to the acceptable degree of relative low cost, it also fails to provide the existing audio communication system background noise can be reduced to the acceptable degree of cost effective device.

aim of the invention and summary object of the present invention is to provide an active noise cancellation

device and active noise reduction device to overcome the noise reduction system of the problem associated with the prior art.

More specifically, an object of the present invention is to provide the background noise reduction to an acceptable degree of the active noise cancellation device and active noise reduction device.

Another object of the present invention is to provide a hanging type microphone in the headset device and noise reduction device or providing elimination device used, and so on.

Still another object of the present invention is to provide the above low-noise and noise removing device and an active noise reduction system.

Further another object of the present invention is to provide in with the standard can be used for online power operation of the telecommunication system using noise and de-noising device of cost is relatively low.

Another object of the present invention is by increasing the talking function to provide a headset of the enhanced active noise and noise, the speaker function so that the user can hear the microphone audio signal and from the surroundings of the external sound, and it is not necessary to actually add any other microphone component. The purpose of the invention is to provide an active noise and noise reduction headset, wherein by increasing the gain of the sidetone path to all the sound outside the region are transmitted to the earphone of speaker. The active de-noising microphone of the invention by removing the voice microphone from the electronic circuit and increase the gain of the microphone amplifier noise to become standard omni-directional microphone.

Yet another object of the present invention is to provide easy to be used for the communication system with a hand holding the handset and to standard can be used for on-line power operating de-noising device of relatively low cost.

a further object of the present invention is to provide a device for reducing noise of very low cost used in the audio communication system, the noise reduction device so that the user can selectively amplifies the received signal, or it can be used in a headset having a suspension type microphone, or it can be used as a noise microphone.

In many applications the described it is intended with a non-directional characteristics of the microphone. The microphone for inhibiting the signal from the certain direction, thereby improving the SNR. The invention of a directional microphone based on summing method depending on the algebraic combination of the sound pressure signal with a phase difference, the phase difference is uniquely generated by the electronic circuit of the system. different with the pressure difference microphone, the directivity of the microphone depending on the ratio of linear dimensions and wavelength.

when two or more than two microphones are fed to the same amplifier, a certain distance away from the microphone signal of the sound source reaches the microphone at a phase difference of 180 is possible and cancel each other out. Therefore, an object of the present invention is to ensure the omnidirectional and directional microphone is correctly phased.

Another object of the present invention is disclosed herein can also be used for audio microphone or even monitoring or telemetry noise such as environment of the microphone has a lobe of a directional microphone such as directional and subtraction device at a predetermined angle and/or the first and second microphones arranged at a predetermined distance.

Therefore, an object of the present invention is to provide low cost microphone used in the denoising system with non-omni-directional characteristic.

Another object of the present invention is to provide a based on various pattern microphone with controllable amplitude and phase of the lobe structure.

Still another object of the present invention is at the predetermined position to reach the position from all the simple sound source acoustic pressure vector and to provide a directional microphone.

Further another object of the present invention is double-end microphone system comprising the directional microphone provided in active noise environment, the double-end microphone system allows audio output signal is superimposed on the voltage input signal at the same terminal.

Another object of the present invention is to provide a novel active noise reducing device used in the headset, the noise reduction apparatus by placing the component in an open-loop system to make the circuit simply and the cost is reduced.

Yet another object of the present invention is to provide a noise eliminating device, wherein the environmental noise is attenuated by general formula, and the performance is not generated by the mechanical part or a vibration of microphone signal deterioration.

Further another object of the present invention is to provide a suspended with microphone or directional microphone of the headset, handset active noise reduction system, the microphone because the open-loop structure and is unconditionally stable.

Another object of the present invention is to reduce noise power needed in the device by actively coupling an electroacoustic transducer.

Still another object of the present invention is by using a single summing node the desired audio signal and noise signal combined conveying to the output transducer of a method to reduce the complexity and/or cost of the active noise reduction circuit.

Further another object of the present invention is in a noise reduction system for reducing the input electric signal to the unwanted distortion introduced by the noise processing, the input electric signal of the desired noise reduction system is converted into acoustic signal and is transmitted to the ear.

Another object of the present invention is a noise reduction device comprises a back or front placed at the output transducer and the microphone or sound pick-up microphone sensor loudspeaker sound field and the plane, so the microphone while only detecting the background noise by using the double functions of sound-absorbing material.

Still another object of the present invention is to provide an acoustic material, when it is placed on the microphone as an acoustic filter and when it is placed between the ears of the output transducer and a user as an acoustic waveguide.

is the control part as the system microphone, the microphone independent of the input audio signal that is the desired output. preferably an elastic acoustic waveguide between the speaker/microphone and ear to form dead. This waveguide preferably is not only the normal rubber sponge for comfort purposes and usually with on the earphone. A slow flow of such material is (Slo-Flo) foam material, its density and structure such that it is capable of determining a noise-free response. and can prevent from face and/or ear of the listener back to any sound reflecting microphone as an acoustic filter, technology using signals from the negative feedback of the microphone, but no such negative feedback in this invention, but uses an open loop structure, in this structure, there is no need to add another audio signal, but the original input audio signal to the loudspeaker. Because of the interference signal is not the open-loop system.

understand the difference between normal closed loop noise reduction device and the invention is novel

open loop noise reducing device is very important.

The open-loop system of the invention is wherein the control action independent of the system output or a desired result. closed loop system is a control action depending on the output of the system. the key term in the defined control actions. Generally, the driving signal of the term system and expressed as starting system, the drive signal to generate the desired output to be responsible for the extent. in an open loop system, the input command is the only factor provides a control action, and for closed-loop system, controlled by difference command input and the corresponding output to provide.

In order to carry out closed-loop and open-loop operation, some operating characteristics of each system is as follows: the open loop system has two characteristics, that is, capable of performing determined by calibration, and a function such as because there is no problem of unstable and simplicity in structure. For the closed-loop system is worth noted characteristics is the drive signal is a function of the output and input of the deviation, so because of the feedback capable of accurately reproducing input; such a control action forces the driving signal is almost zero. is the feedback factor is to be responsible for any difficult (i.e. easy oscillations) when using the closed loop system of the maximum.

in any telecommunication system of active noise reduction device and noise removing device can used on the aircraft (e.g., helicopter or airplane) or other device, such as a telephone, or such as for accessing an actual facility or (via a direct or indirect interface or via telephone) into a computer or machine voice identification and/or authentication system, or used in other identification and/or authentication system.

noise removing device comprises a shell, the shell has the first microphone device, for receiving the first sound sent by operator by operating the muting device of voice and background noise and converting it into the first signal, second microphone device. φ is set at a predetermined angle and close to the first microphone device for receiving second sound mainly composed of the background noise and it is converted into a second signal, and to subtract the second signal from the first signal device so as to obtain a substantially representative of the speech signal. double-end transducer used in the de-noising device for reducing background noise comprises: a plurality of microphone connected with the amplifier device of the silencing device, the amplifier device for receiving audio signals from a second tip having a first end and a microphone. the second end grounded; direct current signal of the voltage on the first terminal input device, connected to the first end and for connecting alternating current signal from the microphone, a transistor device for the device of direct current signal AC signal superimposed on the first end; a device for filtering the AC signal from the DC signal, so that the DC signal for supplying power to the amplifier device, and a device for alternating current signal output generated by the microphone of the first terminal. for a directional microphone when the suspension type microphone speaker faces the active de-noising device obtains the far-field response of the directional microphone to a variety of different directional pattern receives sound, comprising: a housing having spaced apart array of microphone device. the electric signal of the microphone device is used for receiving the sound signal and the output with the distance between the microphone input sound source of the shell is as has an amplitude and a phase of the sine wave, the sine wave and the microphone at a predetermined distance to form an angle; for calculated from each microphone to the sound source and the distance, a device for the output signal of the microphone array are added to obtain a sum of the output signal of the summation channel, generating only voice represented by the sum output signal of the acoustic signal in the signal processing device, and for adjusting the amplitude of the sum signal to produce a device of desired response mode. active noise reducing device for reducing ring-opening environmental noise near the tympanic membrane comprising: a housing receiving the input signal, the output transducer in the shell; and the output transducer is substantially in the same plane, for detecting and reducing environmental noise of the input transducer; reducing the open loop signal processing device of input transducer detected ambient noise for the input audio signal transmitted to the eardrum and not interfered by environmental noise of device; the output transducer and the input transducer so as to form a path of sound device mainly representing speech of the input audio signal between the output transducer and eardrum. wherein a dead zone is formed to isolate the sounds sent by the input transducer. open loop noise reduction system for use with active de-noising device comprises: means for detecting noise signal

and to transform it into electric signal, the sound pickup microphone speaker having a sound device in the headset, audio transmission signal; inhibiting vibration of the electric signal with the electric mode, a device for adjusting the variable gain/control device, a noise signal for removing low frequency disturbance mechanical vibration introduced to prevent such interference from reaching the speaker device, combining the anti-noise signal and noise signal is used in the acoustic device to form a static area of the addition node; transmitting the audio signal to the speaker device, and the phase between the noise signal and noise signal held in the speaker device with same.

for reducing the open loop active noise reduction device of environmental noise near the tympanic membrane, comprising: a shell for receiving an input audio signal, the output transducer in the shell; in the shell, used for detecting and reducing environmental noise of the input transducer; the signal processing device by inputting the opening ring of environmental noise transducer, detecting for the input audio signal without noise interference to the eardrum of the device; the output transducer and the input transducer separates to form mainly representing speech of the input audio signal path and forming a quiet sound isolation device of the sound by the input transducer to transmit between the output transducer and eardrum.

active noise in headset of external sound is used for transmitting audio signals from the microphone and used for receiving energy from around environment and noise reduction system, comprising: a first microphone device has a first switch device; the first switch device has a noise cancelling mode and the first speaker through mode, a second microphone device, the second switch device connected with the two microphone of microphone amplifier device, the first switch device and the second switch device is working in elimination mode for audio microphone transmission device connected with the amplifier device. wherein the microphone transmission device when the first switch device and the second switch device is speaking through mode is bypassed, and are transmitted to the transmission gate of the buffer amplifier in muting mode both the first switch device and the second switch device when the two microphone device of audio signal the transfer gate of the second switch device is in the talking mode is disabled, the buffer amplifier device are operated in the muting mode from the transmission gate receives the audio signal to the audio system and scaling amplifier in the first switch device and the second switch device; the buffer amplifier device operates in speaker mode when used for directly outputting the audio signal received by the microphone amplifier device in the first switch device and the second switch device; comprises a noise cancelling mode and speaking the scaling amplifier third switch device of the direct mode works in the muting mode transmitted by the two microphone device and the sound from the outside of the side tone signal provided to the earphone speaker in all switch devices, scaling amplifier with gain control, wherein all switch devices are working side tone signal is speaking through mode when increasing the gain control to increase the input to the loudspeaker; active noise reduction system receiving the side tone signal and outputs it to the headset speaker.

when reading the following detailed description of the illustrated embodiment with reference to the accompanying drawings to the other objects, characteristics and advantages of the present invention, corresponding parts in the figure is represented by the same label.

FIG. 1 briefly shows the telephone de-noising device according to an embodiment of the present invention; FIG. 2 a block diagram of the noise removing device used in the telephone of the FIG. 1;

FIG. 3 A is a graph 1 of the telephone receiver part of the front view, FIG. 3 B is to remove the cover of the receiver portion of the telephone in FIG. 1 side view, FIG. 4 is a schematic diagram of the block diagram of FIG. 2 is shown another schematic diagram, picture 5 the de-noising device of FIG. 2; FIGS. 6A, 6B and 6C represents the suspension type microphone device using a noise reduction device according to the embodiment of the invention of FIG. 7A and 7B are for explaining the operation of the present invention in reference to schematic diagram, picture 8 represents the noise reduction device according to the invention; FIGS. 9A, 9B, 9C, 9D, 9E and 9F for the invention the suspension type microphone and headset embodiment (an embodiment of FIGS. 9A and 9B each represents a specific microphone is placed; FIG. 9C represents the lineament of the headset with active noise reducing device, FIGS. 9D, 9E and 9F represent a

side view of suspension type microphone), and FIG. 9F represents a preferred embodiment of the active noise reducing device used in the headset of FIGS. 10A and 10B is a schematic diagram of the noise reduction device of FIG. 8; FIG. 11 shows reversed phase circuit; FIG. 12 a reverse charging of the microphone circuit, FIGS. 13A and 13B represent active noise curves of various embodiments the present invention; FIG. 14 a schematic diagram of directional microphone; FIG. 15 is a schematic diagram of a linear array of for explaining an operation of the embodiment of the invention when the reference microphone; another embodiment of the principle diagram and a circuit array of the microphone array of FIG. 16A and 16B arranged in a column, FIG. 17 A and 17 B represent existing technology end microphone structure and the double-end microphone structure of square frame; FIG. 18 is a schematic diagram of a simple double-end microphone circuit; FIG. 19 a preferred embodiment of double-end microphone circuit used in the active noise removing system, FIG. 20 is another embodiment of double-end microphone circuit used in the active noise removing system; FIG. 21 is a schematic diagram of the existing technology closed loop active noise reduction system, picture 22 the invention open-loop active noise reduction system schematic diagram of FIGS. 23A and 23B represent perspective and side view acoustic waveguide of the invention; FIG. 24 a graphical representation of dead realized by using active noise reduction system; FIG. 25 shows a preferred embodiment of an active noise reduction system of the present invention;

FIG. 26 shows another preferred embodiment of the active noise reduction system of the present invention, FIG. 27 shows active another embodiment of noise reduction system comprises a high-pass filter of the invention; FIG. 28 a having straight, square frame of the active noise elimination system and side tone and automatic audio microphone transmission characteristic of the headset in use.

preferred embodiment detailed FIG. 1 indicates a use of the noise reduction device according to the embodiment 8 of the invention. As shown, telephone 8 typically comprises a has a speaker part 41 and a receiver part 42 hand-hold handset 10 and a telephone unit 18, which may be by means of telephone line 30 is connected between them. Alternatively, the telephone may be a wireless phone, then the mobile phone 10 can be coupled by RF (radio frequency) radio and telephone unit 18. a receiver portion 42 comprises first and second microphones 12 and 14 (FIG. 2) for adjusting the volume of signal supplied to the speaker portion 41 of the switch 40, and has a concave portion 44 and the mesh portion 46 of the cover 48.

FIG. 2 diagram form represents a telephone 8. As shown, the handset 10 typically includes first and second microphones 12 and 14, subtraction device 16 (in the preferred embodiment is an operational amplifier), an amplifier 20 (preferably also an operational amplifier), and a speaker 22. first and second microphones 12 and 14, operational amplifier 16, and the amplifier 20 preferably is included in the receiver portion (see FIG. 1).

by voice and background noise sound signal is supplied to the first microphone 12 and when it is converted into the corresponding electric signal, and the electric signal is then supplied to the positive end of the operational amplifier 16. the background noise is provided to second microphone 14 and when it is converted into the corresponding electric signal, and the electric signal is then supplied to the negative end of the operational amplifier 16. the operational amplifier 16 is adapted to from the first microphone 12 of the voice and noise signal minus noise signal from the second microphone 14, and the electric signal substantially represents the voice of the telephone unit 18 to transmits the voice signal to a telephone wanted or more telephone through a telephone line. the output signal of the operational amplifier 16 also in the telephone unit 18 and telephone combination from the received signal transmitted to the amplifier 20. of operational amplifier 16 and 17 preferably is very low power integrated circuit (IC), such as a complementary metal oxide semiconductor (CMOS), it can use one or more CMOS IC chip. Although not shown in FIG. 2, but the operator can selectively set amplifier 20 by switch 40 (FIG. 1), so that the amplification amount adjusting degree of received signal is of a desired. an amplifier 20 for amplifying a signal supplied to the speaker 22, the speaker 22 the amplified signal into an audible acoustic signal.

FIGS. 3A and 3B represents two views of receiving part 42, remove the cover in FIG. 3A of FIG. 48. The shown in the two views, receiving part 42 typically includes a housing 74, circuit board assembly 78, the first

and second microphones 12 and 14, and a lid 48. preferably is an electret microphone or of such first and second microphone similar to the microphone 12 and 14 respectively is described on the back of placed or set. the two microphones of the fixed part 76 and the fixing part 76, for example, can be made of foam-like material, it is fixed on the housing 74. first and second microphones 12 and 14 each output through respective wires (not shown) to the operational amplifier 16, an operational amplifier 16 is included on the circuit board assembly 78, a circuit board assembly 78 is fixed on the housing 74. The following detailed description, circuit board 78 may include other circuit elements, these circuit elements for processing received from the first and second microphone and amplify the signals, and transmits them to the speaker 22 (FIG. 2). can be used for covering 72, it is fixed on the shell 74 by using adhesive, or may be a sonic weld on the outer shell 74. covering 72 and a circuit board assembly 78, a fixing member 76 and the first and second microphones 12 and 14 of the shell 74 to form assembly 71.

the part can be made by plastic material, such as polycarbonate lid 48 comprises an annular edge member 43 and generally a thickness of T 45, the portion of the 45 43 connected with the edge component, than the top of the edge component low minimum predetermined amount such as 0.020 inches, so as to form a recessed portion 44. portion 45 a has a thickness T less than the thickness T of the part 46, the part 46 has a plurality of through holes, may be similar to a mesh-like portion. In a preferred embodiment, the thickness T of portion 46 ' is less than 0.030 inch. Because the part 46 only portion 45 is very small, so that a portion of reduced thickness will not adversely affecting the whole structure rigidity of the cover 48. or part 46 can be made of relatively hard material, such as stainless steel or similar material, combined with the part 45. The, the see through the portions 45 and 46 recessed from the top edge portion 43, even if the receiver part 42 is put on the plane, only the edge part 43 is contacted with the plane portion 45 or 46 is not in contact with the plane. Therefore the load does not directly act to the part 45 and/or part 46, but to the edge part 43.

the cover 48 is placed on the assembly 71, the first and second microphones 12 and 14 are placed below the portion 46, first microphone very close to the bottom of portion 46. Therefore, preferably the operator less than 1 inches distance from receiver portion 42 facing the speaking voice sent by-passing portion 46 reaches the first microphone only a very short distance, thus minimizing the sound distortion.

first and second microphones 12, 14 are shown in Figure 3A and 3B placed in the receiver portion 42. Specifically, shown in Figure 3B, the first and second microphones are arranged between them with an angle φ, the value of the inclination is preferably 30 degrees and 60 degrees. the first and the second microphone are arranged such that between the parallel to first microphone 12 receiving surface or "sensitive" surface of the plane and the voice of the operator of the direction angle is θ. the angle between the axis and the voice direction of the sensitive face is perpendicular to the second microphone 14 is [(exciation θ) + φ], shown in Figure 3B, and angle between the direction of the voice and the second microphone ψ, shown in Figure 3A, In a preferred embodiment, the value of the corner θ is less than about 35 degrees; and the value of angle ψ is about 180 degrees. this is the result of the first and second microphones is, first microphone 12 receiving operator voice and near the background noise, while the second microphone 14 only receives substantially the same background noise received by the first microphone.

As described above, although the value of inclination is preferably 30 degrees and 60 degrees, however, even the first and second microphones being arranged to have the angle value is out of this range, they still can be operated satisfactorily. However, when the corner φ is much smaller than 30 or much greater than 60 degrees, the performance will be adversely affected. That is, when the angle φ is much smaller than 30, the second microphone 14 receives speech and receiving background noise. Therefore, when the microphone 12 from the first output signal subtracting the output signal of the second microphone 14, a part or all of voice will be counteracted. Conversely, when the angle φ is much greater than 60, the second microphone 14 receives the background noise may not be the same as the background noise received by the first microphone 12. Therefore, from the output signal of the first microphone 12 subtracting the output signal of

the second microphone 14 may not sufficiently counteract the first microphone receiving background noise.

Similarly, although the angle θ as described above and the value of ψ is less than 35 degrees and about 180 degrees, however, even the first and second microphones are arranged to make the angle which is different from the value of these values, they still can be operated satisfactorily. However, when the corner θ and ψ of value and each optimal value is significantly different, performance will be adversely affected. That is, when the angle θ is much greater than 35, the second microphone 14 may be receiving both voice and receiving background noise. Likewise, when the angle ψ less than 180 degrees much or much greater, second microphone 14 may not only receive speech and receiving background noise. As a result, under the condition of any one of two situations, when subtracting the output signal of the second microphone 14 from the output signal of the first microphone 12 in part or even all of the voice will be counteracted.

The will be seen by using the device and the material as part of the receiver portion 42, to form the receiver portion of the cost is relatively low. In addition, as described above, by using the CMOS chip can make the receiver part of maintaining a relatively low power consumption. Thus can be available for use in the handset of standard power supply to the receiver part, thus it does not need additional power supply or transformer. Also, although the receiver part 42 is a component for the receiver part of handheld handset 10 and telephone 8 (which is a new phone) is described, but the receiver portion or a small change in hand in existing telephone handset is used. That is, In the latter case, is included in the existing telephone hand-hold cover and a microphone in the headset are only replaced in receiver portion 42. Thus a receiver portion of such application 42 provides very simple and low-cost device to modify the existing telephone handheld handset, to include noise reduction device of the present invention.

FIG. 4 FIG. 1 FIG. 2 schematic diagram of a circuit represented by phone 8. As shown in FIG. 4, the first microphone 12 through resistance 202 connected with the input power end 200, the resistor 202 is a current limiting resistor for correcting the bias of the output of the first microphone. the first microphone 12 further connected with the positive end of the operational amplifier 16 through the resistor 210, and then through the resistor 212 and the variable resistor 214. the second microphone 14 is also a current-limiting resistance through variable resistor 208 to the input terminal 201 and the negative end of the operational amplifier 16, the variable resistor 208 is used to correct the bias of the output of the second microphone. the current-limiting resistor 208 is preferably a variable current-limiting resistor, the level of the second microphone output signal can be matched to the level of the first microphone output signal within a predetermined range of values. Specifically, the current-limiting resistor 208 can make the output signal of the second microphone 14 is weighted so as to have the same level of the signal from the first microphone 12 is output, the amplitude of the difference between them is minimal. can be minimized according to criteria to select value of current-limiting resistor 208. power end 198 connected with the resistor 204 and 206, also with the negative end of the operational amplifier 16 connected with resistors 204 and 206 for dividing the voltage received at the voltage at the input power end 198. output end of operational amplifier 16 and the capacitors 220, 222 and 226 and resistors 224 and 228, resistor 228 being connected to the telephone unit 18 of the microphone input end. output end of operational amplifier 16 also by a variable resistor 214, a resistor 216 and a capacitor 218 connected to the ground. resistors 210, 212 and 216 and the variable resistor 214 to the output terminal of the operational amplifier 16 provide, for example, a magnification factor of 20 to 1 of variable gain. capacitors 218, 220, and 222 is used to remove residual DC (direct current) level may be present in the output signal of the operational amplifier. resistors 224, 228 and capacitor 226 functions as a low-pass filter which has a 3.7KH2 at the breakpoint may be, for example, a predetermined value.

telephone unit 18 also connected to the telephone line, capable of using the receiving signal through the microphone input end and handle the signals provided to the desired one or more telephone via the telephone. the telephone unit 18 can also facilitate telephone receiving from other telephone signal, such a signal and the signal received by the input end of the microphone are combined and the combination of the signal provided to the receiver input 231. the input end 231 through the blocking capacitor 230 and a resistor 232 connected with the negative terminal of the operational amplifier 17, and then through the resistor 234

and the variable resistor 240. power supply terminal 199 connected with the positive end of the operational amplifier 17. output end of operational amplifier 17 through capacitors 242 and 244 and a resistor 246 connected with the receiver 22. the output end of the operational amplifier by a variable resistor 240, a resistor 238 and a capacitor 236 connected to ground.

Hereinafter, description phone 8 shown in FIG. 4 operation.

Once the handset 10 to be started from the switch hook (not shown) and so on, the standard telephone line voltage is transmitted to the input end 198, 199,200, and 201. has been current-limiting resistor 202 to the bias correction of the signal of the first microphone 12 transferred to the positive end of the operational amplifier 16 through the resistor 210. has been current-limiting resistor 208 to the bias correction of the output signal of the second microphone 14, transmitted to the negative end of the operational amplifier 16. subtracting the signal received from the second microphone 14 in the operational amplifier 16 from the signal received from the first microphone 12, the output obtained is the subtraction signal. removing possibly present in the output signal of the DC level and amplify the signal. then from the removed such as those more than 3.7KHz high-frequency signal, the obtained signal provided to the telephone unit 18 amplifying the output signal. Thus the telephone unit 18 provides proportional to difference between the respectively generated by the first and second microphones 12 and 14 of the voltage of the voltage signal.

the telephone unit 18 output signal (combined signal which is received through the microphone input end of receiving via the telephone) is provided to amplifier 17 input end 231. the input end 231 of the signal supplied to the capacitor 230 to remove any DC signals that may be present. the output of the capacitor 230 provided to the negative end of the operational amplifier 17 through the resistor 232. operational amplifier 17 buffer from the telephone signal unit 18, and the plus side of the received signal tone transmitted to the operational amplifier input end 231. This signal can be amplified by using the switch 40 (FIG. 1) by resistors 232, 234 and 238 and variable resistor 240 selectively by an operator. may be present in any DC signal amplified signal then eliminating by the capacitance 242, 244, and 236. the output signal of the capacitor 244 resistor 246 limiting current, is then supplied to the speaker 22, the speaker 22 is converted into the sound signal.

FIG. 5 is obtained from the first and second microphones 12 and 14 for processing so as to generate the signal respectively provided to another circuit structure of telephone unit 18 of the current output, the current output proportional to the difference of the voltage generated by the first and second microphones.

Specifically, FIG. 5 circuit structure comprises a plurality of input terminals 300, 301, 370, and 390 of the hand-hold set 10 ', each one of these input terminals are adapted to receive standard line power for use. the first microphone 12 through current-limiting resistor 302 connected with the input power source end 300 is further connected, the subtraction of the subtraction device 316 device preferably is a CMOS operational amplifier. output of the second headset 14 by a variable current-limiting resistor 308 connected with the input end of 301 is also connected with the negative end of the operational amplifier 316. signal output by the operational amplifier 316 provided by filter stage 350 to preferably a CMOS operational amplifier negative end of the subtraction device 351. filtering stage 350 provide a predetermined frequency response characteristics, such as signal roll-off at a predetermined frequency. according to see, although FIG. 5 shows two filtering stages, but can use any number of filter stages. input power supply terminal 390 connected with the resistor 392 and 394, the two resistors can reduce the signal provided to them, input power end 390 further connected with the positive end of the operational amplifier 351. the output signal of the operational amplifier 351 is transmitted to the base of the transistor 366. input power end 391 and the Zener diode 360, the capacitor 362 and the resistor 364 with the resistor 364 then connected with the collector electrode of the transistor 366 and the input end of the microphone of the telephone unit 18 connected. emitter of the transistor 366 through the resistor 367 and 368 connected with the negative terminal of the operational amplifier 351, formed to the feedback loop of the operational amplifier 351. an operational amplifier 351 and associated elements provide electrical isolation between transistor 366 and filter stage 350. transistor 366 capable of amplifying the signal supplied to the telephone unit 18.

the way of telephone unit 18 output is transmitted to the input end 231 (FIG. 4), then the described according to reference picture 4 hand-hold handset 10 is processed to provide an acoustic signal from the speaker 22.

Hereinafter, description the operation of phone 8 '.

Once the handset, the power supply from the switch hook (not shown) and so on, the part of the telephone line voltage is provided to the input terminal 300, 301, 370, 390, and 391. has been current-limiting resistor 302 for bias correction of the first microphone 12 signal is provided to the positive end of the operational amplifier 316. has been current-limiting resistor 308 to the bias correction of the output signal of the second microphone 14 is provided to the negative end of the operational amplifier 316. resistor 308 is preferably a variable current-limiting resistor, it comprises the substantially identical to the resistor 208 the described manner of the output level of the signal of the second microphone 14 can be matched with the first microphone 12 output signal is at a level within a predetermined range of values. operational amplifier 316, the output difference signal by filter stage 350 is provided, the filtering stage 350 may include one or more RC network or equivalent circuit, the upper limit frequency of the output signal is limited to a predetermined, such as 3.7KHz. output signal of the filter stage 350 is provided to the negative end of the operational amplifier 351, voltage signal from the input power end 390 (which has been voltage-divided to a predetermined value, such as half of the power) is supplied to the positive end of the operational amplifier 351, operational amplifier 351 is input to the base of the transistor 366 of the corresponding output signal. input power end 391 of the voltage supplied to the collector of the transistor 366 through the resistor 364. Thus, the amplifier signal according to the manner described above with reference to FIG. 4 the same manner, from the handset 10 to the telephone unit 18, the circuit unit 18 transmitted to the wanted telephone via the telephone, or after the receipt signal combination from a telephone and then transmitted to input terminal 231.

Because no mark in FIGS. 5 and 4 of the respective circuit element is connected and the element values for this field common technician is obvious, is not necessary for understanding of the present invention, so they are as shown connected, will not be further explained.

FIG. 6A, 6B and 6C represent the noise removing device according to the embodiment of the present invention suspended type microphone 100. Specifically, the suspended microphone 100 typically comprises a shell 174, a phone board assembly 178, the first and second microphones 112 and 114 and portion 147. housing 174 (which can be made of plastic or metallic material to manufacture) comprising a circular part with a hole, the shaft 106 can be inserted into the hole. Thus suspended microphone 100 can rotate around the shaft 106 according to FIG. 6A.

first and second microphones 112 and 114 are connected by wires 102 and 104 and circuit board assembly 178. circuit of the circuit board assembly 178 a similar to the circuit board assembly 78 of the processing from the first and second microphones 12 and 14 of the signal for transmission to the telephone unit 18 (for sake of concise, detailed description of which is no longer repeated here). Therefore, the circuit board assembly 178 from the first microphone 112 receives speech and background noise signal from the voice and the background noise signal minus the background noise signal from the second microphone 114 to generate substantially represents the voice signal. This signal is transmitted to the transmitting device (not shown), is converted to an RF signal and transmitted to the remote receiving device (not shown). first and second microphones 112 and 114 are for example fixed component can be made of foam-like material 176. 146 for example, can be made of plastic or metal material and so on of the grid screen is fixed on the cut part 147, so as to protect the first and second microphones. grid 146 may be, for example, about 0.030 or predetermined thickness of less than 0.030 inches.

can be electret microphone of the first and second microphones 112 and 114 of the first and the second microphone is placed with the handset 10 of the 12 and the 14 is the same way. That is, as shown in FIG. 5A, the first and the second microphone are arranged so that the parallel between the receiving surface of

the first microphone or sensitive surface of the plane and the voice of the operator of the direction angle is θ degrees, the angle between the axis and the voice direction of the sensitive face is perpendicular to the second microphone is ((exciation θ) + φ]. Moreover, the first and second microphones 112 and 114 are arranged to each other with an angle φ ', the inclination value of preferably between 30 degrees and 60 degrees. first and second microphones 112 and 114 of the placing position close to the grid 146 and housing 174 of cutting portion 147 so as not to receive the distortion degree is not acceptable sound.

Although the embodiment described above only with a first microphone 12 (112) and a second microphone 14 (114), but the present invention is not limited, the first and/or second microphone may have any number of microphone. For example, can the receiver portion 42 '(not shown) is designed as comprising as a first microphone 12' (not shown) for operation of the two or more than two microphones and two or more than two of the microphone as a second microphone 14 ' (not shown) to work. In this design, when using multiple microphones as the first and/or second microphone, preferably a variable current-limiting resistor are all microphone of first microphone 12 'except the one of all microphone and second microphone 14'. then respectively from the first and second microphones 12 'and 14' of the output will include several such microphone output voltage of weighted sum. preferably each determining respective current-limiting resistance value, so as to make the first and the second microphone 12 '14' of the difference and some functional minimum. for selecting the weighting function of each microphone criterion or the equivalent current-limiting resistance value can be determined according to any well-known gradient search algorithm.

FIG. 9A represents a first microphone 300 and the second microphone 302 of the microphone holder 320 shown in FIG. the first microphone 300 comprises a sensitive surface 301, second microphone 302 comprising a second pressure sensitive surface 303. shown in FIG. 9A, the first and second microphones 300 and 302 placed so that the sensitive surface of each 301 and 303 are formed about 180 degrees of corner. further a structure of reflecting plate 322 between the microphones 300 and 302. This structure reflecting plate 322 be made of a material capable of generating acoustic separation between the microphone structure components. or may be replaced by sound reflecting device structural component. In addition, as shown in FIG. 9A, the first and second microphones 300 and 302, in particular their respective sensitive surface located within a distance or dimension, b 301 and 303.

the first microphone 300 can receive sounds, such as speech from a user and converting the received sound is converted into a signal corresponding to the speech. The first microphone 300 also can receive the possibly existing background noise. If the saw, the background noise and voice of the operator, thus provided by the first microphone signal corresponding to the user voice and background noise. Conversely, placing the microphone holder in the second microphone 300 302 receives substantially only the background noise. Specifically, the second microphone 302 of the sensitive surface 303 preferably with the first microphone 300 of the sensitive surface 301 to an angle of approximately 180. Also, the first and second microphones 300 and 302 is mounted between the reflecting plate 322. The reflecting board can make the second microphone 302 for receiving at least user speech or not. Also, the first and second microphones 300 and 302 preferably are heatable very near, namely within the distance b. As an example, the distance b can be in the range of 0.10 to 0.50 inches, preferably about 0.25 inches or less than 0.25 inches. common technical personnel in the field according to the content of this specification and without excessive experiment can confirm proper distance b, the invention does not need to limit the specific value of b.

FIG. 9B represents a slightly different from FIG. 9A of the two microphones in the microphone holder 320 placing the placing manner of the first and second microphones 300 and 302 of the microphone holder 330. That is, as shown in FIG. 9B, the first and second microphones 300 and 302 placed parallel to each other. Furthermore, the reflecting plate 332 is disposed between the first and second microphones 300 and 302, according to the same manner of reflecting plate 322 FIG. 9A provides acoustic isolation of the voice.

FIG. 9C uses the headset assembly of the active noise reducing device 400. As shown, the headset assembly 400 typically comprises a headset 401, a left cover 403 and a left cushion 409 of the left shell 402,

with the right cover 405 and right cushion 410 of the right shell 404, microphone holder assembly 413, and a microphone holder 440. The microphone holder 440 comprises a can according to the above reference to FIG. 9A and to the 9B mode of the first and second microphones 300 and 302. In addition, the microphone holder 440 comprises on the microphone housing 406, the microphone housing 407, the first and second microphones 300 and 302, and sock (Windsock) 408. FIG. 9C with respect to output transducer 460 can be foam, pad of the acoustic filter 470 is a sensing microphone 450 structure. preferably a sound filter 470 is foam flows slowly, as in FIG. 23A and 23B the detailed description, such foam for forming an acoustic waveguide between the speaker and the ear of the user. partially covering the sensing microphone 450 of sound filter 470 function is separated from the sound pickup microphone and the output transducer. sound pickup microphone 450 is not necessary and the output transducer 460 can be on the same plane, and the plane of the output transducer 460, below the tangent or adjacent to the plane. not covering the sensing microphone 450 of the sound filter 470 also has the effect of 475 acoustic waveguide between the ears of the output transducer 460 and the user. As shown in FIG. 24, the acoustic waveguide 475 forming a dead zone. an acoustic waveguide coupled to the output transducer in order to improve the efficiency of the speaker 475 the ear of a user. sensing microphone 450 and loudspeaker is not on one plane of the set such that the closer to the dead and realize accurate phase noise and noise signal between the same. Furthermore, the sensing microphone 450 placed and oriented along the direction of speaker sound field microphone sensitivity lobe directional map minimized. In the active noise reducing device using the sensing microphone 450 is an omnidirectional microphone which can receive from all angles of the noise. the characteristic sensing microphone so that it can be flexibly placed in the earphone of the headset.

FIG. 9D represents a view of the headset assembly 400. As shown, the left shell 402 comprises a circuit board assembly 412, the circuit board assembly 412 may include used according to the following detailed description that is to process the sound signal of the circuit, the left shell 402 further comprises the signal transmitted to the external or host device (not shown) and receive signals from their cable assembly 411. FIG. 9E a right side view of the housing 404.

FIG. 9F represents another embodiment 450 of the sensing microphone in the noise reduction device. In FIG. 9F, the sensing microphone and the output transducer 460 adjacent, but not necessarily with the transducer are in the same plane. outside the dead zone a substantial portion of the acoustic waveguide 475 covering the speaker, microphone 450 formed in waveguide 475.

As described above, the first and second microphones 300 and 302 preferably are arranged in a distance b, and further is arranged to the first microphone 300 receives speech and background noise, and the second microphone receives substantially only the background noise. As shown in FIGS. 7A and 7B, the background noise can be emitted by pressure sound source position 304. That is, as shown, the position 304 can be connected with the first and second microphones 300 and 302 between the midpoint a distance r, an angle θ between them. Thus the first microphone 300 and the position of the distance 304 is about equal to [r - (b 2) (Sin θ)], a position the distance between 30 4 the second microphone is about equal to [r + (b 2) (Sin θ)].

FIG. 8 is a differential amplifier signal generated by microphone 300 and processing 302 to 500. As shown, the differential amplifier 500 comprises an amplifier 310, an amplifier 312 and summing circuit 314. generated by the first microphone 300 signal is transmitted to the amplifier 310, the amplifier 310 is suitable for such a signal provides a substantially 1 gain, and provides this signal as an output signal. This output signal is supplied to one input end of the adding circuit 314. signal generated by the second microphone 302 to the amplifier 312, the amplifier 312 to substantially invert a signal received, and supplies it to the second input end of the adding circuit 314. adding circuit 314 for adding the received signal, generating the output signal e (out). The saw, the output signal e of the addition (out) represent substantially only corresponding to the voice signal of the user.

FIGS. 10A and 10B more detailed representing graph 8 of differential amplifier 500. That is to say, FIG. 10A

indicates that the differential amplifier 500 of the first structure, and FIG. 10B represents the differential amplifier 500 of the second structure. Now described in more detail each of the two schematic diagram of FIG.

shown in FIG. 10A, signal generated by the first microphone 300 is provided to the input terminal 600, and is supplied to the inverting input terminal of the operational amplifier V1A via a capacitor C1 and a resistor R from the input end. the signal generated by the second microphone 302 is provided to an input terminal 602. the input terminal of the 602 connected with the resistance RA, potentiometer RA and is connected to ground. the input end 602 is further connected through the non-inverting input end of capacitor C2 and resistors R1 and 2R and an operational amplifier V1A. the operational amplifier able to work in a differential mode, the output signal supplied to the terminal 606, the terminal 606 is connected with the inverting input end of the operational amplifier V1A. the output of the operational amplifier V1A is further transmitted to the potentiometer 608, one end of the potentiometer 608 is grounded. potentiometer 608 connected through the non-inverting input end of the coupling capacitor C3 and operational amplifier V1B. the output of the operation amplifier V1B is supplied to the base electrode of the transistor 610. the emitter of the transistor (610 is connected with the terminal 612, the terminal 612, and then through the capacitor C4 connected with the output terminal 614. the added signal e (out) provided by terminal 614. the collector electrode of the transistor 610 connected with the terminal 616, terminal 616 and then connected with the power supply (not shown) of supply voltage V + to the circuit. terminal 616 and is adapted to provide a DC bias resistance R3 and R4. the specific description is not element shown in FIG. 10A is connected.

impedance used by the circuit shown in FIG. 10A, presented for the first and second microphones 300 and 302 is symmetrically balanced, so as to make the differential frequency shift between minimum. In addition, the output signal of the circuit with very low impedance.

FIG. 10B represents the graph 8 of the differential amplifier 500 of the second circuit or an alternative circuit. the circuit of FIG. 10B is suitable for receiving power from a power source (not shown) through the source resistance. That is, the circuit of the power drive 10B having a finite output resistance R of the power supply, rather than by having zero output resistance of power supply (circuit of FIG. 10A, for example). according to the circuit shown in FIG. 10B on the other hand is substantially the same as the circuit of FIG. 10A, and are therefore not described here.

FIG. 11 shows an inverter circuit, which may be used instead of FIG. 10A or FIG. 10B circuit. As shown, the circuit 700 generally comprises first and second microphones 300 and 302, amplitude adjusting resistance RA, resistor R1 and R3 and a capacitor C, their connection as shown in FIG. 11. first and second microphones 300 and 302 each of which can include a field effect transistor (FET), the drain electrode of the FET is regarded as positive (+), the source thereof is regarded as negative (-). the phase between the drain electrode and the source electrode is about 180. For example, the drain may have a phase of 180 degrees, and the source electrode has a phase of 0 degrees. Thus the first and second microphones 300 and 302 each comprise two terminals, namely positive (+) terminal and a negative (-) terminal. In the circuit of FIG. 11, positive (+) end of the first and second microphones may be the upper end, while the negative (-) ends of the microphone can be its lower end. Besides, amplitude regulating potentiometer can be adjusted or set during initial assembly of the circuit, or can be adjusted by operator of the headset assembly of FIG. 9C 400. when the sound of the same sound pressure by the first and second microphones 300 and 302 receives the output value of the signal e (out) is zero (0).

the 12 can be used to replace the FIG. 11 inverter circuit 700 of circuit 800. In the circuit 800, microphones 300 and 302 are oppositely charged. Thus, the first and the second microphone receives the sound of the same sound pressure under the condition that, once added to the output thereof, the output value of the signal e (out) is substantially zero (0). circuit part 800 is substantially the same as circuit 700 of FIG. 11, are therefore not described.

Thus, in the invention can use the FIG. 10A, 10B, 11, or 12 shown in a circuit. the circuit makes the first and

the second microphone may be a microphone of electret 300 and 302 execution of calibration processing is convenient to realize. Furthermore, these circuits may be included on a printed circuit (PC) board, the printed circuit (PC) board can be mounted in the headset assembly 400, for example, just like FIG. 9D the PC board 412. Alternatively, the PC board may be included in the other part of the headset assembly 400, or assembly 400 separated from the main device and the headset.

So the invention claims a component capable of reducing or eliminating background noise, especially the headset assembly. first and second microphone device of the invention can use the dipole effect, the two microphones can be matched by the manufacturer, or can be matched through a test after manufacture, their frequency response within the desired working range of is substantially flat. In addition, as described above, the first and the second microphone is set to make their respective sensitive surface are formed 180 degrees and approach each other closer. Through the set first and second microphone, it can make the sound (in particular background noise) emitted from the sound source (which is much greater than the distance between the two microphones to distance of the microphone) can be simultaneously receives the two microphone. Thus there is no significant phase difference between them. Furthermore, this invention further makes the noise amount during the manufacture of the headset assembly to adjust or alternatively be adjusted by the operator using such a component.

e.g. FIG. 7A 13B suspension type microphone may be based on correct placing of principle dominates in the near field and far field of omni-directional microphone directivity pattern and the pressure sensitive surface of the microphone. the structure design of the microphone shown in FIG. 9A and 9B is the determinant of the S/N ratio. thicknesses these drawings will find the best microphone sensitive surface mutually form 180 degrees, and provides optimal separation of the voice microphone and noise microphone in the near field of the signal. the main factor of such a separation is the S/N ratio of the signal. Generally, in order to obtain the signal in the far field is needed at the desired position reaches the position from all the simple sound source acoustic pressure vector addition. a basic component of this analysis is called herein " dipole acoustic receiver.

the geometrical relationship shown in FIG. 7A and 7B. assumed received from two microphones (300, 302) to generate the sound pressure P of the point A of the distance r is greater than the distance b between the two microphone (300, 302). the distance from the point A to the receiving dipole of the spherical sound wave to microphone 300 (r-b/2Sin θ), the microphone 302 has been propelled [r + b/2Sin θ). if r > b shown in FIG. 7A and 7B, the spherical wave passes through the distance is r, the output of each receiving transmitter (300, 302) are the same. If the two microphones (300, 302) of the output shown in FIG. 8 is zero, the associated scaling factors are the same. If the correlation factor thereof is not the same, then any phase and amplitude of the sound pressure of the can as shown in FIG. 8 is e (/support). it can realize the regulation of the amplitude by the means of electricity, but not necessarily both can realize the phase adjusting for all frequencies. because the reproducibility is fixed in the manufacturing of the microphone, and provide them with the output of the frequency tracking phase, so there is no need for phase adjustment. This method is called amplitude and phase the microphone lobe structure, this structure is the basis of a directional microphone of the present invention. the microphone can receive sound better on some direction than other directions.

Microphone just described are two dipole source, similar to a dipole theory. Furthermore, if the distance b between the microphone at any distance from the wavelength (λ) is very small (b < < λ), then the two microphones is substantially combined, at any frequency, to the matching ratio factor (amplitude/phase), the output of any angle will be zero. In addition, it is possible to output any angle θ the way of scaling and phasing to achieve a desired lobe intensity output. if b is not much smaller than r, then receiving the phase relation between two microphone input sound wave is φ =360bfv-(1)] wherein the spacing f b = microphone and noise sensing microphone = hz is the frequency unit

v= speed (inches per second) = φ phase shift at a specific frequency can be seen from formula (1), the

phase relationship is relative to the theoretical limit of near-field and far-field noise microphone. Due to the frequency change, under the condition that the fixing of b, phase change, that is, the φ =90 degrees, may be provided with any noise cancellation. under the condition of no sound filter, the phase change can be decisive factors of the noise bandwidth.

FIG. 7A to 13B of the invention embodiments may use microphone for noise in the far-field mode. By using this sound to obtain design reduces the effect of b, namely the acoustic design the size b in FIG. 9A is minimized or reduced to zero, and in FIG. 9B, is used to reduce the thickness of probe shown. The two designs using the relation (i.e., between b and r b < r).

In order to ensure that the near response is the desired response, a circuit filter (e.g., including FIG. 14) only allows low-pass filter present in the output frequency e (out) with the voice-frequency band = (mic1-mic2) K/ (B + W), and the limitation of the handle b and λ held within the actual constraint range.

if the number of elements is increased, and as shown in FIG. 15 uses the microphone array, the cancellation/enhancement of the lobe pattern is (θ = 90 degrees, θ = 270 degrees), θ = 0 degrees and θ = 270 degrees of the lobe pattern increases, the number of elements of a linear array is larger, θ = 0 degrees and θ = 180 degrees of the lobe pattern becomes sharp. FIG. 15 shows a microphone 922 spaced evenly for analysis in the x-axis, but the distance is not uniform. the middle pair of pitch of elements M2 and M3 is b, the outermost pair of element M1 and NN are the distance d. when the sound effect generating sine wave to the microphone, the sine wave incident to the unit or microphone array. the wave propagation direction and the midpoint of the x-axis between the unit M2 and the M3 918 form an angle θ. wave (not shown) of the amplitude is 304 measurement of the instantaneous sound amplitude at that point. distance d is the linear distance between the first microphone and the n-th microphone. These assertions are based on the same microphone and using suitable electric filter, such that when R is not substantially greater than b, the electrical filter allows the lobe structure according to mathematic method to calculate transmitter dipole. The concept of the lobe structure is familiar to those skilled in the art.

using the array to the receiving lobe is adjusted to θ = 0 degrees and θ =180 degrees, by the linear array shown in FIG. 16A the radius is a a/2 cylinder can be greatly reduce by 180 degrees lobe, wherein the value is a voice input and 180 degrees side of the physical absorbing filler 905 to fill and prevent generation of any standing wave. in the plane parallel to the microphone array or the slotted hole, the acoustic signal so as to ensure the dipole effect is θ =90 degrees and θ =270 degrees direction.

it should also indicate the microphone array of the two ends, namely 1 plus n of FIG. 16A is placed in a linear distance d along the axis of the cylindrical sound-absorbing filler 905, filler of 905 acoustic resistance. Because the distance is sufficiently large, so the microphone are independent to each other, further enhancing the =0 along the θ degree axis of sound, so as to improve the directivity.

FIG. 16B is the same of FIG. 8 B is a differential amplifier capable of processing linear array sent to amplifier 910 by microphone 900 to n-th microphone signal, and the output is input to the adding circuit 914, wherein the output signal is transmitted a last amplifier circuit A to 13B as depicted in FIG. 7 to be used in. its output signal is almost only corresponding to the voice of the user.

FIGS. 10A and 10B of the circuit and on the reference circuit described in FIG. 1 to 9 in the embodiment using the circuits are the same. U1A in the circuit for subtracting, and U1B as the output interface. the phase inverter circuit as shown in FIG. 11. if (during manufacturing) the microphone 1 and 2 are matched, then the circuit will provide the same sound signal with 180 degrees phase difference by two to the two microphone at points A and B. C can be adjusted by adjusting the RA and capacitor output, so realize the amplitude matching at the reference frequency. when the microphone is placed in the actual environment of the proper signal e (out) is the noise output.

analyzing the FIG. 11 circuit can obtain the following information. electrical angle angle of the output A from the included source of internal FET (preferably in the microphone is electret type), the output of the source has 0 relative to an input sound pressure signal, B is the output from the drain comprising internal FET in the electret microphone, the drain of the output has a 180-degree relative to an input sound pressure signal. when the two far-field signals are summed up in voltage mode, if RA by potentiometer adjusts amplitude at the reference frequency, and the amplitude response is flat in the spectral range, the output is zero.

In the circuit of FIG. 12, two signal by a microphone of the reverse charging at position A and B provide a phase difference of 180 degrees, the two signals are the same as the sound signal of the microphone 1 and 2. The phase inversion effect is realized by conducting reverse charging in the electret microphone capacitance polar plate manufacturing process.

inverting all other characteristic circuit described above. In FIG. 11 and 12 see the circuit type without using the operational amplifier to realize the subtraction mode.

position is optimal, the hanging type microphone/system of the invention by the sensitive surface of the microphone is determined, under the suspension type microphone is preferably 180 degrees, but because is a subtraction type system shown in FIG. 10A-12, so the noise effect occurs at all angles. Actually, when the microphone sensitive surface 0 angle, to each other in theory can obtain all noise, but there is no audio signal is transmitted. the system of the invention can depend on the directivity pattern of the microphone in the near field and far field, their sensitive surface of the alignment and subtraction processing of the electric mode.

can be used for subtraction of the typical circuit shown in FIG. 10A-12. The headset device of the invention (e.g., FIG. 7A-13B) is capable of providing computer speech recognition. the headset provides excellent suppression of unwanted background noise and excellent voice response. headset may be designed to be compatible with all of the Sound BlasterTM sound card. it can easily adapt to all other sound card interface.

connected with the latest high-quality speech recognition software of the invention headset (e.g., FIG. 7A-13B) using voice to improve the computer-controlled to equal the reliability of keyboard and mouse and user-friendly degree. With the invention, the speech recognition is not limited to quiet office door, but can be the real world in a noisy environment, such as used in the hotel hall, hospital emergency room, factory and office areas with noise. Thus the computer, the telephone headset can be connected with other devices or in the real world interface, or suspended microphone (telephone receiver) can be used in various speech recognition applications.

The headset of the invention is designed to be is sensitive to distance from the sound source. substantially from the microphone than any sound field noise emitted by a distance of several inches to 30dB (3200 %).

headset of the invention with 3 meter length of cable connected miniature plug (not shown) one end of the cable is 3.5 mm. in order to make it connected to the sound card, the user only needs to insert the micro plug is inserted into the sound card of the mike input socket (not shown). then the headset microphone of the invention is sent to the user. head-mounted telephone preferably has the following two characteristics, so that the microphone is placed in the proper position for reliable voice recognition: (1) which can adjust the left and right two sides of the temple (temple) pad (2) adjustable bending of the steeve. the microphone preferably suspending end can be bent at small point has a white or other color coding, to indicate the voice side of the microphone, the voice side should be opposite to the nozzle. short distance over the speaker microphone of the invention is helpful for accurate operation. distance from the nozzle to the transmitter preferably should be in the range of about 1/4 to about 3/4 inches, preferably about 1/2 inches or less than 1/2 inches.

an automatic gain control (AGC) to fail when used together with Sound BlasterTM sound card, in a denoising

application prior to using the invention on sound card is important. If the AGC function, then when the user is not speaking, the AGC will automatically make the volume of input sound increases, damage the noise performance of the microphone. it can make the AGC by running Creative MixerTM software for controlling mouse and click AGC in the " ... " recording setting conditions. using the Creative MixerTM program can easily enable the input audio gain to meet the needs of the target application. using the recording and reproducing characteristic of Creative Labs WaveStudioTM program can easily test the headset of the present invention.

FIGS. 13A and 13B is the active noise curve of a head suspension type microphone in the telephone receiver embodiments, the upper part of the curve in FIG. 13A represents the near-field response, and the lower curve represents a far field response. In FIG. 13B, the upper part of the curve represents the speaking, lower part of the response curve representing the background noise response. Typical technical index of the suspension type microphone embodiment of the present invention the following frequency response: 20 Hz to 10KHz output impedance is low-resistance (capable of driving 560 ohm) sensitivity: -47dB + 2dB (0dB=1/Pa. 1 KHz, 5 volts), the working voltage is 2 volt to 10 volt current is less than 1 mA (5 power supply) noise power: 60dB (minimum) noise: see FIG. 13B cable type non-detachable shielding cable length: 3000 +/50 plug types: 3.5, the stereo micro-plug; weight: 56 (without cable) using the speech intelligibility and ANSI S3.5-1969 specification, the suspension type microphone of the invention and standard (prior art) dynamic noise microphone for the test, the result is as follows: the intelligibility index: hanging type microphone of this invention

intelligibility index: standard (prior art) dynamic noise microphone

AI and ANSI S3.5-1969 speech can understand the description of the present invention has the accuracy of 93%, and standard of dynamic noise microphone has only 45% accuracy. comparison of the data reflects the error rate of this invention about 8:1 reduction (AI (intelligibility) standard has 45% of dynamic noise microphone, the invention has a noise of 93% AI). In addition, when the correcting constant is effectively reduced to 50 cycles 50 cycles or less, it may be desirable additionally AI. calculating the AI literally evaluation shows that for each 100 word, the present invention only 7 error, and standard dynamic microphone 55. all data and calculating the Andrea electronic company to collect and executed. testing of the two microphone system is the Andrea electronic company under the same condition.

A peripheral 17 represents a three-end circuit structure for outputting signal or from the power source standard line power in any type of microphone device of the existing technology of the input amplifier and the microphone 1004 of the square frame, it comprises an amplifier 1004 in the telephone headset is connected. the three-terminal structure comprises a power input terminal 1001, the voltage output terminal 1005 and a ground terminal 1003. In order to simply the signal processing circuit, and FIG. 17 B of the diagram represents a microphone and amplifier structure of the invention has double-end microphone. terminal 1005 receives power through the resistor 1006 input 1001 (which is a DC signal) and received from the power on the same terminal 1005 transmits audio output terminal 1003 is grounded. Therefore, on the terminal 1005, the direct current is supplied to the active noise removing system, further coexist with audio signal generated by microphone 1004. the point 1005 is shown in FIG. 18 the collector of transistor 1050.

FIG. 18 shows basic circuit for signal processing obtained respectively from the first and second microphones 12 and 14, the basic circuit is provided by the microphone signal 1060 generated by operational amplifier 1070 output audio signal output 1050 and the terminal 1020 through the direct current input of the resistor 1005, the signal and DC power are occurred at the same time on the same terminal. That is, the output audio signal and providing DC power on the same terminal 1015. need of a separated at

point 1035 of the direct current and alternating current, this method preferably is connected with the capacitor 1040 the resistor 1030. at point 1035 obtained by direct current for power supply to the operational amplifier 1070 and the microphone 1060, the point 1015 of the terminal is used for outputting audio signal. to transmit to the capacitor from the collector of transistor 1050 at point 1015, audio signal (C) of the resistor R 1040 is connected (1030) to make the AC signal and the DC signal. a low-pass filter connected with the capacitor of the resistor forms provide AC (audio) and DC (power supply separation), which filtering AC from DC. point 1015 of the AC and DC signal at point 1035 is separated, because the resistor 1030 out of the capacitor 1040 filtering effect, so the point 1015 only allows DC. an audio output point 1015 of the AC signal generated by microphone 1060. the preferable device due to the subtraction of the microphone, this separation is for the operation of the invention. at 1015, the input end of the AC signal and DC power is transmitted to the resistor 1030. AC signals are then connected with capacitor 1040 resistor 1030 for filtering, direct current for supplying power to circuit 1070. audio signal (which is an AC signal) is transmitted as an output signal at 1015.

DC (current) signal of a different embodiment shown in FIG. 19 represents a line microphone, input power supply 2020 through the resistor 2005, generated by the same lead 2015 is transmitted. Therefore, the collector electrode of the transistor 2050 the output of the audio AC (alternating current) signal at point 2015 of the same terminal is superposed on a DC signal, and the combined signal is provided to the resistor 2030. AC component is then connected with the capacitor circuit 2040 resistor 2030 for filtering, rest of the DC signal for supplying power to circuit 2055 comprises an operational amplifier 2070. audio output signal transmitted at 2015 AC signal output by two microphones 2060, the signal is generated by circuit 2055 and an operational amplifier 2070 (these circuits are commonly understood by those skilled in the art) to be processed, and on the point 2015 of the same terminal is output. the double-wire microphone circuit shown in FIG. 17A comprises an input end, a voltage output end and the grounding end of the three-wire microphone circuit is much simple. any one circuit of the double-wire microphone circuit can be described in figure 4-5, 10-12 in use, in these circuits, signals produced by at least two microphones. In addition, the two-wire transmitter circuit further can be shown in FIG. 14-16 used in the far field directional microphone.

FIG. 20 uses two-wire microphone circuit of an alternative embodiment of FIG. 19, the same lead-terminal 3015 audio signal output and power input. the collector of the transistor 3050 to generate the AC signal with the power supply 3020 through the resistor 3005 to feed DC power signal are output on the same one of the lead terminals 3015. Therefore, the AC signal is superimposed on the input DC signal at 3015, the combined current (AC + DC) signal is transmitted to the resistor 3030. AC component of the AC and DC signals combined at the position of the resistor 3030 connected with the capacitor circuit 3040 for filtering, rest of the DC signal for driving other circuit 3055 and an operational amplifier 3070, the circuit 3055 is commonly understood by those skilled in the art. the microphone circuit 3055 and the 3070 output of the AC audio signal is transmitted on the same terminal supplying DC at the point 3015, the DC is provided to the active noise system as described.

each circuit element not represented by reference numbers in FIG. 19-20 are shown in the figure as connection, and are not discussed, because its connection and value is obvious for those skilled in the art, and are not necessary to the understanding of the present invention.

FIG. 21 shows the active noise of the existing technology uses a closed loop system. the basic formula is: P=S [H1H2 + H21 + BH1H2) + (11 + H2) N]] wherein P represents a test sound pressure, S is an audio signal, H1 is a high pass filter, H2 is the speaker of the headset, B is a variable gain/phase control, N is the noise pickup microphone. Because transmission gain (1 + BH1H2) is very large, so the noise component (N) 1210 P (output 1200) is zero. In order to make the electrical signal as the input of the desired audio signal (S) 1220 is not eliminated, added with two addition node (1230, 1240). audio signal 1220 input to the two nodes (1230, 1240) to generate the signal transmitted to the ear of a user. a first addition node 1230 with the negative feedback signal of the input audio signal. However, the feedback from the microphone signal includes the desired audio signal and the ambient noise signal, the noise signal is needed to be signal cancellation. from the input audio signal 1220 is subtracted from the feedback signal to generate a noise

signal does not contain audio signal 1250. the second addition node 1240 the audio signal 1220 into the loop, so as to transmit it to the loudspeaker.

FIG. 22 relates to active noise removing system of the invention, by the formula P=AH2 - (N + D) BH1H2 + N1. in the formula, P represents 1330, A represents the standard audio transmission 1340, H2 representing the headset speaker 1370; N is the noise at the sound pickup microphone 1315, D represents the very-low-frequency interference 1320, B is a variable gain/phase controller or the calibration cartridge 1350, H1 represents the high-pass filter 1380, N1 is the noise area at the ear of the user 1390. the active noise reduction system has the following elements by an open loop circuit is composed of audio signal 1340, is capable of detecting and eliminating the noise 1315 of the sensing microphone 1310, located near the ear of a user of the output transducer 1370. adjusting the amplitude of the noise signal 1315 with variable gain/phase controller 1350, the noise signal and the audio signal 1340 of the addition node 1360, preventing mechanical vibration frequency generated by the interference component 1320 to an output transducer of the high pass filter 1380. the system through the microphone or sound pick-up microphone sensor detecting ambient noise 1315 and the acoustic treatment to generate a cancellation acoustic signal of environmental noise. The system can be used to eliminate all noise, obtaining the representative speech signal, the signal is the desired signal will be heard by the user ear.

active noise reduction system of FIG. 22 by using the sensing microphone 1310 detects noise 1315 and generates the input noise signal (N1) 1315 of the same amplitude but opposite phase noise signal of 180 to remove noise at a specific position in the space. by adjusting the variable gain/phase controller 1350 generates the noise signal 1315 the same amplitude but opposite phase 180 of the noise signal, and the input audio signal 1300 and the noise signal to obtain the anti - audio signal in a summing node 1360, thereby attenuating the environmental noise and the input audio signal 1300 is not generated by the mechanical vibration of the microphone signal is deteriorated.

The invention of variable gain/phase controller or the calibration cartridge 1350 remote coordination or balance the output speaker of the sensor microphone and headset or any other communication device, the communication device comprises an earphone, the earphone also has used for transmitting voice of the microphone device. the frequency of the noise signal of the controller or the calibration cartridge balance pickup microphone 1310 detects the response of the gain and phase to make it in the spatial gain and phase of the noise component signal is the same as a predetermined position. the position in the space close to the output transducer is located at the headset earphone. Because the microphone is very close to the output transducer and the frequency response of the output transducer is a linear phase component of the noise signal is generally very flat. by independently adjusting the gain of the signal and the phase of the microphone and the output transducer of the headset in the active noise reducing device to make them earphone in accordance with the gain and phase can be at a position of the space to generate a theoretically zero point or a dead zone. Generally speaking, by adjusting the gain and phase of the ambient noise signal into noise signal so as to space a predetermined position that static noise component area is counteracted. a gain/phase controller or the calibration cartridge of the invention makes the headset can be flexibly applied to any communication system, a flight control system, a computer interface, a telephone network and so on, and this is because the headset has strong adaptability and can be applied to any of the communication system.

Therefore, the desired audio input signal 1340 is transmitted to the output transducer of the earphone is not interfered by background noise. output audio signal reaches the ears of users has the formula P=AH2, it is originally input to the headset or the like of a desired audio transmission. ring-opening design reduces the complexity of the noise of all types, repeated are eliminated and the instantaneous noise.

de-noising system shown in FIG. 22 can be referred to as not open loop system of closed loop feedback compensation. FIG. 22 system by using variable gain/phase controller 1350 to adjust the open-loop system parameters and/or to correct the sensing microphone sound filtering method capable of driving a speaker. the best acoustic filter is a specially selected using foam, the foam preferably is slowly flow shown in FIG.

23B (Slo-Flo). sound pickup microphone 1310 the acoustic channel 1400 formed between the speaker of the headset 1370 or any suitable speaker and ear of a user relative to the placement of the speaker and foam. placing the handle of the microphone audio signals to the ear of the user and any audio signal with the pickup microphone 1310 detects noise separated. sound pickup microphone 1310 preferably with the speaker are not on the same plane and out of the acoustic waveguide, but close to the ear of the user, the ear is formed a dead zone as shown in FIG. 24. the dead zone of FIG. 24 maintains the same phase of the noise signal picked up by the microphone and between the sound wave guide after the speaker of the noise signal. The invention and is substantially independent of the microphone and speaker of the same plane. they can be in the same plane, however, they are not necessarily in the same plane. The noise reduction device of the invention relates to using acoustic filter between a speaker and an ear of a user of the device to form an acoustic waveguide to convert the audio input signal into the ear canal of the user and not be detected by the sound pickup microphone 1310 any noise interference (the noise has been eliminated). when the phase difference is 90 degrees or 1/4 wavelength can no silencing effect to obtain the enhanced noise at 180 or 1/2 wavelength condition. dominating the distance formula is: φ = lf360v]] > wherein φ = specific frequency phase n= Phif frequency v= (inches per second) shown in FIG. 22 the open loop formula of H1 transfer function 1380 is a high pass filter. in the frequency range, the high-pass filter is effective at H1=1, while the H1 0 is invalid. the high-pass filter 1380 is in a conventional manner suppress the transient phenomenon caused by low frequency mechanical vibration to make the active noise reducing performance continue in a conventional manner, but not according to the standard closed loop feedback system is used as the pre-stabilizing network. formula, in open loop in FIG. 22 The invention is position of the breakpoint, the breakpoint position provides the best performance of the device. breakpoint is amplitude from zero (0) reaches the position of the passband edge. below the break point in the frequency range, H1 is about 0, and the product (D * H1) = 0. adjusting step is as follows: P=AH2 - (N + D) BHIH2 + N1 becomes P=AH2-NBHIH2 + N1, if the adjustment is B NBHIH2=N1, P=AH2, which is the desired audio signal.

on the breakpoint, H1=1 and D=0. product H1D=0, the same reasoning, P=A * H2, which is the desired audio signal. the correct position and slope transition point specifies the most preferred active noise reduction and the optimum interference. Because the inherent stability of an open-loop system, a low-frequency signal of the mechanical vibration can be filtered by the means of electricity and will not obviously increase the complexity of circuit, and it also does not need to satisfy closed loop stability requirements.

image measurement of the transfer function 22 shows open-loop concept is present in an embodiment of the present invention. from N to P transfer function shows that the amplitude is less than 1, if the system is a closed loop system of G=1, H=1, the maximum noise is 50%. CLTF=eoutein=G1 + GH]] >, if GH <1 G <1eoem=11 + 1=12,]] > eo=12ein]] > under these conditions, the open-loop system actually will reach 100 % of noise.

In the invention, is increased as shown in FIG. 22 the second addition node. However, closed-loop denoising system of existing technology as detailed in FIG. 21 for two times sum to reduce the pickup microphone to sound. The invention relates to eliminating only the noise microphone 1310 is detected, and the microphone is independently from the transmission to obtain desired audio signal 1340 to the speaker of the audio signal, so the system displays only use one audio summing node 1360 has no audio is reduced in FIG. 22.

structural diagram of a muting device active of the invention shown in FIG. 23A and 23B. FIG. 23B the acoustic waveguide 1400 can perform the following functions: 1) any one of functions conducting sound and 2 between speaker 1410 and ear of a user 1430) is isolated from the speaker/user ear 1430 of the dead zone 1440 the sound to noise pickup microphone at the speaker edge 1420. the device of the invention of structure design element may take any of the following forms in one of 1) noise pickup microphone and dead spaced very close between the phase noise and the noise signal strict compliance, 2) the microphone placed; orientation and isolating the microphone sensitivity lobe pattern along the direction of speaker sound field minimum, 3) using acoustic filter or septum 1440 (preferably using slowly flow (Slo-Flo) foam), but can also use other suitable materials for forming an acoustic waveguide. an acoustic waveguide as shown in FIG. 23A the noise pickup microphone and receiver are separated, as shown in FIG. 23A in front of the user

ear forming dead zone 1440 to improve the efficiency of the speaker. an acoustic waveguide function as a receiver, for receiving the electric signal of the microphone noise signal generated by the signal processing device. quiet the noise signal generating an acoustic waveguide. an acoustic waveguide device can be applied to any type of back cover with open head-wear earphone, namely non-ear-shaped object of the passive headset or after sealing cover headset, which has passive noise reduction earphone or receiver and by the transducer of any other suitable headset.

FIG. 24 is a measurement of a dead space, wherein the first vector 1500 is the noise vector and the second vector is an active noise reduction system of the present invention generates noise vector 1501. the two vector form an angle θ, variable gain/phase controller for attenuating the amplitude, so as to control and reduce the electrical input signal distortion caused by the noise processing of the electric input signal is transformed into an acoustic signal and is transmitted to the ear of a user.

FIG. 25 shows a detailed schematic diagram of the active noise reduction system shown in FIG. 22. the schematic diagram comprises a pickup microphone 1600, a loudspeaker 1650, a variable gain/phase controller 1610, a signal converter 1620, a summing amplifier 1630, a power amplifier 1640, an anti-noise output signal 1660. standard audio signal 1605 input to the user of the headset. sensing microphone 1600 detects ambient noise and generate an electrical signal. a sound signal of the signal input to a sound processing unit is composed of a variable gain/phase controller 1610, a signal converter 1620 and a summing amplifier 1630 to generate for cancelling ambient noise, the sound signal is output at 1600 of noise signal. the noise signal is placed in the space of the speaker at a certain position of the front, in order to generate a dead zone shown in FIG. 24. the desired input audio signal 1605 with the pickup microphone separated such that the input audio signal is independent of the sound pickup microphone 1600 detects ambient noise. the original input audio signal 1605 is not interfered by noise through the speaker enters the dead zone. Therefore, in the open-loop system of the invention, an active noise reduction system produces an audio input signal is not affected by the ambient noise, the ambient noise detected by the sensing microphone circuit and decrease the sensing microphone circuit comprising: a variable gain adjuster 1610, a signal converter 1620, a summing amplifier 1630 and power amplifier 1640. Thus no need to added twice like the audio input signal 1605 in a closed loop system.

FIG. 26 shows an embodiment with a different example to FIG. 25, it is an active noise reduction ring-opening system embodied using the sensing microphone 1700, variable gain/phase controller or the calibration cartridge 1710. The audio signal converter 1720, amplifier 1730, power amplifier 1740 and speaker 1750. operation of the circuit with reference to FIG. 22 and description 25 are the same.

FIG. 27 is a preferred embodiment of FIG. 25, to the active noise removing system is added with a high-pass filter circuit 1840 according to conventional method to inhibit transient phenomenon generated by low frequency mechanical vibration, making it not noise reduction performance for the active causing interference. the high-pass filter circuit 1840 not in a standard feedback system to be used as the pre-stabilizing network. FIG. 27 further comprises a saturation reduction circuit for clamping diode 1860. In FIG. 27, clamping diode function is to prevent the output transducer has reached its physical limit. is the amplitude of the signal to limit the input to the transducer, preventing the speaker or output transducer exceeds its physical value.

each circuit element not represented by reference numbers in FIG. 25-27 are shown in the figure as connection, and are not discussed, because its connection and value is obvious for those skilled in the art, and are not necessary to the understanding of the present invention.

FIG. 28 a has a speaker through an enhanced version of active noise eliminating function and noise used in the headset system.

FIG. 28 is enhanced by comprising the following function to achieve active noise removing system for automatically detecting speech in audio microphone transmission (VOX circuit ") 1950. gain the capability

("side tone circuit") 1960, 1907, 1970, and 1930 receive a portion of the microphone signal is transmitted to the earphone speaker, by removing the voice microphone from the circuit and improve noise microphone amplifier ("talking") of the active noise eliminating microphone into standard omni-directional ability of the microphone 1930. using " speaking " function, all the sound (1990) outside is increased by gain sidetone channel 1907 to the ear speaker 1980. FIG. 28 enhanced active noise and noise-reducing headset telephone receiver comprises: only detecting active muting the microphone audio signal 1900 and detecting the audio signal and the background noise of the active noise microphone 1901; a first S1A switch-mode and speaker mode or position of 1910, a noise cancelling mode and speaking second mode of S1B switch 1925, a noise cancelling mode and speaking the third S1C switch direct mode, microphone position with the working and push-to-talk (PTT) switch 1920 imitates the voice signal mode; active noise microphone amplifier 1940, VOX circuit 1950, voice signal 1955, transmission gate 1945, a buffer amplifier 1935, an audio system 1915; a gain control function 1907 of the calibration amplifier 1970, at 1906 the input of the side tone signal 1960, ear speaker 1980 and an external audio system 1990 and is best shown in FIG. 21-24 and refer to these drawings the described active noise reduction system. one head of the FIG. 28 wearing the telephone receiver is not is in speaker mode to work according to the muting mode.

in elimination mode, the switch S1 is in the "N" position 1910, active noise microphones 1900 and 1901 described above to work. PTT (push to talk) switch 1920 in the noise mode is not working. at point A (1945) and the microphone the microphone output end of the operational amplifier 1940 connected with the VOX circuit 1950 monitoring amplifier 1940 of the microphone output signal. VOX comprises starting time (the time of the averaging circuit connect the audio) and recovery time (time averaging circuit off audio), it is adjusted to the response of minimizing spurious signals and the microphone in the noise mode on-time keeps shortest. doing so will improve voice and noise ratio S/N of the system ". Once the VOX1950 confirmed the microphone output end of signal is an audio signal, it is the C point (1955) of the voice signal is valid, the speech signal will start the transmission gate 1945, the active noise microphone amplifier device 1940 can enter the microphone audio signal output buffer amplifier 1935, and then enters the audio system at the point E (1915). Here the audio signal 1915 on W (1906) is transmitted to the scaling amplifier 1970, when the third switch S1C (1960) is in N position (noise mode) to the sidetone signal to the ear speaker 1980. scaling amplifier 1970 also can receive input from the external audio system 1990, that sound different from the surroundings, such as bell sound, sound of human presence or not other external sound by the microphone 1900 and transmitted 1901. is the linear addition of tone 1960 and external sound 1990 at the ear speaker 1980 of the combined signal.

in the talking mode, switch S1 (first, second and third switches 1910, 1925, and 1960) is in talking mode or display of 1930 position. a voice microphone 1900 does not work. the voice and the noise microphone 1901 work. microphone amplifier 1940 the output of point A (1905) is the noise to the output of the microphone 1901. in the talking mode, VOX circuit 1950 is in the second switch S1B (1925) bypass the straight position of the noise omnidirectional microphone signal 1901 output to the D point (1903) directly into the buffer amplifier 1935 and is then output to the audio system 1915 at the E point. Thus, because the gate 1945 is disabled, the output end at the transmission point B (1904) door 1945 has no voice signal is output. Because in the speaking action of switch S1C (1960) through position 1930, the W (1906) is reinforcing scaling amplifier 1907 gain control function 1970. Then (FIG. 21-27) active noise system output of the side tone signal at the speaker 1980 is increased.

Because the device described in FIG. 28, actually does not increase any other microphone component when 27 shown in to FIG. 9 and reference to the figure description of the headset increases the talking function. this function so that no headset can hear the voice in the earplug-typed speaker 1980 of audio transmission. This enhancement to the headset provides the user wearing the headset to receive microphone audio signal transmitted by and in the surrounding environment of any other distinct noise outside selection. This external noise can be any sound, such as explosive emergency bell sound or talking to head-wear headset user presence of a human voice. This enhancement avoids unsafe continuously headset for listening is not in headset noise outside the through signals transmitted is inconvenient. the external sound the user can wear shown in FIG. 28 and with reference to active noise reduction described in the map and de-noising device,

while listening to the internal audio signal and from the surrounding environment.

In addition, although the description of the embodiments of the present invention use of the telephone handset and suspension type microphone, etc., but the invention is not limited to this, it can be applied to many other devices, such as internal communication system, telemetry technology, an acoustic monitoring microphone, a directional microphone, and so on. In addition, the invention also can be used such as voice recognition and/or verification system such a system for accessing the actual facilities, access to a computer program, computer or vending machine access and so on. Also, the invention can be also applied to according to a predetermined processing algorithm, such as described in US Patent US5251263 processing algorithm for the operation of the processing device, and the present application have a common assignee, which is referenced to the, as a reference, but doing so is not necessary for this invention.

In addition, although the detailed description of a preferred embodiment of the present invention and the improvement in the, but should understand the invention is not limited by these specific examples and the improvement of limiting, and those skilled in the art that other improvements and change can be made without violating the spirit of the invention defined by the appended claims and not beyond its range.

Claims

1. noise eliminating device, comprising: a housing having first microphone device and the second microphone device, the first microphone device is used for receiving the first sound sent by operator by operating the muting device for voice and background noise, and for converting the first sound transforming the first signal, the second microphone device abuts the first transmitter device and the second sound at a predetermined angle φ is set for receiving consists essentially of the background noise and for converting the second sound is converted into a second signal; and a subtracting device of the second signal from the first signal to obtain a substantially representative of the speech signal.
2. noise removing device according to claim 1, wherein at least one of said first and second microphone device comprises a plurality of microphones.
3. double-end transducer for reducing background noise in the de-noising device according to claim 1, comprising: a plurality of microphone muting device connected with the amplifier device, the amplifier is applied to the microphone receiving the audio signal with the first terminal and a second terminal, wherein the second terminal is grounded. voltage device, input direct current signal on the first terminal connected with the first terminal of the transistor device, for receiving the AC signal from the microphone for at the first terminal the AC signal superimposed on the direct current signal, a device for filtering the AC signal from the DC signal device so as to use the DC signal to the amplifier device, and power supply for output device of the AC signal generated by the microphone at the first terminal.
4. double-end transducer according to claim 3, wherein the amplifier device is an operational amplifier.
5. according to claim 3, wherein the double-end transducer for filtering the AC signal from the DC signal device is a resistance circuit connected with the capacitor.
6. the opposite active de-noising device of suspension type microphone speaker used for obtaining far-field response of a directional microphone, in a variety of different directional receive sound, comprising: a) a shell, a spaced array of microphone device. electric signal is used for receiving the sound signal and outputs a, b) between the microphone distance as a sine wave having an amplitude and a phase of an input sound source of the shell, the sine wave to form an angle with the microphone at a predetermined distance, c) for calculating device of the distance from each microphone to the sound source; d) for the output signal of the microphone array are added to channel device obtains a sum output signal, e) for generating voice represented by the sum of the output signal of the acoustic signal in the signal processing device, and f) for adjusting the amplitude of the sum signal to produce a device of desired response mode.
7. a directional microphone according to claim 6, wherein, wherein the microphone device includes a first microphone and a second microphone.
8. a directional microphone according to claim 6, wherein the distance from each microphone to the sound source is larger than the distance between the microphone.

9. a directional microphone according to claim 6, wherein the device for calculating the distance from the first microphone to the sound source is equal to (r - (b/2) (siu θ)].
10. The directional microphone according to claims 6 and 7, wherein the device for calculating the distance from the second microphone to the sound source is equal to (r + (b/2) (siu θ)].
11. a directional microphone according to claim 6, wherein the signal processing device has for each microphone in the microphone array operational amplifier of the differential amplifier.
12. a directional microphone according to claim 11, wherein, wherein, the operational amplifier can provide unity gain and provide the same signal as an output signal to the signal generated by the first microphone.
13. a directional microphone according to claim 11, wherein the operational amplifier of which can substantially inverted signal generated by the second microphone and provide the same signal as an output signal.
14. a directional microphone according to claim 6, wherein the channel device is an operational amplifier of the microphone device can be spaced apart for receiving the output signal of the addition circuit.
15. a directional microphone according to claim 6, wherein, when the sum of output signal is not zero, for adjusting the amplitude of the surface acoustic wave device comprises a circuit.
16. a directional microphone according to claim 6, wherein when the phase angle is zero degrees, wavelength spacing compared with the surface acoustic wave between the microphone is reduced.
17. a directional microphone according to claim 16, wherein the space by the sound filter is reduced.
18. a directional microphone according to claim 17, wherein the acoustic filter is a sound insulation board.
19. active noise reducing device for reducing ring-opening environmental noise near the tympanic membrane, comprising: a shell for receiving the input audio signal, the output transducer in the shell; and the output transducer are not in the same plane, for detecting and reducing environmental noise of the input transducer; reducing the open loop signal processing device for environment noise of the input transducer detection for not interfered by environmental noise in the input audio signal to the tympanic membrane of the device; the output transducer and the input transducer separated so as to form a path of input audio signal mainly representing speech between the output transducer and eardrum acoustic device. wherein forming the dead zone is isolated from the input transducer to transmit sound.
20. active noise reduction device according to claim 19, wherein sound device, wherein when the input transducer is placed is an acoustic filter, and when it is placed in between the output transducer and the eardrum is an acoustic waveguide.
21. open-loop active noise reduction device, comprising: a shell with earphone; placing in the earphone, for detecting microphone device of unwanted ambient noise, the noise is converted into an electrical signal, phase-shifting and attenuating device noise signal connected with the microphone device, so as to provide an inverted; substantially different from a plane with the microphone device, for transmitting the audio signal to the output transducer of the user ' s ear for preventing low frequency interference generated by the mechanical vibration transmitted to the output transducer, a device used for generating very near the dead zone of the output transducer; for preventing unwanted environmental noise from reaching the ear of a user of the device.
22. in a suspended microphone headset using open-loop active noise reducing device for reducing reaches the ambient noise in the ear of a user without interfering with output to a desired listener ear audio signal, the noise reduction device comprising: earphone of the headset for detecting pickup microphone earphone; a noise signal for the noise signal into ring-opening device of electric signal, for the function of the electric signal to the earphone to generate inverted 180 degrees with ambient noise electro-acoustic device of sound signal; placing in the earphone with sound filter and the output transducer, the acoustic filter is used for transmitting the voice to the ear of a user and to prevent low frequency interference generated by vibration reaching the ear of a user.
23. and the active de-noising device open loop noise reduction system, comprising: means for detecting noise signals so as to converting it into electric signal of the sound pickup microphone, placed in the head worn microphone, comprising a sound device speaker, audio transmission signal; a device for vibration in electrical way inhibiting an electrical signal for inverting the noise signal to generate the variable gain/control device, a noise signal for filtering low-frequency interference generated by the mechanical vibration by preventing it from reaching speaker device, for combining the noise signal and noise signal to generate a

dead zone in the acoustic device of the addition node; for the audio signal to the speaker, and a device for phase consistency of the device holding the noise signal between the noise signal and the loudspeaker.
24. open loop noise reduction system according to claim 23, wherein inhibiting the low-frequency response is a high pass filter.
25. open loop noise reduction system according to claim 24, wherein the static device is an acoustic filter.
26. noise reduction system according to claim 23, wherein, the active de-noising device comprises a housing having first microphone device and the second microphone device, the first microphone device for receiving operator by operating the muting device sends the voice and the background noise and for converting the first sound of the first sound is converted into the first signal, the second microphone device abuts the first transmitter device and a second sound at a predetermined angle φ is set for receiving consists essentially of the background noise and for converting the second sound is converted into a second signal; and a subtracting device of the second signal from the first signal to obtain a substantially representative of the speech signal.
27. active noise reducing device for reducing ring-opening environmental noise near the tympanic membrane, comprising: a shell for receiving the input audio signal, the output transducer in the shell; in the shell, for detecting and reducing environmental noise of the input transducer; reducing the open loop signal processing device for environment noise of the input transducer detection for not interfered by environmental noise in the input audio signal transmitted to the tympanic membrane of the device, the output transducer and the input transducer separated from the sound device so as to form a path of the input audio signal mainly representing speech between the output transducer and eardrum. and forming the sound device sound quiet to isolate from the input transducer.
28. noise reduction system according to claim 23, wherein the variable gain to adjust/control device automatically so as to butt with the communication system.
29. The active noise shown in FIG. 28 and the active noise reduction system.
30. for transmitting audio signals from the microphone and for receiving source noise in the headset from external sound around environment and noise reduction system, comprising: a first switch device with de-noising mode and speaker mode of first microphone apparatus and the second microphone device, the second switch device by having a noise cancelling mode and speaker mode and is connected to the microphone amplifier device, a microphone for the first switch device and the second switch device to work in denoising mode audio microphone transmission device connected to the amplifier device. wherein, when the first switch device and the second switch device works in the talking mode, the microphone transmission device is bypassed for the first switch device and the second switch device to work in elimination mode, the audio signal of the two microphone devices to the transmission gate of the buffer amplifier. wherein when the second switching device operates in speaker mode when the transmission gate is disabled, the buffer amplifier device for working in elimination mode when the first switch device and the second switch device when the audio signal received from the transmission gate is transmitted to the audio system and scaling amplifier; the buffer amplifier device used for directly outputting the audio signal received by the microphone amplifier device when the first switch device and the second switch device working under straight-through model speaking, the scaling amplifier comprises a noise cancelling mode and specifies a third switch device through mode; the whole switch device transmitted by the two microphone device and the sound from the outside of the side tone signal transmitted to the earphone loudspeaker, the scaling amplifier with gain control are operated in the muting mode, wherein when all the switch device operates in speaker mode when increasing the gain control to increase the tone.

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权利要求书5页 说明书38页 附图页数30页

[54]发明名称 消除噪声和减小噪声的设备

[57]摘要

本发明涉及与头戴送受话器或连接到悬掛式话筒装置等的悬掛式头戴送受话器一道使用的、用于减小环境噪声的方法和设备。该设备可以包括检测背景噪声信号的传感话筒、想要的输入声音传输、以及用于消除噪声信号以便在与头戴送受话器的耳机相邻的声波导内产生反相抗噪信号的信号处理装置。本发明的减噪方法由一开环电路来提供,该开环电路允许来自操作者或呼叫者的输入音频信号不受不希望有的环境噪声干扰地被传送至用户耳朵。该方法调整用于消除在声波导内被检测的噪声分量的噪声信号的增益或/和相位,以便为要被传送的想要的话音产生一静区。该设备还可包括消噪话筒发射器系统,该系统内的第一和第二话筒的安放使得第一话筒接收想要的话音输入和在话音附近存在的背景噪声,而第二话筒基本上只接收背景噪声。第二话筒的背景噪声被变换为相应的电信号并从相应于第一话筒的话音和背景噪声的信号中被减去,以便产生主要代表话音的信号。有源消噪和减噪系统因具有以下功能而得到增强:通过检测话音的自动音频话筒传输("VOX"电路),利用增益被增大的侧音通道把一部分话筒信号传送给耳塞式扬声器("侧音"),以及通过从电路设计中去除话音话筒和增大噪声话筒放大器的增益来把有源消噪话筒变换为标准全向话筒。根据本发明,在需要远场响应时,第一和第二话筒可被用作为定向话筒。本发明的方法还涉及双端头话筒结构的应用。

ISSN1008-4274

Apple Inc. Exhibit 1015 Page 1634

权　利　要　求　书

1.消除噪声设备，包括:

外壳，具有第一话筒装置和第二话筒装置，该第一话筒装置用于接收由操作所述消噪设备的操作者发出的话音和背景噪声组成的第一声音和用于将所述第一声音变换为第一信号，该第二话筒装置紧靠着所述第一话筒装置与其成预定角度ϕ设置，用于接收基本上由所述背景噪声组成的第二声音和用于把所述第二声音变换为第二信号；以及

用于从所述第一信号中减去所述第二信号的装置以便获得基本上代表所述话音的信号。

2.权利要求1的消噪设备，其特征在于，其中所述第一和第二话筒装置中的至少一个包括多个话筒。

3.在权利要求1的消噪设备中用来减小背景噪声的双端换能器，包括:

与消噪设备的放大器装置连接的多个话筒;

该放大器装置用于从具有第一端子和第二端子的话筒接收音频信号，其中第二端子接地。

电压装置，在第一端子上输入直流信号;

与该第一端子连接的晶体管装置，用于从话筒接收交流信号;

用于在该第一端子处把交流信号叠加在直流信号上的装置;

用于从直流信号中滤除交流信号的装置，以便用该直流信号给放大器装置供电；以及

用于在该第一端子处输出由话筒产生的交流信号的装置。

4.权利要求3的双端换能器，其特征在于，其中放大器装置是运算放大器。

5.权利要求3的双端换能器，其特征在于，其中用于从直流信号中滤除交流信号的装置是与电容器电路连接的电阻。

6.在对着有源消噪设备的悬挂式话筒说话时用来获得远场响应的定向话筒，它以各种不同方向性图接收声音，包括:

a)外壳，装置了间隔开的话筒装置的阵列，用来接收声信号和输出具有在这些话筒之间的间距的电信号;

Apple Inc. Exhibit 1015 Page 1635

b)作为具有振幅和相位的正弦声波输入该外壳的声压源，该正弦声波在预定距离处与话筒交叉以形成一个角度；

c)用来计算从每一话筒至声源的距离的装置；

d)用于把话筒阵列的输出信号相加以获得一总和输出信号的相加通道装置；

e)用来产生只代表总和输出信号中的话音的声信号的信号处理装置；以及

f)用来调整总和信号的振幅以产生所希望的响应模式的装置。

7.权利要求6的定向话筒，其特征在于，其中的话筒装置包括第一话筒和第二话筒。

8.权利要求6的定向话筒，其特征在于，其中从每一话筒至声源的距离大于话筒之间的间距。

9.权利要求6的定向话筒，其特征在于，其中用于计算的装置计算出从第一话筒至声源的间距等于[r －（ b/2 ）（ siuθ ）]。

10.权利要求6和7的定向话筒，其特征在于，其中用于计算的装置计算出从第二话筒至声源的间距等于[r ＋（ b/2 ）（ siuθ ）]。

11.权利要求6的定向话筒，其特征在于，其中信号处理装置是具有用于话筒阵列中的每一个话筒的运算放大器的差分放大器。

12.权利要求11的定向话筒，其特征在于，其中运算放大器能够提供单位增益给由第一话筒产生的信号并提供相同的信号作为输出信号。

13.权利要求11的定向话筒，其特征在于，其中的运算放大器能够基本上反相由第二话筒产生的信号并提供相同的信号作为输出信号。

14.权利要求6的定向话筒，其特征在于，其中相加通道装置是能够从间隔开的话筒装置的运算放大器接收输出信号的相加电路。

15.权利要求6的定向话筒，其特征在于，当总和输出信号不是零时，用于调整球面声波的振幅的装置包括一电路。

16.权利要求6的定向话筒，其特征在于，其中当相角是零度时，话筒之间的间距与球面声波的波长相比被减小。

17.权利要求16的定向话筒，其特征在于，其中该间距被声滤波器减小。

18.权利要求17的定向话筒，其特征在于，其中声滤波器是隔音板。

19.用于减小鼓膜附近的环境噪声的开环有源减噪设备，包括：

Apple Inc. Exhibit 1015 Page 1636

用于接收输入音频信号的外壳;

位于外壳内的输出换能器;

与输出换能器不在同一平面内的、用于检测和减小环境噪声的输入换能器;

减小由输入换能器检测的环境噪声的开环信号处理装置;

用于不受环境噪声干扰地把输入音频信号传送给鼓膜的装置;

把输出换能器与输入换能器隔离开来以便在输出换能器和鼓膜之间形成主要表示话音的输入音频信号的通路的声装置，其中形成静区来隔离从输入换能器发送的声音。

20.权利要求 19 的有源减噪设备，其特征在于，其中的声装置当靠近输入换能器放置时是声滤波器，而当被放置在输出换能器和鼓膜之间时是声波导。

21.开环有源减噪设备，包括:

具有耳机的外壳;

安放在耳机内、用于检测不想要的环境噪声的话筒装置;

把噪声变换为电信号的装置;

与话筒装置连接、以提供反相的抗噪信号的移相及衰减装置;

与话筒装置基本上不同于一平面、用来把音频信号传送给用户耳朵的输出换能器;

用来防止机械震动产生的低频干扰传送给输出换能器的装置;

用来产生非常靠近输出换能器的静区的装置;

用来防止不想要的环境噪声到达用户耳朵的装置。

22.在具有悬挂式话筒的头戴送受话器中使用的开环有源减噪设备，用以减小到达该用户耳朵的环境噪声，而不干扰输出到收听者耳朵的所想要的音频信号，该减噪设备包括:

在头戴送受话器内的耳机;

用于检测耳机内的噪声信号的拾音话筒;

用于把噪声信号变换为电信号的开环装置;

用于把电信号作用于耳机以产生与环境噪声反相 180°的声信号的电－声装置;

安放在耳机内的、具有声滤波器的输出换能器，该声滤波器用于把话音传送至用户耳朵，并防止震动产生的低频干扰到达用户耳朵。

Apple Inc. Exhibit 1015 Page 1637

23.与有源消噪设备一道使用的开环减噪系统，包括：

用于检测噪声信号以便把其变换为电信号的拾音话筒；

放置在头戴话筒内的、具有声装置的扬声器；

音频传输信号；

用于以电的方式抑制电信号的振动的装置；

用于使噪声信号反相以产生抗噪信号的可变的增益/控制装置；

用于滤除机械震动产生的低频干扰以防止其到达扬声器的装置；

用于组合抗噪信号和噪声信号以便在声装置中产生静区的相加节点；

用于把音频信号传送给扬器的装置；以及

用于保持在噪声信号和扬声器的抗噪信号之间的相位一致性的装置。

24.权利要求23的开环减噪系统，其特征在于，其中抑制低频响应的装置是高通滤波器。

25.权利要求24的开环减噪系统，其特征在于，其中静区装置是声滤波器。

26.权利要求23的减噪系统，其特征在于，其中有源消噪设备包括：

外壳，具有第一话筒装置和第二话筒装置，该第一话筒装置用于接收由操作所述消噪设备的操作者发出的话音和背景噪声组成的第一声音和用于将所述第一声音变换为第一信号，该第二话筒装置紧靠着所述第一话筒装置与其成预定角度ϕ设置，用于接收基本上由所述背景噪声组成的第二声音和用于把所述第二声音变换为第二信号；以及

用于从所述第一信号中减去所述第二信号的装置以便获得基本上代表所述话音的信号。

27.用于减小鼓膜附近的环境噪声的开环有源减噪设备，包括：

用于接收输入音频信号的外壳；

位于外壳内的输出换能器；

位于外壳内的、用于检测和减小环境噪声的输入换能器；

减小由输入换能器检测的环境噪声的开环信号处理装置；

用于不受环境噪声干扰地把输入音频信号传送给鼓膜的装置；

把输出换能器与输入换能器隔离开来的声装置以便在输出换能器和鼓膜之间形成主要表示话音的输入音频信号的通路、并且形成静区来隔

Apple Inc. Exhibit 1015 Page 1638

离从输入换能器发送的声音的声装置。

28.权利要求 **23** 的减噪系统，其特征在于，其中可变的增益/控制装置自动地进行调整，以便与通信系统对接。

29. 如图 **28** 所示的有源消噪和有源减噪系统。

30.在用于传送来自话筒的音频信号和用于接收来自周围环境的外界声音的头戴送受话器中使用的有源消噪和减噪系统，包括:

包括具有消噪模式和说话直通模式的第一开关装置的第一话筒装置和第二话筒装置;

通过具有消噪模式和说话直通模式的第二开关装置而被连接到话筒的话筒放大器装置;

用于在第一开关装置和第二开关装置工作在消噪模式下时连接放大器装置的音频话筒传输装置，其中当第一开关装置和第二开关装置工作在说话直通模式下时，该话筒传输装置被旁路;

用于在第一开关装置和第二开关装置工作在消噪模式下时把两个话筒装置的音频信号传送给缓冲放大器的传输门，其中当第二开关装置工作在说话直通模式下时该传输门被禁止;

该缓冲放大器装置用于当第一开关装置和第二开关装置工作在消噪模式下时把接收自传输门的音频信号传送给音频系统和定标放大器;

该缓冲放大器装置用于在第一开关装置和第二开关装置工作在说话直通模式下时直接输出由话筒放大器装置接收的音频信号;

该定标放大器包括具有消噪模式和说话直通模式的第三开关装置，在全部开关装置都工作在消噪模式下时把由两个话筒装置传送的和来自外界声音的侧音信号传送给扬声器的耳塞机;

该定标放大器具有增益控制，其中当全部开关装置都工作在说话直通模式下时增大增益控制来增大侧音。

Apple Inc. Exhibit 1015 Page 1639

说　明　书

消除噪声和减小噪声的设备

相关申请

本申请是1994年11月14日提交的待审查美国专利申请08/339126号的部分继续申请，前者又是1992年10月29日提交的美国专利申请968180号（现在是美国专利US 5381473，1995年1月10日授权）的后续申请，这两份专利申请被援引于此作为参考。还参考了1993年10月5日授权的美国专利5251263，它也被援引于此作为参考。

发明背景

发明领域

本发明涉及当和头戴送受话器或自由伸缩式送受话器等一起使用时、通过衰减不想要的环境噪声使之不到达鼓膜和消除来自自由伸缩式话筒或定向话筒的背景噪声来进行噪声消除及噪声减小的方法及设备。

本发明还涉及在头戴送受话器中、尤其在耳机附近使用的有源减噪系统，该系统利用传感式话筒检测不想要的背景噪声。由传感式话筒输出的这种噪声信号被电－声装置进行处理，产生一反相信号，以便在位于输出换能器和鼓膜之间的声波导中形成静区．因此所需要的原始声音信号在传送至用户的耳朵时，将不受到噪声的干扰。声波导吸收从耳朵返回话筒的任何声音（阻止反馈）和消除从话筒返回到耳朵的任何声音。

本发明还涉及与头戴送受话器、自由伸缩式话筒或定向话筒等中一起使用的消除噪声设备，其中系统使用了两个话筒，用于接收包括话音和背景噪声的声音的第一话筒，和用于接收主要包括背景噪声的声音的第二话筒，结合使用了用于从第一信号中减去第二信号的装置。

在本发明的噪声消除系统中的话筒利用双端头系统，其中由话音和用来驱动该系统功率支持输入组成的输出音频信号在一个端头上被发送，而第二端头接地。

本发明的噪声消除设备还涉及在远区话筒装置中所使用的定向话筒，它能够在某一方向上比其它方向更好地接收声音．

本发明的消噪和减噪系统可通过包括以下特性来提高其性能：自动音频话筒传输特性，把一部分信号传送给说话人的耳机的侧音特性，以及通过从电路中去除话音话筒和提高噪声话筒放大器的增益来把有源消噪话筒

Apple Inc. Exhibit 1015 Page 1640

转换为标准全向话筒的特性。这种性能提高使得通过提高侧音通路增益可把外界的全部声音传送给扬声器(speaker)的耳塞机，不用增加任何其它话筒部件。

已有技术说明

将看到在许多情况下不希望存在背景噪声。一个例子是考虑话务员正在试图进行和位于噪声区域的电话或这样的类似装置的电话对话的情况。在这种情况下，声音很响的背景噪声被电话手持送受话器中的话筒接收并被变换为电信号，该电信号被传送给与话务员进行通话的人的电话机，在其中被变换为声音信号。于是正在与话务员通话的那个人持续地听到很响的背景噪声。此外，当那人在说话时，他的话音与背景噪声混在一起，这会使其它人难于听懂。因此话务员可能不得不对着电话话筒大声喊叫。而且，代表背景噪声的信号还作为侧音从话务员手机中的话筒传送至话务员手持送受话器中的扬声器。于是话务员也持续地听到来自其手持送受话器中的扬声器的背景噪声，一旦其它人正在说话，这种背景噪声会妨碍听懂说些什么。

作为另一个例子，考虑驾驶直升飞机等的驾驶员想利用射频（ RF ）通信与其它人通话的情况。在这种情况下，驾驶员通常对着与无线电发送/接收装置连接的所谓悬挂式话筒或悬挂式送受话器说话，话音被变换为 RF 信号，这些 RF 信号被传送给第二个接收/发送装置，在该装置中被变换为话音以便被其它人听到。如同以上在噪声区域内的电话的情况一样，直升飞机的很响的背景噪声被悬挂式话筒或送受话器装置接收，并被变换为电信号，然后被传送给接收装置。因此，与驾驶员通话的人听到很响的背景噪声．这在驾驶员在驾驶直升飞机的同时使无线电发送/接收设备处于“接通”（正在工作的话筒）位置时尤其令人厌烦。

作为再一个例子，考虑语音验证和/或识别系统，操作者必需对着该系统说话来接入例如一实际设施或者操作计算机或自动售货机。背景噪声会妨碍接入（因背景噪声而无法识别或验证）或因错误的验证而造成错误的进入。

在试图减小背景噪声来改进在噪声环境等中的电话或悬挂式话筒或送受话器等的性能时，可以使用压差式话筒。一般来说，压差式话筒对两个靠近的间隔点处的压力差作出响应。当在背景噪声的压力差是各向同性的环境中使用时，压差式送受话器因这种背景噪声而产生的电信号实际上为

Apple Inc. Exhibit 1015 Page 1641



零。但是，在大多数的实际情形中，背景噪声的压力差不是各向同性的，因此在这些情形中，压差式话筒的性能受到不利影响。另外，由于话音或声音沿一个以上的方向传播，所以对话音或声音作出响应的话筒产生的电信号常常被恶化。因此，即使在电话送受话器或悬挂式话筒中使用了压差式话筒，所希望的背景噪声消除量还不是足够大，性能还不能满足要求。

还有，如上所述，由于压差式话筒的相对两侧面对声压作出响应，所以必需对已有电话的手持送受话器进行很大的改动，以使话筒的这两个侧面能够对声压作出响应。而且，由于在电话送受话器中使用了这样的话筒，就应对由这种话筒所产生的电信号进行放大。因此，用压差式话筒代替已有电话的电话送受话器中的传统话筒通常将需要用新的手持送受话器来代替该电话送受话器，这样做将是相当昂贵的。

作为对使用压差式话筒的一种替代方案，可以使用声反馈型系统。这种系统一般包括用来均衡输出换能器的传递函数的补尝滤波器。由于扬声器的特性受到这些滤波器的严格控制，所以滤波器的成本是相当高的。于是这种声反馈系统一般来说也是相当昂贵的。

与消噪和减噪设备一起使用的许多话筒本来就是无方向性的或全方向的，例如静电的、压电的、磁性的和碳粒的话筒。对于全向小型话筒，在低频下，在话筒的附近有足够的声音绕射，所以膜片运动对声音的方向是不敏感的。在高频下，相应地在较短波长下，话筒对于声波而言变得较大，呈现出有利于沿垂直膜片方向到达的声音。因此，话筒的尺寸越小，它就在越高的频率下保持全向性。于是全向话筒与波长相比是小的，且话筒外壳保住膜片的背面，使它不能够接收某些以不同角度的声波。因此，由于压强是标量，不是矢量，所以已有技术的这些话筒被称为声压式话筒。于是对于在有源消噪系统中的话筒装置，需要能够提高沿各个方向的在远场区域中声音的灵敏度的定向话筒响应。就是说，通过把全向方向图和双向或“8字形”方向图的输出相加来实现定向性话筒响应，然后仅调整被相加的输出信号的振幅和相位来产生所需要的方向图。8字形方向图还被称为余弦方向图，在数学上用极坐标表示为 $P = COS\theta$。在定向性话筒中，距离是一个因子。距离因子可衡量：定向话筒相对于全向方向图来说，可以在距声源多远处使用以及仍保持直接获取与反射的获取的相同比值。于是已有技术没能够提供在基于全向方向图和心形方向图的有源减噪设备中的定向话筒器，在这种设备中，到达被确定位置处的声压被矢量相加。

Apple Inc. Exhibit 1015 Page 1642

在设计与包括至少两个话筒的悬挂式话筒装置或定向话筒装置一起使用的有源消噪设备的电路时，已知可使用三端头话筒结构。就是说，具有两个或两个以上的连接到放大器的话筒的消噪系统，例如，需要具有三个端头的电路：电源输入端、音频信号输出端和接地端。为了降低在可任选地与减噪设备的头戴送受话器一起使用的话筒或悬挂式话筒等中所使用的消噪系统的复杂性和成本，希望有两端头的话筒结构。希望有一种话筒结构，其中电源提供的直流电压在一个和话筒输出交流音频信号的端头相同的端头处输入，藉此交流信号被叠加在直流信号上。于是已有技术没能够提供供有源消噪设备使用的双端头话筒结构，在其中电源和信号被叠加在第一个端头上，而第二个端头接地。

在进一步试图减小背景噪声以便改善藉使用具有话筒的头戴送受话器的电－声通信的清晰度时，已开发了被称为有源减噪的技术，这种技术采用放置在扬声器和处在扬声器的声场中的耳朵之间的传感话筒，该传感话筒感受背景噪声和编程音频。对于这种有源型头戴耳机装置，使用了负反馈环，倒相地反馈由话筒单元从外界噪声变换的电信号，以便减小在该头戴耳机单元附近的噪声。如已有技术中所示，采用闭环方式的反馈电路提供在扬声器和耳朵之间的“静区”，这消除了背景噪声。这是因为在有噪声的环境中，耳朵将不仅检测到受话器的输出，还将检测到背景噪声的缘故。

参看以下的提供闭环有源减噪系统的文献，这些文献被援引于此作为参考：

Hawley 等人的美国专利 **US 2972018**，

Wadsworth 的美国专利 **US 3098121**，

Carme 等人的美国专利 **US 4833719**，

Kimura 等人的美国专利 **US 5138664**，

Sacki 的日本专利文摘 **JP－3－161999**。

以上引用的专利描述了各种消噪装置。例如，**Hawley** 等人的专利涉及耳机的减噪系统，耳机具有位于受话器和话筒之间的塑料外壳；**Wadsworth** 提供了具有位于头戴受话器(headband)的顶部的话筒的耳机；**Carme** 等人的专利针对具有位于扬声器和话筒之间的中空环形部分的耳机；**Kimura** 等人的专利涉及具有位于扬声器和话筒之间的杯形部件的减噪耳机；**Saeki** 的专利涉及具有位于两个互相面对的扬声器之间的话筒的

Apple Inc. Exhibit 1015 Page 1643

消噪耳机。

但是，普通有源减噪系统存在各种不足。已有的消噪系统例如采用由以下相关的公式表示的闭环式电路：

$$P = S\left(\frac{H_1H_2 + H_2}{1 + BH_1H_2}\right) + N\left(\frac{1}{1 + BH_1H_2}\right)$$

其中 P = 输出

S = 标准音频信号

H_1 = 高通滤波器

H_2 = 头戴送受话器中的扬声器

N = 噪声分量

B = 可变的增益/相位控制

由于为了把输出（P）的噪声分量（N）减小至零需要非常大的直接传输增益（$1 + BH_1H_2$），所以普通闭环减噪系统不是理想的。这种系统存在不稳定的问题。这造成了振荡的缺陷，即扬声器、反馈话筒和包括这些部件和用户头戴受话器的声腔的传递函数的变化造成的不稳定环路条件引起的啸声。普通闭环减噪装置产生的减噪程度在任何频率下都直接与该频率下的直接传输增益相关。但是，增益越高，装置就越不稳定。

普通有源减噪头戴送受话器装置还具有这样的不足，即当机械振动（例如连接电线时的冲击、摩擦引入的振动、用户夹紧装置移动引入的振动等）被传送至噪声反馈话筒时，这些振动噪声被该话筒变换为电信号。这些信号被放大，造成不稳定性和其它非线性效应，例如音频中断、大的噪声或声压冲击。普通有源减噪头戴送受话器装置的另一个不足是为了避免消除想要的音频信号而给该装置所增加的复杂性，该音频信号是被作为电信号输入的。普通装置所想要的音频信号（S）被输入给两个相加节点来产生传送给用户耳朵的信号。第一相加节点把负反馈话筒信号与想要的输入音频信号相加。但在普通闭环反馈装置中，从话筒反馈的信号包含所想要的音频信号和必需被消除的环境噪声。该反馈信号从所想要的输入音频信号中被减去，产生不含所想要的音频信号成份的抗噪声信号。然后用第二相加节点来把所想要的音频信号加回到环路中去，以便可把其传送给输出换能器。这种产生所想音频信号的方法增加了普通减噪装置的复杂性和成本。普通装置中的附加的相加节点处理还增大了在所想要的音频信号中产生失真的机会和提高了不稳定性的可能性。

Apple Inc. Exhibit 1015 Page 1644

此外，还开发了各种其它已有技术的头戴送受话器结构来构成有源减噪装置，其中输入和输出换能器相对于耳朵来设置，例如以下三篇文献，它们被援引于此作为参考。

Moseley 的美国专利 US 5134659，

Moseley 的美国专利 US 5117461，

Moseley 的美国专利 US 5001763.

Moseley 的美国专利 US 5133659 涉及具有障板、两个受话器和两个话筒的头戴送受话器减噪系统，障板的作用是通过迫使噪声绕过该障板走更长的距离和迫使噪声通过泡沫阻挡层而妨碍噪声源直接传送至输入换能器。Moseley 的美国专利 US 5117461 针对使用头戴受话器时的包括消噪的电声功能，该头戴受话器具有固定在其上的对着耳孔的相同方向的话筒。Moseley 的美国专利 US 5001763 涉及对于具有扬声器、话筒和障板的头戴受话器的消噪系统。

因此，一般来说，Moseley 的专利涉及作为输出换能器的扬声器和作为输入换能器的话筒的位置。事实上，这些专利要求扬声器和话筒在同一平面上或基本上在同一平面上。还有，这些专利还教导了被处理的信号输出基本上与原始声波在相同的时域内，即信号是同相的。

与 Moseley 的专利不同，本发明不是专门涉及扬声器和话筒在同一平面内的设置（虽然这种设置不必明确地被排除在外）。在本发明的开环有源减噪系统中使用的输出换能器和话筒可以垂直、相切或在非同一平面的任何位置上（也可在同一平面内）。本发明提供了能够把原始输入音频信号传送给扬声器、不对该输入音频信号进行再相加的减噪系统。这是因为作为开环的控制部分的传感话筒相对于音频信号的设置使得该音频信号不被拾音器或传感话筒所检测的缘故。就是说，在本发明的开环系统中，原先的想要的音频信号是与由话筒检测的环境噪声无关地被传送给扬声器。此外，在本发明中，声材料可以被放在输出换能器和用户的鼓膜之间，把音频信号传送至用户的耳朵，形成该换能器的声波导。输出换能器和话筒之间的声材料起声滤波器的作用，通过在拾音话筒和输出换能器的通道上形成声障来减小开环增益。声材料使所想要的原先的输入音频信号与被拾音话筒检测和消除的噪声隔离开来。由拾音话筒检测的背景噪声信号被产生抗噪声信号的电－声处理装置进行反相，该抗噪声信号被传送给声波导以便产生一个静区。这个静区位于输出换能器和用户的鼓膜之间。

Apple Inc. Exhibit 1015 Page 1645

因此，已有技术没能提供在通信系统等中使用的把背景噪声减小至可接受程度的相对低成本的装置，也没能提供使已有音频通信系统能够把背景噪声减小至可接受程度的成本有效的装置。

发明的目的和概要

本发明的目的是提供有源消除噪声设备和有源减小噪声设备来构成克服了与已有技术有关的问题的减噪系统。

更具体来说，本发明的目的是提供把背景噪声减小到可接受程度的有源消除噪声设备和有源减小噪声设备。

本发明的另一个目的是提供在头戴送受话器装置和悬挂式话筒中使用的减噪设备或提供消噪设备等。

本发明的再一个目的是提供如上所述的相当廉价的减噪和消噪设备以及有源减噪系统。

本发明的还一个目的是提供在能以标准的可供使用的在线电源运行的电信系统中使用的成本相当低的减噪和消噪设备。

本发明的另一个目的是通过增加说话直通功能来提供增强的有源消噪和减噪的头戴送受话器，这种说话直通功能使用户能够听到话筒音频信号和来自周围环境的外界声音，而不必实际增加任何其它的话筒部件。本发明的目的是提供有源消噪和减噪的头戴送受话器，其中通过提高侧音通路的增益来把外部区域的全部声音都传送至扬声器的耳机。本发明的这种有源消噪话筒通过从电子电路中去除话音话筒和提高噪声话筒放大器的增益而变成标准的全向话筒。

本发明的再一个目的是提供易被用于已有通信系统的手持送受话器的和能以标准的可供使用的在线电源运行的成本相当低的消噪装置。

本发明的还一个目的是提供在音频通信系统中使用的成本相当低的减噪装置，该减噪装置使用户能够有选择地放大接收的信号，或者它可在具有头戴式耳机的悬挂式话筒中使用，或者它可被用作为消噪话筒。

在此处所描述的许多应用中，想要有非全向特性的话筒。这种话筒抑制来自某些方向的信号，由此改善了信噪比。本发明的基于求和方法的定向话筒可依赖于具有相位差的声压信号的代数组合，这些相位差是唯一地由系统的电子电路产生的。与压差式话筒不同，这种话筒的方向性依赖于线性尺寸与波长之比值。

当把两个或两个以上的话筒馈入到同一个放大器时，距这些话筒一定

Apple Inc. Exhibit 1015 Page 1646

距离的声源的信号有可能以180°的相位差到达这些话筒，彼此抵消。因此，本发明的目的正是为了保证全向和定向话筒被正确地定相。

本发明的另一个目的是，在此公开的以预定角度和/或以预定距离设置的第一和第二话筒连同减法装置还能够用于话筒的声频监测或遥测或甚至如具有旁瓣的定向话筒之类的定向话筒的环境噪声消除。

因此，本发明的目的是提供在具有非全向特性的消噪系统中使用的低成本话筒。

本发明的另一个目的是提供基于振幅和相位波瓣结构的话筒的可控的各种方向图。

本发明的再一个目的是通过在预定位置处对从全部简单声源到达该位置的声压求矢量和来提供定向话筒。

本发明的还一个目的是提供在有源消噪环境中的包括上述定向话筒的双端头话筒系统，该双端头话筒系统允许音频输出信号在同一端子处被叠加在电压输入信号上。

本发明的另一个目的是提供在头戴送受话器中使用的新颖的有源减噪设备，该减噪设备通过把部件放置在开环系统中而使电路简单和降低了成本。

本发明的再一个目的是提供消噪设备，其中环境噪声以常规公式被衰减、而性能不被由机械部分或振动产生的话筒信号恶化。

本发明的还一个目的是提供包括带有悬挂式话筒或定向话筒等的头戴送受话器、手持送受话器等的有源减噪系统，这些话筒由于其开环结构而是无条件地稳定的。

本发明的另一个目的是通过有源地耦合电－声换能器来减少减噪设备所需的功率。

本发明的再一个目的是通过利用在单个相加节点中把所想要音频信号和抗噪信号组合输送给输出换能器的方法来降低有源减噪电路的复杂性和/或成本。

本发明的还一个目的是在减噪系统中减小由抗噪处理引入的对所想要的输入电信号的失真，该所想要的输入电信号在减噪系统被变换为声信号并被传送至耳朵。

本发明的另一个目的是减噪设备包括被放置在输出换能器后面或前面的以及在扬声器声场和平面之外的传感话筒或拾音话筒，这样话筒通过利

Apple Inc. Exhibit 1015 Page 1647

用完成双重功能的声材料而只检测背景噪声。

本发明的再一个目的是提供一种声学材料，当它被放在话筒上面时就作为声滤波器而当它被放在输出换能器和用户的耳朵之间时就作为声波导。

正是话筒作为系统的控制部分，该话筒独立于输入的音频信号，即所想要的输出。最好在扬声器/话筒和耳朵之间设置弹性声波导来形成静区。这种波导最好不仅仅是出于舒适目的而在耳机上通常都带有的那种一般橡胶海绵。一种这样的材料是所谓的“缓慢流动（ Slo Flo ）”泡沫材料，它的密度和结构使得它能够确定无噪声响应，并作为声滤波器能够阻止从收听者的脸和/或耳返回至话筒的任何声音反射；而已有技术采用信号从话筒的负反馈，但在本发明中没有这种负反馈，而是采用开环结构，在这种结构中，不需要增加另一音频信号，而是把原始输入音频信号传送给扬声器。因为信号没有受到开环系统的干扰。

懂得普通闭环减噪设备和本发明新颖的开环减噪设备之间的区别是很重要的。

本发明的开环系统是其中控制动作独立于输出或所想要的结果的系统。闭环系统是控制动作依赖于输出的系统。这些定义中的关键术语是控制动作。一般来说，该术语指系统的驱动信号，驱动信号又表示为启动系统来产生所想要的输出而应负责的程度。在开环系统的情况下，输入命令是提供控制动作的唯一因素，而对于闭环系统，控制动作由输入命令和相应输出之间的差值来提供。

为了进行闭环和开环操作比较，每一系统的一些操作特性如下：开环系统具有两个突出的特点，即，能够执行由校准所确定的功能，以及例如因为不会出现不稳定的问题而在结构上的简单性。对于闭环系统，值得指出的特点是由于驱动信号是输出与输入的偏差的函数，所以因反馈的作用能够精确地再现输入；这种控制动作迫使驱动信号几乎为零。这种反馈因素的主要不足是它要对在采用闭环系统时的最大的困难之一（即容易振荡）负责。

有源减噪设备和消噪设备可在飞行器（例如直升飞机或飞机）上所使用的任何电信系统中或在其它装置、例如电话，或例如用于接入一实际设施或（经由直接或间接接口或经由电话线）进入计算机或自动售货机的语音识别和/或验证系统中、或在其它识别和/或验证系统中使用。

Apple Inc. Exhibit 1015 Page 1648

消噪设备包括：一外壳，该外壳具有第一话筒装置，用来接收由操作所述消噪设备的操作者发出的话音和背景噪声组成的第一声音并把它变换为第一信号，第二话筒装置，紧靠所述第一话筒装置并以预定角度ϕ设置，用来接收主要由所述背景噪声组成的第二声音并把它变换为第二信号；以及用于从第一信号中减去第二信号的装置，以便获得基本上代表了所述话音的信号。在用于减小背景噪声的消噪设备中使用的双端头换能器包括：与该消噪设备的放大器装置连接的多个话筒；该放大器装置用于从具有第一端头和第二端头的话筒接收音频信号，其中的该第二端头接地；在第一端头上输入直流信号的电压装置；与第一端头连接、并用于从话筒连接交流信号的晶体管装置；用于把交流信号叠加在第一端头上的直流信号的装置；用于从直流信号中滤除交流信号的装置，以便用该直流信号对放大器装置供电；以及用于输出由话筒在第一端子处产生的交流信号的装置。用来在对着有源消噪设备的悬挂式话筒说话时获得远场响应的定向话筒，该定向话筒器以各种不同的方向性图接受声音，它包括：具有间隔开的话筒装置的阵列的外壳，这些话筒装置用来接收声音信号和输出具有在这些话筒之间的间距的电信号；被作为具有振幅和相位的正弦声波输入到外壳的声压源，该正弦声波和在预定距离处的这些话筒交叉以形成一角度；用于计算从每一话筒至声源的距离的装置；用于把话筒阵列的输出信号相加以获得一总和输出信号的求和通道；产生只代表总和输出信号中的话音的声信号的信号处理装置；以及用于调整该总和信号的振幅以产生所希望的响应模式的装置。用于减小鼓膜附近的环境噪声的开环有源减噪设备包括：用于接收输入信号的外壳；位于外壳内的输出换能器；与输出换能器基本上不在同一平面内的、用于检测和减小环境噪声的输入换能器；减小被输入换能器检测的环境噪声的开环信号处理装置；用于把输入音频信号传送给鼓膜而不受环境噪声的干扰的装置；把输出换能器与输入换能器隔离开以便在输出换能器和鼓膜之间形成主要表示话音的输入音频信号的通路的声装置，其中形成了静区来隔离由输入换能器发送的声音。与有源消噪设备一起使用的开环减噪系统包括：用于检测噪声信号并将其变换为电信号的拾音话筒；位于具有声装置的头戴送受话器内的扬声器；音频传输信号；以电方式抑制电信号的振动的装置；用于调整噪声信号的可变的增益/控制装置；用于滤除机械振动引入的低频干扰以阻止这种干扰到达扬声器的装置；组合抗噪声信号和噪声信号用来在声装置中形成静区的相加节点；把

Apple Inc. Exhibit 1015 Page 1649

音频信号传送给扬声器的装置；以及保持在扬声器中的噪声信号和抗噪声信号之间的相位一致的装置。

用于减小在鼓膜附近的环境噪声的开环有源减噪设备，包括：用于接收输入音频信号的外壳；位于外壳内的输出换能器；位于外壳内的、用来检测和减小环境噪声的输入换能器；减少被输入换能器检测的环境噪声的开环信号处理装置；用于把输入音频信号传送给鼓膜而没有噪声干扰的装置；把输出换能器与输入换能器隔离开来以便在输出换能器和鼓膜之间形成主要表示话音的输入音频信号的通路并且形成静区来隔离由输入换能器发送的声音的声装置。

在用来传送来自话筒的音频信号和接收周围环境的外界声音的头戴送受话器中使用的有源消噪和减噪系统，包括：具有第一开关装置的第一话筒装置，该第一开关装置具有消噪模式和最先说话直通模式；第二话筒装置；通过第二开关装置与这两个话筒连接的话筒放大器装置；在第一开关装置和第二开关装置工作在消噪模式时用于连接放大器装置的音频话筒传输装置，其中话筒传输装置在第一开关装置和第二开关装置工作在说话直通模式时被旁路；在第一开关装置和第二开关装置都处于消噪模式时把两个话筒装置的音频信号都传送给缓冲放大器的传输门，该传输门在第二开关装置处于说话直通模式时被禁止；该缓冲放大器装置在第一开关装置和第二开关装置都工作在消噪模式时把从传输门接收的音频信号传送给音频系统和定标放大器；该缓冲放大器装置在第一开关装置和第二开关装置都工作在说话直通模式时用于直接输出由话筒放大器装置接收的音频信号；包括具有消噪模式和说话直通模式的第三开关装置的该定标放大器在全部开关装置都工作在消噪模式时把由两个话筒装置传送的和来自外界声音的侧音信号提供给扬声器的耳塞机；定标放大器具有增益控制，其中全部开关装置都工作在说话直通模式时增加增益控制来增大输入给扬声器的侧音信号；有源减噪系统接收侧音信号并将其输出给头戴送受话器内的扬声器。

当结合附图阅读以下的对所说明的实施例的详细描述时将明了本发明的其它目的、特点和优点，图中相应的部件用相同的标号来表示。

附图简述

图 1 表示具有按照本发明的实施例的消噪设备的电话；

图 2 是在图 1 的电话中使用的消噪设备的方框图；

Apple Inc. Exhibit 1015 Page 1650

图 3A 是图 1 的电话的接收器部分的正视图;

图 3B 是除去了上盖的图 1 的电话的接收器部分的侧视图;

图 4 是图 2 的方框图的原理图;

图 5 是示于图 2 的消噪设备的另一原理图;

图 6A、6B 和 6C 表示使用按照本发明的实施例的减噪设备的悬挂式话筒装置;

图 7A 和 7B 是用来说明本发明的操作时所参考的示意图;

图 8 是表示按照本发明的减噪设备;

图 9A、9B、9C、9D、9E 和 9F 表示本发明的悬挂式话筒和头戴送受话器的实施例(图 9A 和 9B 每个表示话筒特定放置的一实施例;图 9C 表示具有有源减噪设备的头戴送受话器的总貌,图 9D、9E 和 9F 表示悬挂式话筒的侧视图),且图 9F 表示在头戴送受话器中使用的有源减噪设备的优选实施例;

图 10A 和 10B 是图 8 的减噪设备的原理图;

图 11 表示倒相电路;

图 12 表示反向充电的话筒电路;

图 13A 和 13B 表示本发明各实施例的有源消噪曲线;

图 14 是定向话筒的原理图;

图 15 是用来说明本发明一实施例的操作时所参考的话筒的线性阵列的示意图;

图 16A 和 16B 表示排成圆柱形的话筒阵列的示意图和电路阵列的原理图的另一实施例;

图 17A 和 17B 表示已有技术三端头话筒结构和本发明双端头话筒结构的方框图;

图 18 是简单双端头话筒电路的原理图;

图 19 表示在有源消噪系统中使用的双端头话筒电路的优选实施例;

图 20 是在有源消噪系统中使用的双端头话筒电路的另一个实施例;

图 21 是已有技术闭环有源减噪系统的原理图;

图 22 是本发明开环有源减噪系统的原理图;

图 23A 和 23B 表示本发明声波导的透视图和侧视图;

图 24 是藉利用有源减噪系统实现的静区的图示;

图 25 表示本发明的有源减噪系统的优选实施例;

Apple Inc. Exhibit 1015 Page 1651

图 26 表示本发明的有源减噪系统的另一个优选实施例；

图 27 表示包括高通滤波器的本发明有源减噪系统的另一个实施例；

图 28 是在具有说话直通、侧音和自动音频话筒传输特性的头戴送受话器中使用的有源减噪和消噪系统的方框图。

优选实施例详述

图 1 表示使用按照本发明的实施例的减噪设备的电话 8。如图所示，电话 8 一般来说包括一具有一扬声器部分 41 和一接收器部分 42 的手持送受话器 10 和一电话单元 18，它们可以藉助于话机绳 30 被连接在其间。或者，该电话可以是无绳电话，于是手机 10 可通过 RF（射频）电波与电话单元 18 耦合。接收器部分 42 包括第一和第二话筒 12 和 14（图 2）、用于调整提供给扬声器部分 41 的信号的音量的开关 40、以及具有凹进部分 44 及网孔部分 46 的盖子 48。

图 2 以方框图形式表示电话 8。如图所示，手持送受话器 10 一般来说包括第一和第二话筒 12 和 14、减法装置 16（在最佳实施例中是一运算放大器）、放大器 20（最好也是一运算放大器）、以及扬声器 22。第一和第二话筒 12 和 14、运算放大器 16 以及放大器 20 最好被包括在接收器部分（见图 1）内。

由话音之类和背景噪声组成的声信号被提供给第一话筒 12 并在其内被变换为相应的电信号，该电信号然后被提供给运算放大器 16 的正端。背景噪声被提供给第二话筒 14 并在其内被变换为相应的电信号，该电信号然后被提供给运算放大器 16 的负端。运算放大器 16 适合于从来自第一话筒 12 的话音和噪声信号中减去来自第二话筒 14 的噪声信号，并把基本上代表话音的电信号传送给电话单元 18，以便通过电话线把话音信号传送给所想要的一台电话或多台电话。运算放大器 16 的输出信号还在电话单元 18 中与来自电话线的接收信号组合，传送给放大器 20。运算放大器 16 和 17 最好是相当低功率的集成电路（IC），例如互补金属氧化物半导体（CMOS），可以用一片或多片 CMOS IC 芯片来构成。虽然在图 2 中没有示出，但操作者可以利用开关 40（图 1）有选择地设定放大器 20，以便把接收信号的放大量调整为所希望的程度。放大器 20 的放大信号提供给扬声器 22，扬声器 22 把该放大信号变换为操作者听得见的声信号。

图 3A 和 3B 表示接收部分 42 的两个视图，图 3A 的图中除掉了盖子 48。如这两个视图所示，接收部分 42 一般来说包括外壳 74、电路板组件

Apple Inc. Exhibit 1015 Page 1652

78、第一和第二话筒 12 及 14、以及盖子 48。最好是驻极体话筒或类似这样的话筒的第一和第二话筒 12 及 14 分别被如在后面所描述的那样安放或设置。这两个话筒被固定部件 76 固定，固定部件 76 例如可以用泡沫状材料制成，它再被固定在外壳 74 上。第一和第二话筒 12 和 14 各自的输出通过各自的导线（未示出）传送给运算放大器 16，运算放大器 16 被包括在电路板组件 78 上，电路板组件 78 再被固定在外壳 74 上。如以下详细描述的，电路板 78 可以包括其它电路元件，这些电路元件用来处理和放大从第一和第二话筒接收的信号，并将它们传送给扬声器 22（图 2）。可以使用覆盖物 72，它通过使用粘着剂被固定在外壳 74 上，或者可以被声波焊接在外壳 74 上。覆盖物 72 和带有电路板组件 78、固定部件 76 和第一及第二话筒 12 和 14 的外壳 74 构成组件 71。

可以用塑性材料、例如聚碳酸脂制成的盖子 48 包括环状边沿部件 43 和通常厚度为 T 的部分 45，该部分 45 与边沿部件 43 相接，比该边沿部件的顶部低例如 0.020 英寸的最小预定量，由此形成了凹进部分 44。部分 45 包括具有比厚度 T 小的厚度 T' 的部分 46，该部分 46 具有多个通孔，可以类似一网孔状部分。在一优选实施例中，部分 46 的厚度 T' 小于 0.030 英寸。由于部分 46 只是部分 45 的相当小的一部分，所以其厚度的减小不会对盖子 48 的整个结构刚度有不利影响。或者部分 46 可以用较硬材料、例如不锈钢或类似材料来制成，与部分 45 结合在一起。如将看到的，通过使部分 45 和 46 从边沿部分 43 的顶部凹进，即使把接收器部分 42 放在平面上时，只是边沿部件 43 与该平面接触，而部分 45 或 46 不与该平面接触。因此载荷不直接作用给部分 45 和/或部分 46，而是作用给边沿部件 43。

盖子 48 被安置在组件 71 上，第一和第二话筒 12 和 14 被分别安放在部分 46 之下，第一话筒相当接近部分 46 的底面。因此，离接收器部分 42 最好小于 1 英寸距离的操作者对着其说话时发出的话音穿过部分 46 到达第一话筒只走了相当短的距离，从而将声失真减至最小。

第一和第二话筒 12 或 14 分别在接收器部分 42 内的安放如图 3A 和 3B 所示。具体来说，如图 3B 所示，第一和第二话筒被安排成其相互间有一角度 ϕ，该角 ϕ 的值最好在 30° 和 60° 之间。第一和第二话筒还分别被安排成使得在平行于第一话筒 12 的接收面或“敏感”面的平面和操作者的话音的方向之间的角度是 θ，在垂直于第二话筒 14 的敏感面的轴线和话音方向之间的角度是 $[(90 - \theta) + \phi]$，如图 3B 所示；以及在话音的方向和第二话筒

Apple Inc. Exhibit 1015 Page 1653

之间的角度是ψ，如图 3A 所示，在一优选实施例中，角θ的值约小于 35°，而角ψ 的值约是 180°。这样安放第一和第二话筒的结果是，第一话筒 12 接收操作者的话音和附近的背景噪声，而第二话筒 14 基本上只接收被第一话筒接收的相同的背景噪声。

如上所述，虽然角φ的值最好在 30°和 60°之间，但即使第一和第二话筒被安排成具有在这一范围之外的角度值，它们仍可令人满意地操作。但是，当角φ比 30°小得多或比 60°大得多时，性能会受到不利影响。就是说，当角φ比 30°小得多时，第二话筒 14 就既接收话音也接收背景噪声。于是，当从第一话筒 12 的输出信号中减去第二话筒 14 的输出信号时，一部分或全部话音就会被抵消。相反地，当角φ比 60°大得多时，第二话筒 14 接收的背景噪声就可能与第一话筒 12 接收的背景噪声不相同。于是，从第一话筒 12 的输出信号中减去第二话筒 14 的输出信号就可能没有充分抵消第一话筒接收的背景噪声。

同样地，虽然如上所述角θ和ψ的值最好分别是小于 35°和约为 180°，但即使第一和第二话筒被安排成使这些角具有不同于这些值的值，它们仍可令人满意地操作。但是，当角θ 和ψ 的值与各自最佳值显著不同时，性能会受到不利影响。就是说，当角0 比 35°大得多时，第二话筒 14 可能既接收话音又接收背景噪声。同样地，当角ψ 比 180°小得多或大得多时，第二话筒 14 可能既接收话音又接收背景噪声。结果，在这两种情况的任一种情况下，当从第一话筒 12 的输出信号中减去第二话筒 14 的输出信号时，一部分或甚至全部话音会被抵消。

如将会看到的，通过使用上述装置和材料作为接收器部分 42 的部件，则构成这种接收器部分的成本相当低。此外，如上所述，通过使用 CMOS 芯片可使接收器部分的功耗保持相当低。于是可以用在手持送受话器内的可供使用的标准电源给接收器部分供电，这样一来就不需要附加电源或变压器等。还有，虽然接收器部分 42 是对于接收器部分和电话 8 的手持送受话器 10 的一个组件（它是一个新的电话）来被描述，但这种接收器部分或其微小的改变可以在现有电话的手持送受话器中被使用。就是说，在后一种情况下，被包括在已有电话的手持送受话器内部的盖子和话筒仅仅被接收器部分 42 所代替。于是接收器部分 42 的这种应用就提供了相当简便和低成本的装置来修改已有电话的手持送受话器，使其包括本发明的减噪设备。

Apple Inc. Exhibit 1015 Page 1654

图 4 表示图 1 和 2 所示电话 8 的一种电路的原理图。如图 4 所示，第一话筒 12 通过电阻 202 与输入电源端 200 连接，该电阻 202 是一限流电阻，用来校正第一话筒的输出的偏压。第一话筒 12 还通过电阻 210 与运算放大器 16 的正端连接，再通过电阻 212 与可变电阻 214 连接。第二话筒 14 通过可变电阻 208 与输入端 201 和运算放大器 16 的负端连接，该可变电阻 208 也是一限流电阻，用来校正第二话筒的输出的偏压。限流电阻 208 最好是可变限流电阻，使第二话筒输出信号的电平能够在预定值范围内与第一话筒输出信号的电平相匹配。具体来说，限流电阻 208 可使第二话筒 14 的输出信号被加权，以便当具有相同电平的信号从第一话筒 12 中被输出时，可使它们之间的差的幅值最小。可以根据最小化准则选择限流电阻 208 的值。电源端 198 与电阻 204 和 206 连接，还与运算放大器 16 的负端连接，电阻 204 和 206 把在输入电源端 198 处接收的电压进行分压。运算放大器 16 的输出端与电容 220， 222 和 226 以及电阻 224 和 228 连接，电阻 228 再与电话单元 18 的“话筒输入”端连接。运算放大器 16 的输出端还通过可变电阻 214、电阻 216 和电容 218 接地。电阻 210、 212 和 216 以及可变电阻 214 向运算放大器 16 的输出端提供例如 20 至 1 的放大倍数的可变增益。电容 218、 220 和 222 的作用是去除可能在运算放大器的输出信号中存在的残留 DC（直流）电平。电阻 224 和 228 以及电容 226 起低通滤波器的作用，具有一个在一个预定值例如可以是 $3.7KH_2$ 处的断点。

电话单元 18 还与电话线连接，能够利用通过话筒输入端接收信号并通过电话线把这些信号提供给所要的一台或多台电话。电话单元 18 还能够藉助于电话线接收来自另外的电话的信号，把这种信号如上所述的和通过话筒输入端接收的信号相组合，并把组合的信号提供给受话器输入端 231 。输入端 231 通过隔直电容 230 和电阻 232 与运算放大器 17 的负端连接，再通过电阻 234 与可变电阻 240 连接。电源端 199 与运算放大器 17 的正端连接。运算放大器 17 的输出端通过电容 242 和 244 以及电阻 246 与受话器 22 连接。运算放大器的输出端还通过可变电阻 240、电阻 238 和电容 236 连接到地。

以下将描述图 4 所示电话 8 的操作。

一旦要启动手持送受话器 10 把其从开关叉簧（未示出）等上拿起时，标准电话线电压就传送至输入端 198、 199、 200 和 201 。已被限流电阻 202 进行了偏压校正的第一话筒 12 的信号通过电阻 210 传送至运算放大器

Apple Inc. Exhibit 1015 Page 1655

16 的正端。已被限流电阻 208 进行了偏压校正的第二话筒 14 的输出信号传送至运算放大器 16 的负端。运算放大器 16 从接收自第一话筒 12 的信号中减去接收自第二话筒 14 的信号，输出得到的被减信号。去除可能在该输出信号中存在的 DC 电平并放大该信号。然后从被放大输出信号中去除例如那些超过 3.7KHz 的高频信号，把得到的信号提供给电话单元 18。于是向电话单元 18 提供了正比于在由第一和第二话筒 12 和 14 分别产生的电压之间的差值的电压信号。

电话单元 18 的输出信号（它是通过话筒输入端接收的通过电话线接收的信号的组合）被提供给放大器 17 的输入端 231。输入端 231 的信号提供给电容 230，去除可能存在的任何 DC 信号。电容 230 的输出通过电阻 232 提供给运算放大器 17 的负端。运算放大器 17 缓冲来自电话单元 18 的信号，并将加上侧音的接收信号传送至运算放大器输入端 231。这种信号可由操作者通过使用开关 40（图 1）而利用电阻 232、234 和 238 以及可变电阻 240 有选择地进行放大。可能存在被放大信号中的任何 DC 信号随后被电容 242、244 和 236 消除。电容 244 的输出信号被电阻 246 限流，然后被提供给扬声器 22，在扬声器 22 处被变换为声信号。

图 5 表示对于分别从第一和第二话筒 12 和 14 获得的信号进行处理以便产生提供给电话单元 18 的电流输出的另一种电路结构，该电流输出正比于由第一和第二话筒产生的电压的差值。

具体来说，图 5 的电路结构包括具有多个输入端 300、301、370 和 390 的手持送受话器 10′，这些输入端的每一个都适合于接收可供使用的标准在线电源。第一话筒 12 通过限流电阻 302 与输入电源端 300 连接，还与减法装置 316 的负端连接，该减法装置最好是一 CMOS 运算放大器。第二送受话器 14 的输出通过可变限流电阻 308 与输入端 301 连接，还与运算放大器 316 的负端连接。由运算放大器 316 输出的信号通过滤波级 350 提供给最好是一 CMOS 运算放大器的减法装置 351 的负端。滤波级 350 提供预定的频率响应特性，例如在预定频率处的信号滚降。如将看到的，虽然图 5 中示出了两个滤波级，但可以使用任意个数的滤波级。输入电源端 390 与电阻 392 和 394 连接，这两个电阻能减小提供给它们的信号，输入电源端 390 还与运算放大器 351 的正端连接。运算放大器 351 的输出信号传送至晶体管 366 的基极。输入电源端 391 与齐纳二极管 360、电容 362 和电阻 364 连接，电阻 364 再与晶体管 366 的集电极和电话单元 18 的话筒

Apple Inc. Exhibit 1015 Page 1656

输入端连接。晶体管 366 的发射极通过电阻 367 和 368 与运算放大器 351 的负端连接，形成至运算放大器 351 的反馈环路。运算放大器 351 及相关的元件在滤波级 350 和晶体管 366 之间提供电隔离。晶体管 366 能够对提供给电话单元 18 的信号进行放大。

电话单元 18 的输出被传送至输入端 231（图 4），然后按照以上参照图 4 的手持送受话器 10 所描述的方式被进行处理，以便从扬声器 22 提供声信号。

以下将描述电话 8′的操作。

一旦要把电源供给手持送受话器，把其从开关叉簧（未示出）等上拿起时，一部分电话线电压就被提供给输入端 300 、 301 、 370 、 390 和 391 。已被限流电阻 302 进行了偏压校正的第一话筒 12 的信号被提供给运算放大器 316 的正端。已被限流电阻 308 进行了偏压校正的第二话筒 14 的输出信号被提供给运算放大器 316 的负端。电阻 308 最好是可变限流电阻，它按照基本上与上述对于电阻 208 所描述的方式相同的方式使第二话筒 14 的输出信号的电平能够在预定值范围内与第一话筒 12 的输出信号的电平相匹配。运算放大器 316 的输出差信号通过滤波级 350 来被提供，该滤波级 350 可以包括一个或多个 RC 网络或等价电路，把输出信号的上限频率限制至预定值，例如可以是 3.7KHz 。滤波级 350 的输出信号被提供给运算放大器 351 的负端，来自输入电源端 390 的电压信号（它已被分压为预定值，例如电源的一半）被提供给运算放大器 351 的正端，运算放大器 351 放大输入到晶体管 366 的基极的相应输出信号。输入电源端 391 的电压通过电阻 364 提供给晶体管 366 的集电极。于是，被放大器信号按照与以上参照图 4 所描述的方式相同的方式，从手持送受话器 10′传送给电话单元 18 ，从电路单元 18 通过电话线传送至所想要的电话，或者与来自电话的接收信号组合后再传送至输入端 231 。

由于图 4 和 5 中无标号的各个电路元件的连接和元件值对于本领域普通技术人员而言是显而易见的，对于理解本发明不是必不可少的，所以它们就如图所示地连接，不作进一步的说明。

图 6A 、 6B 和 6C 表示采用按照本发明的实施例的消噪设备的悬挂式话筒 100 。具体来说，该悬挂式话筒 100 一般来说包括外壳 174 、电话板组件 178 、第一和第二话筒 112 和 114 以及部分 147 。外壳 174（它可以用塑料类或金属类材料来制成）包括具有一个孔的圆形部分，轴 106 可以

Apple Inc. Exhibit 1015 Page 1657

插入该孔。于是悬挂式话筒 100 可以如图 6A 所示地绕轴 106 旋转。

第一和第二话筒 112 和 114 分别通过导线 102 和 104 与电路板组件 178 连接。电路板组件 178 包含类似于在电路板组件 78 上的如上所述的处理来自第一和第二话筒 12 和 14 的信号以便传送给电话单元 18（为简明起见，在此不再详述）的电路的电路。因此，该电路板组件 178 从第一话筒 112 接收话音和背景噪声信号，从该话音和背景噪声信号中减去来自第二话筒 114 的背景噪声信号，产生基本上代表话音的信号。这种信号被传送给发送装置（未示出），被变换为 RF 信号并被发送给远端接收装置（未示出）。第一和第二话筒 112 和 114 分别被例如可用泡沫状材料制成的固定部件 176 固定。例如可以用塑料类或金属材料等制成的格网屏 146 被固定在切掉部分 147 上，以便保护第一和第二话筒。格网 146 具有例如可以是约 0.030 或小于 0.030 英寸的预定厚度。

可以是电驻极体话筒的第一和第二话筒 112 和 114 的安放方式与上述手持送受话器 10 的第一和第二话筒 12 和 14 的安放方式相同。就是说，如图 5A 所示，第一和第二话筒被分别安排成使得在平行于第一话筒的接收面或敏感面的平面和操作者的话音的方向之间的角度是θ'，在垂直于第二话筒的敏感面的轴线和话音方向之间的角度是$[(90 - \theta)' + \phi']$。此外，第一和第二话筒 112 和 114 被安排成其相互间有一角度ϕ'，该角ϕ'的值最好在 30^0 和 60^0 之间。第一和第二话筒 112 和 114 的安放位置相当接近格网 146 和外壳 174 的切掉部分 147，以便不接收其失真程度为不可接受的声音。

虽然以上描述的实施例只是有一个第一话筒 12（112）和一个第二话筒 14（114），但本发明不受限制，第一和/或第二话筒可以具有任意个数的话筒。例如，可以把接收器部分 42′（未示出）设计成为包括作为第一话筒 12′（未示出）进行工作的两个或两个以上的话筒和作为第二话筒 14′（未示出）进行工作的两个或两个以上的话筒。在这种设计中，当使用多个话筒作为第一和/或第二话筒时，最好为第一话筒 12′的除一个外的全部话筒和第二话筒 14′的全部话筒设置各自的可变限流电阻。于是分别从第一和第二话筒 12′和 14′的输出都将包括几个这样的话筒输出电压的加权和。最好分别确定各个限流电阻的值，以便使第一和第二话筒 12′和 14′的某些功能性差别减至最小。用于选择限流电阻值的准则或等价各个话筒的加权函数可以按照任何众所周知的梯度搜索算法来确定。

图 9A 表示具有如图所示地放置的第一话筒 300 和第二话筒 302 的话

Apple Inc. Exhibit 1015 Page 1658

筒架 320。第一话筒 300 包括一个压敏表面 301，第二话筒 302 包括第二压敏表面 303。如图 9A 所示，第一和第二话筒 300 和 302 的安放使得各自的压敏表面 301 和 303 彼此构成约 180° 的角。在话筒 300 和 302 之间还有一结构反射板 322。这种结构反射板 322 可以由能够在话筒之间产生声分离的结构部件组成。或者可以用声反射装置来代替结构部件。此外，如图 9A 所示，第一和第二话筒 300 和 302、尤其是它们各自的压敏表面 301 和 303 位于一个距离或尺度 b 之内。

第一话筒 300 能接收声音、例如来自用户的语音并将这种接收的声音变换为相应于这种语音的信号。这种第一话筒 300 还可以接收可能存在的背景噪声。如将看到的，这种背景噪声与接线员的话音相组合，于是由第一话筒提供的信号相应于来自用户的语音和背景噪声。相反地，安放在话筒架 300 内的第二话筒 302 基本上只接收背景噪声。具体来说，第二话筒 302 的压敏表面 303 最好与第一话筒 300 的压敏表面 301 成约 180° 的角。还有，如上所述，第一和第二话筒 300 和 302 之间安有反射板 322。这种反射板能够使第二话筒 302 接收最少的这种用户话音或根本接收不到。还有，第一和第二话筒 300 和 302 最好彼此靠得相当近，即在距离 b 以内。作为一个例子，这一距离 b 可以在 0.10 至 0.50 英寸的范围内，最好是约 0.25 英寸，或小于 0.25 英寸。本领域的普通技术人员根据本说明书的内容而不必进行过度的实验就能够确定合适的距离 b，本发明不必受 b 的具体值的限制。

图 9B 表示具有以略微不同于图 9A 的话筒架 320 内的两个话筒的安放方式安放的第一和第二话筒 300 和 302 的话筒架 330。就是说，如图 9B 所示，第一和第二话筒 300 和 302 彼此并排错开地放置。此外，反射板 332 设置在第一和第二话筒 300 和 302 之间，按照与图 9A 的反射板 322 相同的方式提供话音的声隔离。

图 9C 表示采用了有源减噪装置的头戴送受话器组件 400。如图所示，这种头戴送受话器组件 400 一般来说包括头戴送受话器 401、具有左盖 403 和左软垫 409 的左外壳 402、具有右盖 405 和右软垫 410 的右外壳 404、话筒架组件 413、以及话筒架 440。这种话筒架 440 包括可以按照以上参照图 9A 和 9B 所描述的方式安放的第一和第二话筒 300 和 302。此外，这种话筒架 440 还包括上话筒外壳 406、下话筒外壳 407、第一和第二话筒 300 和 302、以及风向袋（Windsock）408。图 9C 表示包括相对于输出

Apple Inc. Exhibit 1015 Page 1659

换能器 460 和可以是泡沫塑料、衬垫等的声滤波器 470 安放的传感话筒 450 的结构。优选声滤波器 470 是流动缓慢的泡沫塑料，如将在图 23A 和 23B 中所详细描述的，用这种泡沫塑料在扬声器和用户的耳朵之间形成声波导。部分覆盖了传感话筒 450 的声滤波器 470 的功能是将该拾音话筒与输出换能器隔离开来。拾音话筒 450 不是必须与输出换能器 460 在同一平面，而是可以在输出换能器 460 的平面之上、之下、与该平面相切或相邻。不覆盖传感话筒 450 的声滤波器 470 的部分也起到在输出换能器 460 和用户的耳朵之间的声波导 475 的作用。如图 24 所示，在声波导 475 内形成静区。声波导 475 把用户耳朵耦合至输出换能器以便提高扬声器的效率。传感话筒 450 与扬声器不在一平面的这种设置使得离静区更近，实现噪声和抗噪信号之间精确的相位一致。此外，传感话筒 450 的安放和取向将沿扬声器声场的方向的话筒灵敏度波瓣方向图减至最小。在本有源减噪设备中使用的传感话筒 450 是全向话筒，它可接收来自所有角度的噪声。传感话筒的这一特性使其能够相对于头戴送受话器的耳机被灵活地放置。

图 9D 表示头戴送受话器组件 400 的侧视图。如图所示，左外壳 402 包括电路板组件 412，该电路板组件 412 可以包含用来如以下详细描述的那样对声信号进行处理的电路，该左外壳 402 还包括把信号传送给外界或主设备（未示出）和从它们那里接收信号的电缆组件 411 。图 9E 表示右外壳 404 的侧视图。

图 9F 表示在减噪设备内的传感话筒 450 的另一实施例。在图 9F 中，传感话筒与输出换能器 460 邻近，但不必与换能器在同一平面内。声波导 475 覆盖扬声器的相当大的部分，话筒 450 在波导 475 形成的静区之外。

如上所述，第一和第二话筒 300 和 302 最好被安排在距离 b 之内，并且还被设置成使第一话筒 300 接收话音和背景噪声，而第二话筒基本上只接收背景噪声。如图 7A 和 7B 所示，这种背景噪声可以是由位置 304 的压力声源发出的。就是说，如图所示，这种位置 304 可以与第一和第二话筒 300 和 302 之间的中点相距距离 r ，它们之间有一角度θ。于是第一话筒 300 和位置 304 之间的距离约等于[r －（ b/2 ）（ Sinθ ）]，位置 304 和第二话筒之间的距离约等于[r +（ b/2 ）（ Sinθ ）]。

图 8 表示适合于处理由话筒 300 和 302 产生的信号的差分放大器 500。如图所示，这种差分放大器 500 包括放大器 310 、放大器 312 和相加电路 314 。第一话筒 300 产生的信号传送给放大器 310 ，该放大器 310 适合于

Apple Inc. Exhibit 1015 Page 1660

为这样的信号提供基本上为 1 的增益，并提供这一信号作为输出信号。这一输出信号提供给相加电路 314 的一个输入端。第二话筒 302 产生的信号传送给放大器 312，该放大器 312 实质上使接收的信号反相，并把其提供给相加电路 314 的第二个输入端。相加电路 314 把接收的信号进行相加，产生相加的输出信号 $e_{(out)}$。如将看到的，这一相加的输出信号 $e_{(out)}$表示基本上只相应于用户的话音的信号。

图 10A 和 10B 更详细地表示图 8 的差分放大器 500。就是说，图 10A 表示这种差分放大器 500 的第一种结构，图 10B 表示这种差分放大器 500 的第二结构。现在更详细地描述这两个原理图的每一个图。

如图 10A 所示，由第一话筒 300 产生的信号被提供给输入端 600，并从该输入端通过电容 C1 和电阻 R 被提供给运算放大器 V1A 的反相输入端。由第二话筒 302 产生的信号被提供给输入端 602。这样的输入端 602 与电位器 RA 连接，电位器 RA 又被连接到地。输入端 602 还通过电容 C2 以及电阻 R1 和 2R 与运算放大器 V1A 的非反相输入端连接。这一运算放大器能够以差分模式进行工作，把输出信号提供给端子 606，端子 606 又与该运算放大器 V1A 的反相输入端连接。运算放大器 V1A 的这一输出还被传送给电位器 608，该电位器 608 的一端接地。电位器 608 通过耦合电容 C3 与运算放大器 V1B 的非反相输入端连接。该运算放大器 V1B 的输出被提供给晶体管 610 的基极。晶体管 610 的发射极与端子 612 连接，端子 612 再通过电容 C4 与输出端 614 连接。相加的信号 $e_{(out)}$由端子 614 提供。晶体管 610 的集电极与端子 616 连接，端子 616 再与给本电路提供电压 V_+ 的电源（未示出）连接。端子 616 与适合于提供直流偏压的电阻 R3 和 R4 连接。没有被具体描述的元件如图 10A 所示地连接。

通过使用图 10A 所示的上述电路，对于第一和第二话筒 300 和 302 所呈现的阻抗被对称地平衡，以便使频率之间的差分相移减至最小。此外，该电路的输出信号具有相当低的阻抗。

图 10B 表示上述的图 8 的差分放大器 500 的第二种电路或一替代电路。图 10B 的电路适合于通过源电阻从电源（未示出）接收功率。就是说，驱动图 10B 的电路的功率由具有有限输出电阻 R 的电源提供，而不是由具有零输出电阻的电源提供（例如图 10A 的电路）。如将看到的，图 10B 所示电路在其它方面基本上与图 10A 的电路相同，因此在此不再描述。

图 11 表示一个倒相电路，它可被用来代替图 10A 或图 10B 所示电路。

Apple Inc. Exhibit 1015 Page 1661

如图所示，该电路 700 一般来说包括第一和第二话筒 300 和 302 、幅度调整电位器 RA 、电阻 R1 和 R3 以及电容 C ，它们的连接如图 11 所示。第一和第二话筒 300 和 302 的每一个都可包括一场效应晶体管（ FET ），可把该 FET 的漏极看作是正（ + ）的，把其源极看作是负（ - ）的。漏极和源极间的相位约是 180°。例如，其漏极可以具有 180°的相位，而源极具有 0°的相位。于是第一和第二话筒 300 和 302 的每一个都包括两个端子，即正（ + ）端和负（ - ）端。在图 11 的电路中，第一和第二话筒的正（ + ）端可以是其上端，而这些话筒的负（ - ）端可以是其下端。此外，幅度调整电位器可以在该电路的初始组装期间进行调整或设定，或者可由图 9C 的头戴送受话器组件 400 的操作者进行调整。当相同声压的声音被第一和第二话筒 300 和 302 接收时，输出信号 $e_{(out)}$的值就是零（ 0 ）。

同 12 表示可用来代替图 11 的倒相电路 700 的电路 800 。在电路 800 中，话筒 300 和 302 被相反地充电。于是，在第一和第二话筒接收相同声压的声音的情况下，一旦对它们的输出进行相加时，则输出信号 $e_{(out)}$的值基本上是零（ 0 ）。电路 800 的其余部分基本上与图 11 的电路 700 的相同，因此不再描述.

这样，在本发明中可以使用图 10A 、 10B 、 11 或 12 所示的任一电路。这些电路使对可以是驻极体型的话筒的第一和第二话筒 300 和 302 执行的校准处理便于实现。此外，这些电路可被包括在一印制电路（ PC ）板上，该印制电路（ PC ）板可被安装在头戴送受话器组件 400 内，例如就像图 9D 所显示的 PC 板 412 。或者，这种 PC 板可被包括在头戴送受话器组件 400 的其它部分内，或位于与头戴送受话器组件 400 分开的主设备内。

于是本发明提供了能够减小或消除背景噪声的组件、尤其是头戴送受话器组件。本发明的设备能够使用起偶极子作用的第一和第二话筒，这两个话筒可以由制造商进行匹配，或者可以在制造后通过测试来进行匹配，它们的频率响应在预期的工作范围内基本上是平坦的。此外，如上所述，第一和第二话筒最好设置成使它们各自的压敏表面彼此构成 180°，并且彼此靠得较近。通过这样设置第一和第二话筒，就能够使从声源（其至话筒的距离远远大于两话筒之间的距离）发出的声音（尤其是背景噪声）能够被这两个话筒同时接收。于是在它们之间不会出现显著的相位差。还有，本发明还使消噪量可在本头戴式送受话器组件的制造期间进行调整或替换地由使用这种组件的操作者进行调整。

Apple Inc. Exhibit 1015 Page 1662

例如图 7A 至 13B 的悬挂式话筒可以基于支配在近场和远场内的全向话筒的方向性图和该话筒的压敏表面的正确安放的原理。图 9A 和 9B 所示的话筒的结构设计是增大 S/N 的决定因素。细看这些图会发现话筒压敏表面最好彼此形成 180°，并提供了传向近场内的话音话筒和噪声话筒的信号的最佳分离。这种分离是确定信号的 S/N 比值的主要因素。一般来说，为了在远场中获得信号，需要在所希望的位置处对从全部简单声源到达该位置的声压进行矢量相加。这种分析的一个基本部件就是这里所谓的“偶极子声接收器”。

几何关系如图 7A 和 7B 所示。假定从两个接收话筒（ 300， 302 ）至产生声压 P 的点 A 的距离 r 大于这两个话筒（ 300， 302)之间的间距 b。从点 A 到达该接收偶极子的球面声波对于话筒 300 而言已走了（ r － b/2 Sinθ ）的距离，对于话筒 302 而言已走了（ r + b/2 Sinθ ）的距离。如果知图 7A 和 7B 所示 r >>b，则球面波走过的距离就是 r，每一接收话筒（ 300， 302 ）的输出相等。如果这两个话筒（ 300， 302 ）的相加的输出如图 8 所示为零，则相关比例因数是相同的。如果它们的相关比例因数不相同，则声压的任意相位和振幅就可以如图 8 所示是 $e_{(ort)}$。可以以电的方式实现对振幅的调整，但对于所有频率未必都能够实现相位调整。因为再现性是在话筒的制造中所固定的，并且它们提供了随频率的跟踪相位输出，所以不需要进行相位调整。这种方法被称为振幅和相位话筒波瓣结构，这种结构是本发明的定向话筒的基础。这些话筒将能够在某些方向上比其它方向更好地接收声音。

刚刚描述的话筒是两个偶极子声源，类似于偶极子理论。此外，如果话筒之间的间距 b 在任何距离处与波长（λ）相比是很小的（ b<<λ ），则这两个话筒基本上是结合的，在任何频率下，对于匹配的比例因数（振幅/相位），在任何角度ϕ 处的输出都将是零。此外，可以以电的方式定标和定相任何角度θ 处的输出来获得所希望的波瓣强度输出。如果 b 不是远小于 r，则接收输入声波的两个话筒之间的相位关系是;

$$\phi = \frac{360bf}{v} \qquad (1)$$

其中 b = 传感话筒和噪声话筒之间的间距

f = 以 hz 为单位的频率

Apple Inc. Exhibit 1015 Page 1663

v = 波速（英寸/秒）

ϕ = 在特定频率下的相移

由公式（1）可看到，这种相位关系是对于消噪话筒的近场和远场交叉时的理论限制。由于频率改变，在固定的 b 的情况下，相位改变，即：在ϕ = 90° 处，可能根本设有任何抵消噪。在没有声滤波器的情况下，这种相位变化可以是消噪带宽的决定性因素。

本发明的图 7A 至 13B 的实施例可在用于消噪的话筒的远场模式中使用。通过利用这样的声设计来获得减小 b 的影响，即这种声学设计在图 9A 中是使尺寸 b 减至最小或减至零，以及在图 9B 中，则是被用来减小所示探头的厚度。这两种设计都利用了 b 和 r 之间的关系（即 b<<r）。

为了保证近场响应是所想要的响应，电路滤波器(例如包括图 14 所示的低通滤波器)只允许在输出中存在有话音频带的频率 $e_{(out)} = (mic_1 - mic_2) K/(B + W)$，并使把对 b 和$\lambda$的限制保持在实际约束范围内。

如果元件数目增多，并如图 15 所示地采用话筒阵列，则抵消/增强的波瓣图就是侧瓣（$\theta = 90°$，$\theta = 270°$），$\theta = 0°$和$\theta = 270°$处的波瓣图增大，线性阵列的元件数目越大，$\theta = 0°$加上$\theta = 180°$ 的波瓣图就越尖锐。图 15 表示话筒 922 沿 x 轴均匀间隔开便于分析，但间距不必是均匀的。中间一对元件 M_2 和 M_3 的间距是 b，最外一对元件 M_1 和 N_N 的间距是 d。当声压作用于话筒时就产生正弦波，该正弦波入射到单元或话筒的阵列。波传播方向与 x 轴在单元 M_2、M_3 之间的中点 918 处形成角度θ。波（未示出）的振幅是该点处瞬时声音振幅 304 的量度。距离 d 是第一个话筒和第 n 个话筒之间的线性距离。这些断言都是基于相同的话筒和使用了合适的电滤波器，使得当 r 不是远大于 b 时，该电滤波器允许根据波瓣结构以数学方法计算话筒偶极子。波瓣结构的概念对于本领域技术人员是熟悉的。

在利用阵列来把接收波瓣调整为$\theta = 0°$和$\theta = 180°$之后，通过把该线性阵列装入图 16A 所示的半径为 a/2 的圆柱体能够大大地衰减 180° 波瓣，其中值 a 是声音输入，180° 侧在物理上用内部吸音填充物 905 来装填，防止产生任何驻波。在与话筒阵列主轴平行的平面内将开缝或孔，以保证对进入的声信号产生偶极子作用是在$\theta = 90°$和$\theta = 270°$的方向。

还应指出阵列两端的话筒、即图 16A 的 1 加上 n 是沿圆柱状吸音填充物 905 的轴以线性距离 d 被放置，填充物 905 起声阻的作用。由于该距离

Apple Inc. Exhibit 1015 Page 1664

足够大，所以话筒是彼此独立的，进一步增强了沿θ = 0°轴的声音，这样就提高了定向性。

图16B与图8B的相同之处在于差分放大器能够处理由话筒900至第n个话筒产生的送到放大器910的信号的线性阵列，其输出被输入给相加电路914，其中输出信号被传送给在如图7A至13B所描述的这些电路中所使用的一最后的相加放大器。其输出信号相应于几乎只是用户的话音。

图10A和10B的电路与在上面参照图1至9描述的电路实施例中所利用的电路相同．该电路中的U1A用于相减，而U1B用作输出接口。倒相电路如图11所示。如果（在制造时）使话筒1和2是匹配的，则该电路将在点A和B提供给这两个话筒以两个具有180°相位差的相等的声音信号。通过调整RA和电容C能够调整输出，使在基准频率下实现振幅匹配。当把话筒放在上述恰当的实际环境中时，信号$e_{(out)}$就是消噪输出。

分析图11的电路能够得出以下信息。A处的输出是来自被包括在话筒（最好是驻极体型）内的内部FET的源极，该源极的输出相对于输入声压信号具有0度的电角度，B处的输出是来自被包括在驻极体话筒内的内部FET的漏极，该漏极的输出相对于输入声压信号具有180度的电角度。当这两个远场信号以电压模式进行相加时，如果在基准频率下利用电位器RA调整振幅，并且振幅响应在频谱范围内是平坦的，则输出就是零。

在图12的电路中，被反向充电的话筒在A处和B处提供相位相差180°的两个信号，这两个信号分别与话筒1和2的声音信号相同。这种倒相作用是通过在驻极体话筒电容极板制造过程中进行反向充电来实现的。

倒相电路的所有其它特性如上所述。在图11和12中看到的电路类型不需要使用运算放大器就实现了电方式的减法运算。

此外，本发明的悬挂式话筒/系统由话筒的压敏表面的位置最佳地被确定，在悬挂式话筒的情况下最好是180度，但因为图10A－12所示的是减法类型的系统，所以在全部角度下都出现消噪效果。实际上，当话筒压敏表面彼此成0角度时，在理论上能够获得全部消噪，但就不会有音频信号被传送。本发明的系统能够依赖于在近场和远场时的话筒的方向性图、它们的压敏表面的取向以及电方式的减法处理。

可用于减法的典型电路如图10A－12所示。本发明的头戴送受话器装置（例如图7A－13B）能够提供计算机话音识别。该头戴送受话器提供对不想要的背景噪声的出色抑制和优越的话音响应。头戴送受话器可被

Apple Inc. Exhibit 1015 Page 1665

设计成与所有 Sound Blaster™ 声卡兼容。还能够容易地适应所有其它声卡接口。

与最新的高质量语音识别软件连接的本发明的头戴送受话器（例如图 7A – 13B ）把利用话音的计算机控制提高到等同于键盘和鼠标的可靠性和用户友好程度。利用本发明，语音识别不再局限于在安静的关了门办公室，而是可在真实世界有噪声的环境中、例如在饭店前厅、医院急诊室、制造厂和有噪声的办公区域中使用。于是本头戴送受话器可以与计算机、电话或真实世界中的其它设备相接口，或者悬挂式话筒（无受话器）可在各种语音识别应用中使用。

本发明的头戴送受话器被设计成对于离声源的距离是敏感的。基本上把从距话筒大于几英寸的距离发出的任意声场消噪达到 30dB （ 3200 % ）。

本发明的头戴送受话器最好与 3 米长的电缆连接，电缆的一头是 3.5 毫米的微型插头（未示出）。为了将其接至声卡，用户只需把该微型插头插入到该声卡的话筒输入插座（未示出）。然后把本发明的头戴话筒呈送给用户。头戴送受话最好具有以下两个特点，以便把话筒安放在恰当的位置进行可靠的语音识别：（ 1 ）在左右两侧的可调整的边撑(temple)垫衬和（ 2 ）可调弯曲的吊杠。在该可弯曲吊杠末端处的话筒最好具有白色或其它颜色编码的小点，以指出该话筒的话音侧，该话音侧应调到正对着嘴。近距离地对着本发明的话筒说话有助于准确的工作。优选地从嘴至话筒的距离应当在约 1/4 至约 3/4 英寸的范围内，最好约为 1/2 英寸或小于 1/2 英寸。

在与 Sound Blaster™ 声卡一起使用时，在消噪应用中采用本发明之前使声卡上的自动增益控制（ AGC ）失效是重要的。如果 AGC 起作用，则当用户没有在说话时， AGC 将自动使输入声音的音量增大，破坏了话筒的消噪性能。通过运行 Creative Mixer™ 和在“记录设定……”条件下用鼠标点击 AGC 软件控制就能够使 AGC 失效。利用 Creative Mixer™ 程序可容易地使输入音频增益满足目标应用的需要。利用 Creative Labs Wave Studio™ 程序的记录和重放特性可容易地对本发明的头戴送受话器进行测试。

图 13A 和 13B 是在一头戴送受话器实施例中的悬挂式话筒的有源消噪曲线，图 13A 中的上部曲线表示近场响应，下部曲线表示远场响应。在图

Apple Inc. Exhibit 1015 Page 1666

13B 中，上部曲线表示靠近说话的响应，下部曲线表示背景噪声响应。本发明的悬挂式话筒实施例的典型技术指标如下：

频响： 20Hz 至 10KHz

输出阻抗：低阻（能够驱动 560 欧姆）

灵敏度： - 47dB ± 2dB （ 0dB=1 伏/帕， 1KHz， 5 伏）

工作电压： 2 伏至 10 伏

电流： <1 毫安（ 5 伏电源）

电信噪比： 60dB （最小）

消噪： 见图 13B

电缆类型：不可拆屏蔽型

电缆长度： 3000 ± 50 毫米

插头类型： 3.5 毫米，立体声微型阳插头；

重量： 56 克（不带电缆）

利用话音可懂度 AI 和 ANSI S3.5 - 1969 的说明，对本发明的悬挂式话筒和标准（已有技术）动态消噪话筒进行了测试，结果如下：

可懂度指数：本发明的悬挂式话筒

1/3 倍频程的中心频率（ Hz ）	S/N （ dB ） [NPR - FPR]	加权系数（带宽校正）	可懂度（ 1 ）权重（ W ）
200	26.6	0.00046	0.01219
250	24	0.0012	0,0288
315	22	0.0012	0.0264
400	20.5	0.0016	0.0328
500	17.5	0.0016	0.028
630	16	0.0023	0.0368
800	15	0.0023	0.0345
1000	12	0.0028	0.0336
1250	15	0.0035	0.0525
1600	9.5	0.0043	0.04085
2000	9	0.0044	0.0396
2500	5	0.0039	0.0195
3150	1	0.0039	0.0039

Apple Inc. Exhibit 1015 Page 1667

可懂度指数：标准（已有技术）动态消噪话筒

1/3 倍频程的中心频率（ Hz ）	S/N （ dB ）[NPR － FPR]	加权系数（带宽校正）	可懂度（ 1 ）权重（ W ）
200	25.5	0.00046	0.01173
250	18	0.0012	0.0216
315	12	0.0012	0.0144
400	11	0.0016	0.0176
500	5.5	0.0016	0.0088
630	3	0.0023	0.0069
800	0	0.0023	0
1000	4	0.0028	0.0112
1250	3.5	0.0035	0.01225
1600	5	0.0043	0.0215
2000	2.2	0.0044	0.00968
2500	3	0.0039	0.0117
3150	2	0.0039	0.0078

AI 和 ANSI S3.5 － 1969 对话音可懂度的说明显示本发明具有 93 % 的准确度，而标准动态消噪话筒只具有 45 % 的准确度。这一数据的比较反映了本发明约 8： 1 的差错率的减小（即标准动态消噪话筒具有 45 % 的 AI（可懂度），本发明具有 93 % 的消噪 AI ）。此外，当把常数校正为有效地减为 50 个周期或小于 50 个周期时，可以期望额外的 AI 。对 AI 计算的逐字评估表明：对于所说的每 100 个字，本发明只犯 7 个错，而标准动态话筒将犯 55 个错。全部数据和计算在 Andrea 电子公司进行收集和执行。这两个话筒系统的测试是在相同条件下在 Andrea 电子公司进行的。

周 17A 表示具有用来输出信号或从使用在任何类型话筒装置中的标准在线电源的电源输入的三端头电路结构的已有技术的放大器和话筒 1004 的方框图，它包括在电话头戴送受话器等中被连接的一放大器 1004 . 该三端结构包括电源输入端 1001 、电压输出端 1005 和接地端 1003 . 为了使信号处理电路简单，图 17B 的方框图表示本发明的具有双端话筒的一话筒加放大器结构。端子 1005 通过电阻 1006 接收电源输入 1001（它是从电源接收的直流信号），并在同一端子即 1005 上传送音频输出，端子 1003 接地。

Apple Inc. Exhibit 1015 Page 1668

因此，在端子 1005 上，直流电被提供给上述有源消噪系统，还共存有由话筒 1004 产生的音频信号。该点 1005 就是图 18 所示晶体管 1050 的集电极。

图 18 表示用于处理分别从第一和第二话筒 12 和 14 获得的信号基本电路，该基本电路提供由话筒信号 1060 产生的、被运算放大器 1070 输出的音频信号输出 1050 和在端子 1020 通过电阻 1005 输入的直流电，该信号和直流电在同一个端子上同时出现。就是说，在同一个端子 1015 上输出音频信号并提供直流电。需要有一种分离在点 1035 处的直流和交流的方法，这种方法最好是使电阻 1030 与电容 1040 连接。在点 1035 处获得的直流用来供电给运算放大器 1070 和话筒 1060，点 1015 处的端子用来输出音频信号。在点 1015 处，音频信号从晶体管 1050 的集电极进行传送，与电容（C）1040 连接的电阻 R（1030）使 AC 信号与 DC 信号分离．与电容连接的该电阻形成了提供 AC（音频）和 DC（电源分离）的一低通滤波器，它从 DC 中滤除 AC。点 1015 处的 AC 和 DC 信号在点 1035 处被分离，因为电阻 1030 外加电容 1040 的滤波作用，所以在该点 1015 处只允许 DC 存在。点 1015 处的音频输出由话筒 1060 的 AC 信号产生。由于所需的话筒的相减的缘故，这种分离是用于本发明操作的优选装置。在 1015 处，来自输入端的 AC 信号和直流电被传送给电阻 1030。AC 信号然后被与电容 1040 连接的电阻 1030 滤除，直流电用来给电路 1070 供电。音频信号（它是 AC 信号）在 1015 处作为输出信号被传送。

图 19 表示双线话筒的一个不同的实施例，电源 2020 通过电阻 2005 输入，所产生的 DC（电流）信号在同一条导线 2015 上传送。因此，晶体管 2050 的集电极输出的音频 AC（交流）信号在点 2015 的同一个端子处叠加在 DC 信号上，组合信号被提供给电阻 2030。AC 分量然后被与电容器电路 2040 连接的电阻 2030 滤除，剩下的 DC 信号用来给包括运算放大器 2070 的电路 2055 供电。在 2015 处传送的音频输出信号由两个话筒 2060 输出的 AC 信号产生，该信号由电路 2055 和运算放大器 2070（这些电路都是本领域普通技术人员所熟悉的）进行处理，并在点 2015 处的同一个端子上被输出。这种双线话筒电路比图 17A 所示的包括输入端、电压输出端和接地端的已有三线话筒电路简单得多。这种双线话筒电路可在图 4 - 5、10 - 12 所描述的任一电路中使用，在这些电路中，信号至少由两个话筒产生。此外，该双线话筒电路还可在图 14 - 16 所示的远场定向话筒中使用。

Apple Inc. Exhibit 1015 Page 1669

图 20 是采用双线话筒电路的图 19 的一替代实施例，在同一个引线端 3015 传送音频信号输出和电源输入。晶体管 3050 的集电极产生的 AC 信号与电源 3020 通过电阻 3005 馈送的直流电信号都在同一个引线端子 3015 上被输出。因此， AC 信号在 3015 处被叠加在输入 DC 信号上，该组合（ AC + DC ）信号被传送给电阻 3030 。在此处组合的 AC 和 DC 信号的 AC 分量被与该电阻 3030 连接的电容器电路 3040 滤除，剩下的 DC 信号用来驱动其余电路 3055 和运算放大器 3070，该电路 3055 是本领域普通技术人员所熟悉的。由话筒电路 3055 和 3070 输出的 AC 音频信号与在点 3015 处的提供 DC 的同一个端子上被传送，该 DC 是提供给在此描述的有源消噪系统。

在图 19 – 20 中没有用参考数字表示的各个电路元件被如图所示那样地连接，并且不再被讨论，因为其连接和数值对本领域技术人员而言是显而易见的，以及对理解本发明并不是必要的。

图 21 表示在已有技术的有源减噪中采用的闭环系统。基本公式是:

$$P=S\left(\frac{H_1H_2+H_2}{1+BH_1H_2}\right)+\left(\frac{1}{1+BH_1H_2}\right)N$$

其中 P 代表试听声压， S 是音频信号， H_1 是高通滤波器， H_2 是头戴送受话器的扬声器， B 是可变的增益/相位控制， N 是拾音话筒处的噪声。因为传输增益（ $1 + BH_1H_2$ ）非常大，所以噪声分量（ N ） 1210 在 P （声压输出 1200 ）处为零。为了使作为电信号输入的想要的音频信号（ S ） 1220 不被消除，增加了两个相加节点（ 1230， 1240 ）。音频信号 1220 输入给这两个相加节点（ 1230， 1240 ），产生传送至用户耳朵的信号。第一个相加节点 1230 把负反馈信号与想要的输入音频信号相加。但是，从话筒反馈的该信号包含想要的音频信号和环境噪声信号，噪声信号是需要被消除的信号。从想要的输入音频信号 1220 中减去该反馈信号，产生不包含音频信号的抗噪信号 1250 。第二个相加节点 1240 把音频信号 1220 加入到环路中去，以便把其传送给扬声器。

图 22 涉及本发明的有源消噪系统，它受公式 $P = AH_2 - (N + D) BH_1H_2 + N_1$ 支配。在该公式中， P 代表声压 1330， A 代表标准音频传输 1340； H_2 代表头戴送受话器 1370 中的扬声器； N 是拾音话筒 1315 处的噪声； D 代表甚低频干扰 1320； B 是可变的增益/相位控制器或校准盒

Apple Inc. Exhibit 1015 Page 1670

1350； H_1 代表高通滤波器 1380， N_1 是在用户耳朵处的静区处的噪声 1390 。该有源减噪系统由具有以下元件的一开环电路组成：音频信号 1340；能够检测并消除噪声 1315 的传感话筒 1310；位于用户耳朵附近的输出换能器 1370；调整抗噪信号 1315 的振幅的可变的增益/相位控制器 1350；把抗噪信号和音频信号 1340 相加的相加节点 1360；防止机械震动产生的频率干扰分量 1320 到达输出换能器的高通滤波器 1380。该系统通过传感话筒或拾音话筒检测环境噪声 1315 并对其进行电声处理来产生消除了环境噪声的声信号。可用该系统来消除所有噪声，获得代表话音的信号，该信号就是用户耳朵将听到的想要的信号。

图 22 的有源减噪系统通过利用传感话筒 1310 检测噪声 1315 和产生与输入噪声信号（ N_1 ） 1315 的振幅相同但反相 180° 的抗噪信号来消除空间中一特定位置处的噪声。通过调整可变的增益/相位控制器 1350 产生与噪声信号 1315 振幅相同但反相 180° 的抗噪信号、并且在一个相加节点 1360 处把输入音频信号 1300 和该抗噪信号相加来得到抗噪加音频信号，从而就衰减了环境噪声且输入音频信号 1300 不被机械震动产生的话筒信号所恶化。

本发明的可变的增益/相位控制器或校准盒 1350 遥控地协调或平衡在传感话筒与头戴送受话器中或任何其它通信装置内的输出扬声器，这种通信装置具有耳机，该耳机又具有用来传送可懂话音的话筒装置。该控制器或校准盒平衡拾音话筒 1310 检测的噪声信号的频率响应的增益及相位以使它与在空间中一预定位置处的噪声分量信号的增益及相位相一致。空间中的这一位置接近位于头戴送受话器的耳机处的输出换能器。由于该话筒非常接近该输出换能器和该输出换能器的频率响应是线性的缘故，噪声信号的相位分量通常是相当平坦的。通过在有源减噪装置中独立地校准话筒的增益和相位以及头戴送受话器的输出换能器的信号，使它们与耳机中的增益和相位一致，就能够在空间的一位置处产生一个理论上的零点或一静区。一般来说，通过调整增益和相位来把环境噪声信号变换为抗噪信号，以便与空间一预定位置即静区处的噪声分量相抵消。本发明的增益/相位控制器或校准盒使头戴送受话器可灵活地应用于任何通信系统、即飞行控制系统、计算机接口、电话网络等，这是由于这些头戴送受话器的适应性很强、可适用于任何通信系统的缘故。

因此，想要的音频输入信号 1340 被传送给耳机的输出换能器，不受背

Apple Inc. Exhibit 1015 Page 1671

景噪声的干扰。到达用户耳朵的输出音频信号具有公式 $P = AH_2$，它是原先输入给头戴送受话器等的想要的音频传输。开环设计的降低了的复杂性便于使所有类型的噪声即伴随、重复和瞬时噪声都被消除。

图 22 所示的消噪系统可被称为没有闭环电反馈补偿的开环系统。图 22 的系统通过采用藉可变的增益/相位控制器 1350 来调整开环系统的参数和/或对传感话筒进行正确的声滤波的方法能够驱动扬声器。最佳的声滤波是使用专门选择的泡沫塑料，最好是如图 23B 所示的缓慢流动(Slo-Flo)泡沫塑料。拾音话筒 1310 相对于扬声器和泡沫塑料的放置在头戴送受话器的扬声器 1370 或任何合适的扬声器和用户耳朵之间形成了声波道 1400。这种话筒的放置把想要的音频信号引导至用户的耳孔，并把产生的任何音频信号与被拾音话筒 1310 检测的噪声隔离开来。拾音话筒 1310 最好与扬声器不在同一平面并在声波导之外，但接近用户的耳孔，在耳孔内形成了如图 24 所示的静区。图 24 的静区保持了在由话筒拾取的噪声信号和在位于扬声器之后的声波导内的抗噪信号之间的相位一致。本发明与基本上在同一平面的话筒和扬声器无关。它们可以在同一平面内；但是，它们不一定是在同一平面内。本发明的减噪设备涉及通过使用在该设备的扬声器和用户耳朵之间的声滤波器形成一声波导来把音频输入信号引导到用户的耳道而不受由拾音话筒 1310 检测的任何噪声的干扰（该噪声已被消除）。在相位差是 90 度或 1/4 波长时可以没有消噪效果，在 180 度或 1/2 波长情况下消噪得到增强。支配这一距离的公式是：

$$\phi = \frac{lf360}{v}$$

其中 ϕ = 特定频率的相位

l = 距离

f = 频率

v = 声速（英寸/秒）

图 22 所示开环公式的 H_1 传递函数 1380 是一高通滤波器。在频率范围内，该高通滤波器在 $H_1 = 1$ 处有效，而在 $H_1 \approx 0$ 处无效。该高通滤波器 1380 的目的是按常规方式抑制低频机械震动造成的瞬态现象以使有源减噪性能以常规的方式继续，而不是如在标准闭环反馈系统中那样被用作前置稳定网络。在开环公式中，支配图 22 中的本发明的断点的是位置，该断点的位置提供装置的最佳性能。断点就是振幅从零（ O ）达到通带前沿的位置。

Apple Inc. Exhibit 1015 Page 1672

在低于断点的频率范围内， $H_1 \approx 0$，及乘积（ $D \times H_1$ ）= 0。调整步骤于是如下：

P = AH2 －（ N + D ） BH1H2 + N1 变成

P = AH2 － NBH1H2 + N1，如果调整 B 使得

NBH1H2 = N1，则

P = AH2，这就是所想要的音频信号。

在断点之上， H1 = 1 和 D = 0。乘积 H1D = 0，进行相同的推理，P = A × H2，这就是想要的音频信号。断点过渡的正确位置和斜率规定了最优选的有源减噪和最佳干扰性能。由于开环系统所固有的稳定性，机械震动的低频信号可被以电的方式滤除而不会显著增加电路的复杂性，也不需要满足闭环稳定性要求。

图 22 的传递函数的测量已表明开环概念存在于本发明的实施例中。从 N 至 P 的传递函数已表明振幅小于 1，如果该系统是 G = 1、 H = 1 的闭环系统，则最大消噪是 50 %。

$$CLTF=\frac{e_{out}}{e_{in}}=\frac{G}{1+GH}$$ ，如果 $GH<1$ $G<1$

$$\frac{e_o}{e_m}=\frac{1}{1+1}=\frac{1}{2}$$，或 $$e_o=\frac{1}{2}e_{in}$$

在这些条件下，开环系统实际上将达到 100 % 的消噪。

在本发明中，不必如图 22 所示地增加第二个相加节点。但是，已有技术的闭环消噪系统如图 21 所详述的对声音进行两次求和来减小拾音话筒相减的影响。由于本发明涉及仅消除被话筒 1310 检测的噪声，并且该话筒独立于被传送给扬声器来获得想要的音频信号 1340 的音频信号，所以本系统显示出在图 22 中只用一个音频相加节点 1360 没有音频减小。

本发明的有源消噪设备的结构图如图 23A 和 23B 所示。图 23B 的声波导 1400 可以执行以下功能中的任一种功能： 1 ）在扬声器 1410 和用户耳朵 1430 之间传导声音和 2 ）隔离从扬声器/用户耳朵 1430 的静区 1440 发出的声音到达在该扬声器边缘处的噪声拾音话筒 1420。本发明的装置的结构设计的元件可以采取以下形式中的任一种： 1 ）噪声拾音话筒和静区之间相距很近，使噪声和抗噪信号之间的相位严格一致， 2 ）话筒的安放、取向和隔离使话筒灵敏度波瓣图沿扬声器声场的方向最小， 3 ）使用声滤波器或隔音板 1440（最好使用缓慢流动(Slo-Flo)泡沫塑料）、但也可使用

Apple Inc. Exhibit 1015 Page 1673

其它合适的材料来形成声波导。声波导如图 23A 所示使噪声拾音话筒与受话器隔离开来，如图 23A 所示地在用户耳朵前方形成静区 1440，以提高扬声器的效率。声波导起接收器的作用，用于接收由对于话筒的电信号的信号处理装置产生的抗噪信号。该抗噪信号产生声波导的静区。具有声波导的装置可应用于任何类型的具有打开的后盖的头戴耳机，即无耳状物的无源耳机或密闭后盖型的头戴送受话器，它们具有无源降噪耳机或采用了接收器和换能器的任何其它合适的头戴送受话器。

图 24 是空间中一静区的测定，其中第一矢量 1500 是噪声矢量，第二矢量是本发明的有源减噪系统产生的抗噪矢量 1501。这两个矢量形成一角度θ，可变增益/相位控制器对振幅进行衰减，藉此控制和减小想要的电输入信号的抗噪处理造成的失真，该电输入信号被变换成声信号并被传送给用户耳朵。

图 25 表示图 22 所示的有源减噪系统的详细的原理图。该原理图包括一拾音话筒 1600、一扬声器 1650、一可变的增益/相位控制器 1610、一信号变换器 1620、一求和放大器 1630、一功率放大器 1640、一抗噪输出信号 1660。标准音频信号 1605 输入给头戴送受话器的用户。传感话筒 1600 检测环境噪声并产生一电信号。该信号输入至由可变的增益/相位控制器 1610、信号变换器 1620 和相加放大器 1630 构成的的电一声处理单元，产生用于消除环境噪声的一声信号，该声信号是指在 1600 处输出的抗噪信号。该抗噪信号被放置在空间中某一位置处的扬声器的前方，以便产生如图 24 所示的一静区。使想要的输入音频信号 1605 与拾音话筒隔离开来，于是该输入音频信号就与被该拾音话筒 1600 检测的环境噪声无关。原先的输入音频信号 1605 能够不受噪声干扰地经扬声器进入静区。因此，在本发明的开环系统中，有源减噪系统产生的音频输入信号不受环境噪声的干扰，该环境噪声被传感话筒电路检测和减小，该传感话筒电路包括：可变增益调整器 1610、信号变换器 1620、相加放大器 1630 和功率放大器 1640。于是不需要如在闭环系统中那样对音频输入信号 1605 进行两次相加。

图 26 表示与图 25 不同的一实施例，它是有源减噪开环系统的具体化，使用了传感话筒 1700、可变增益/相位控制器或校准盒 1710、音频信号变换器 1720、相加放大器 1730、功率放大器 1740 和扬声器 1750。该电路的操作与参照图 22 和 25 描述的相同。

图 27 是图 25 的优选实施例，给有源消噪系统增加了一高通滤波器电

Apple Inc. Exhibit 1015 Page 1674

路 1840 以按常规方式抑制低频机械震动产生的瞬态现象，使其不对有源减噪性能造成干扰。该高通滤波器电路 1840 不是如在标准反馈系统中那样要被用作为前置稳定网络。图 27 还包括用来箝位二极管的饱和降低电路 1860 。图 27 中箝位二极管的功能是防止输出换能器达到其物理极限。即限制输入给换能器的信号的幅值，防止扬声器或输出换能器超过其物理额定值。

在图 25 – 27 中没有用参考数字表示的各个电路元件被如图所示那样地连接，并且不再被讨论，因为其连接和数值对本领域技术人员而言是显而易见的，以及对理解本发明并不是必要的。

图 28 是在具有“说话直通”功能的头戴送受话器中使用的有源消噪和减噪系统的增强形式。

图 28 的增强是通过包括以下功能而达到的：有源消噪系统中检测话音的自动音频话筒传输（“VOX 电路”）1950，把一部分接收的话筒信号传送至扬声器的耳塞机的能力（“侧音电路”）1960 、1907 、1970 和 1930，通过从电路中去除话音话筒和提高噪声话筒放大器（“说话直通”）的增益把有源消噪话筒变换为标准全向话筒的能力 1930 。利用“说话直通”功能，外界的全部声音（1990）都通过增益被增大的侧音通道 1907 传送至耳塞式扬声器 1980 。图 28 的增强有源消噪和减噪头戴送受话器包括：仅检测音频信号的有源消噪话筒 1900 和检测音频信号及背景噪声的有源消噪话筒 1901；具有消噪模式和说话直通模式或位置的第一 S1A 开关 1910；具有消噪模式和说话直通模式的第二 S1B 开关 1925；具有消噪模式和说话直通模式的第三 S1C 开关；具有在工作的话筒位置和模仿话音信号模式的按键通话（PTT）开关 1920；有源消噪话筒放大器 1940；VOX 电路 1950，话音信号 1955；传输门 1945；缓冲放大器 1935；音频系统 1915；具有增益控制功能 1907 的定标放大器 1970，在 1906 处输入的侧音信号 1960；耳塞式扬声器 1980；外部音频系统 1990；以及最好是图 21 – 24 所示的并参看这些图所描述的有源减噪系统。图 28 的这一头戴送受话器不是按消噪模式就是按说话直通模式进行工作。

在消噪模式中，开关 S1 处于“N”位置 1910，有源消噪话筒 1900 和 1901 如上所述地进行工作。PTT（按键通话）开关 1920 在消噪模式下不工作。在 A 点（1945）处与话筒放大器 1940 的话筒输出端连接的 VOX 电路 1950 监测放大器 1940 的话筒输出信号。VOX 包括起动时间（接通

Apple Inc. Exhibit 1015 Page 1675

音频的平均电路的时间）和复原时间（关断音频的平均电路的时间），它被调整来将寄生信号的响应减至最小和在消噪模式中使话筒“接通时间”保持最短。这样做实际上将提高系统的话音与噪声的比值“S/N”。一旦VOX1950已确认话筒输出端处的信号是可用音频信号，它就使C点（1955）处的“话音信号”有效，该“话音信号”将启动传输门1945，使有源消噪话筒放大器装置1940输出的话筒音频信号能够进入缓冲放大器1935，然后在E点（1915）处进入音频系统。此处该音频信号1915在W（1906）处被传送给定标放大器1970，以便在第三开关S1C（1960）处于N位置（消噪模式）时把侧音信号提供给耳塞式扬声器1980。定标放大器1970也能同时从外部音频系统1990接收输入，即来自周围的截然不同的声音，例如喇叭声、在场的人的声音或不是由话筒1900和1901传送的其它外界声音。在耳塞式扬声器1980处的组合信号是侧音1960和外界声音1990的线性相加。

在说话直通模式中，开关S1（第一、第二和第三开关1910、1925和1960）处于说话直通模式或显示为1930的位置。话音话筒1900不工作。话音和噪声话筒1901工作。话筒放大器1940在A点（1905）的输出就是噪声全向话筒1901的输出。在说话直通模式中，VOX电路1950被处于说话直通位置的第二开关S1B（1925）旁路，使噪声全向话筒信号1901的输出在D点（1903）处直接进入缓冲放大器1935，然后在E点处被输出给音频系统1915。于是，因为门1945被禁止，所以在传输门1945的B点（1904）处的输出端处没有话音信号被输出。由于处于说话直通位置1930的开关S1C（1960）的作用，在W（1906）处加强定标放大器1970的增益控制功能1907。于是（图21－27所描述的）有源减噪系统输出的侧音信号在扬声器1980处被增大。

由于图28所描述的装置，在实际上不增加任何其它话筒部件的情况下，就给图9－27所示的并参照这些图描述的头戴送受话器增加了说话直通功能。这一功能使得不摘下头戴送受话器就能够在耳塞式扬声器1980中听到话音的音频传输。这种增强给头戴送受话器用户提供了总是戴着头戴送受话器来接收话筒传送的音频信号以及周围环境中的任何其它截然不同的外界噪声的选择。这种外界噪声可以是任何声音，例如爆炸声、紧急喇叭声或向头戴送受话器用户说话的在场的人的说话声。这种增强避免了整天不断地摘下头戴送受话器来听不是在头戴送受话器中的内部传送的直

Apple Inc. Exhibit 1015 Page 1676

通信号的外界噪声的不便。用户现在能够一边戴着图 28 所示的并参照该图描述的有源减噪和消噪装置，一边听内部音频信号和从周围环境来的外界的声音。

此外，虽然描述了本发明的上述实施例在电话手持送受话器和悬挂式话筒等中的应用，但本发明不限于此，它可应用于许多其它装置，例如内部通话系统、遥测技术、声监测话筒、定向话筒等。此外，本发明还可应用诸如语音识别和/或验证系统这样的系统，用于接入实际设施、访问计算机程序，接入计算机或自动售货机等。还有，本发明还可应用于按照预定处理算法、例如在美国专利 US 5251263 中描述的处理算法进行运行的处理设备，该专利和本申请具有共同受让人，它被引用于此，作为参考；但这样做对于本发明并不是必需的。

此外，虽然在此详细描述了本发明的优选实施例及其改进，但应懂得本发明不受这些具体实施例及其改进的限制，以及本领域普通技术人员在不违背所附权利要求书所限定的发明的精神和不超出其范围可作出其它改进和变动。

Apple Inc. Exhibit 1015 Page 1677

说 明 书 附 图

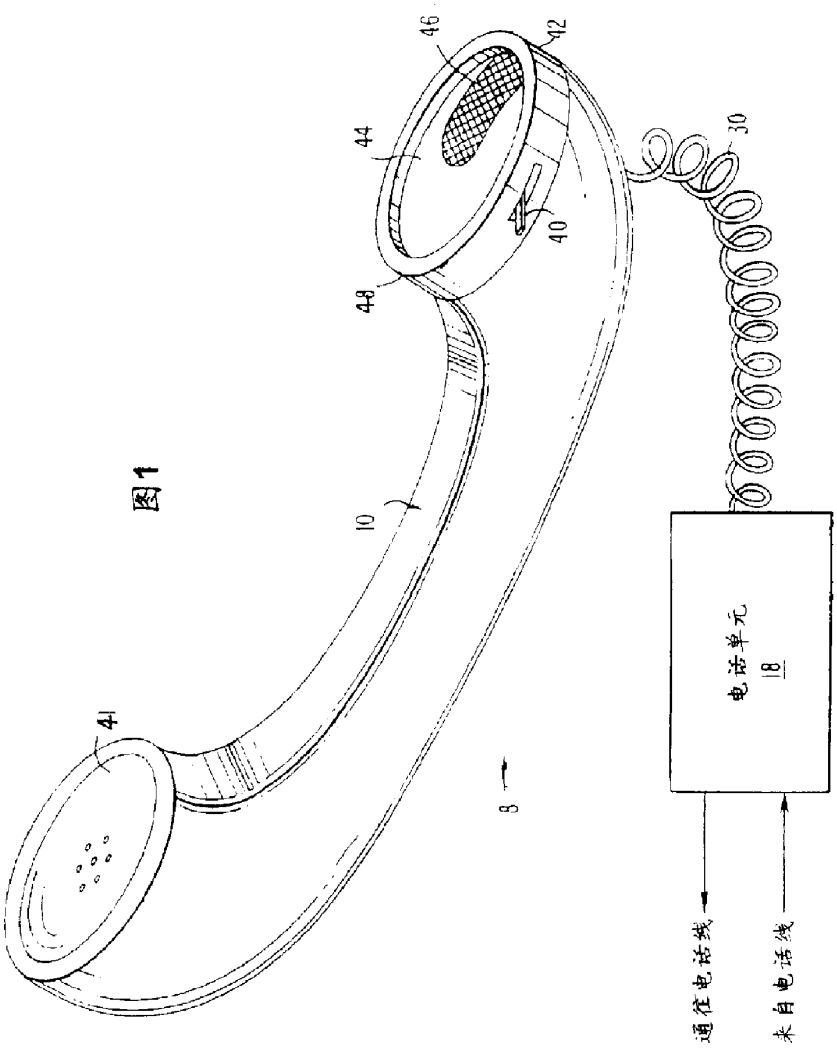


图1

00-02-05

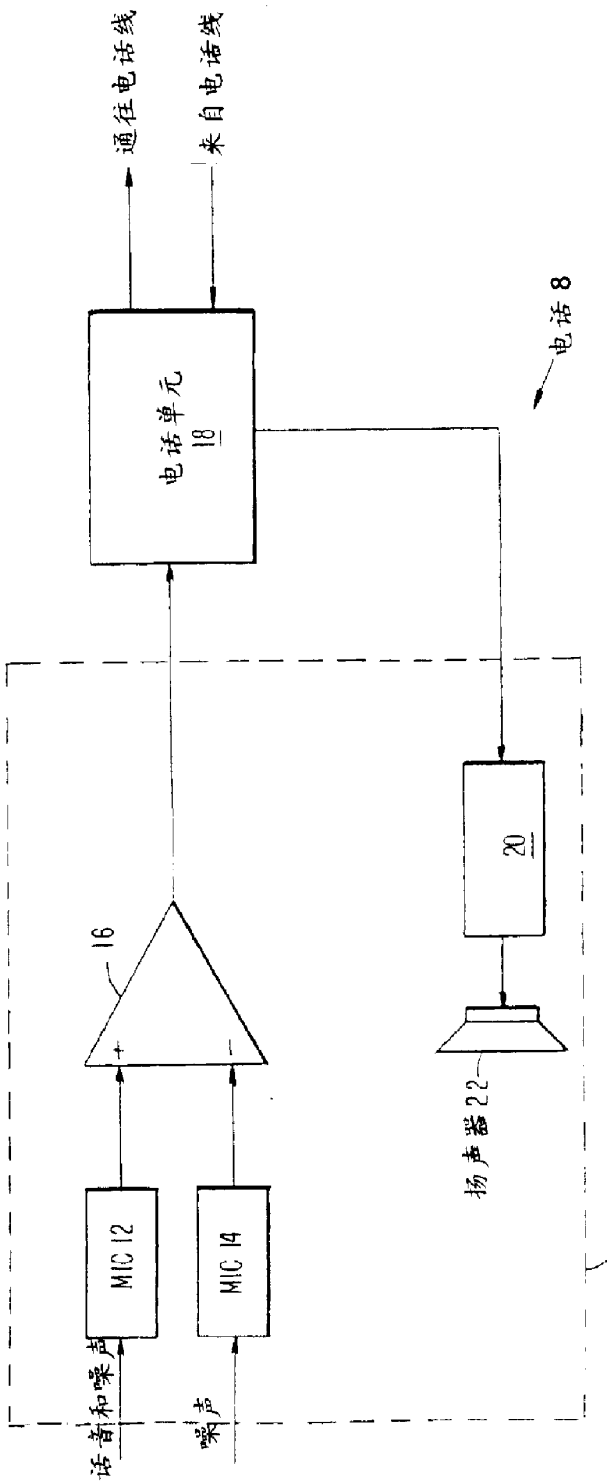


图 2

Apple Inc. Exhibit 1015 Page 1679

98.12.08

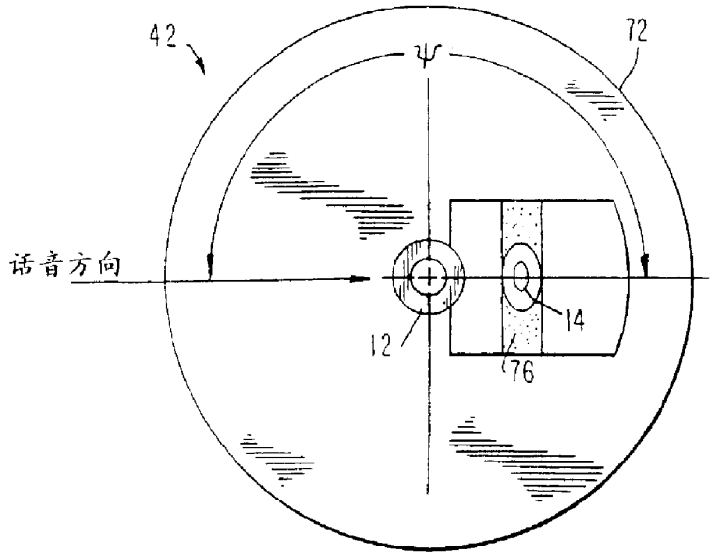


图 3 A

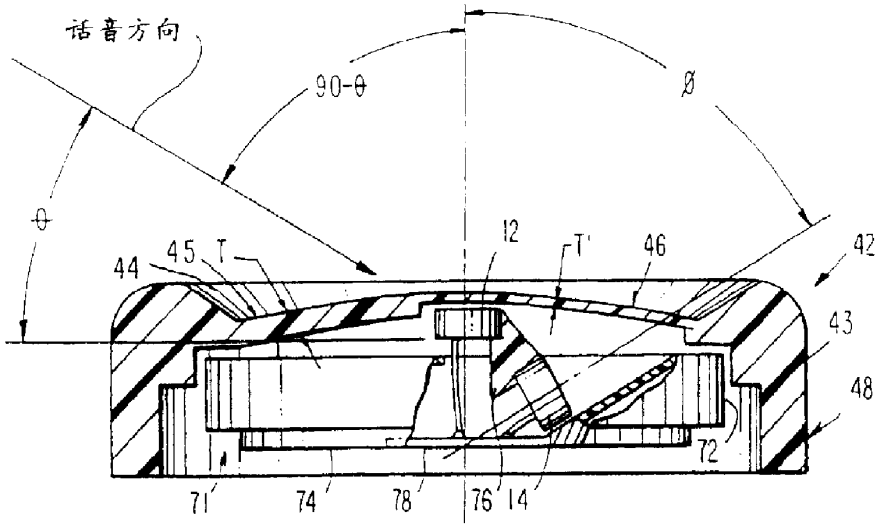


图 3 B

Apple Inc. Exhibit 1015 Page 1680

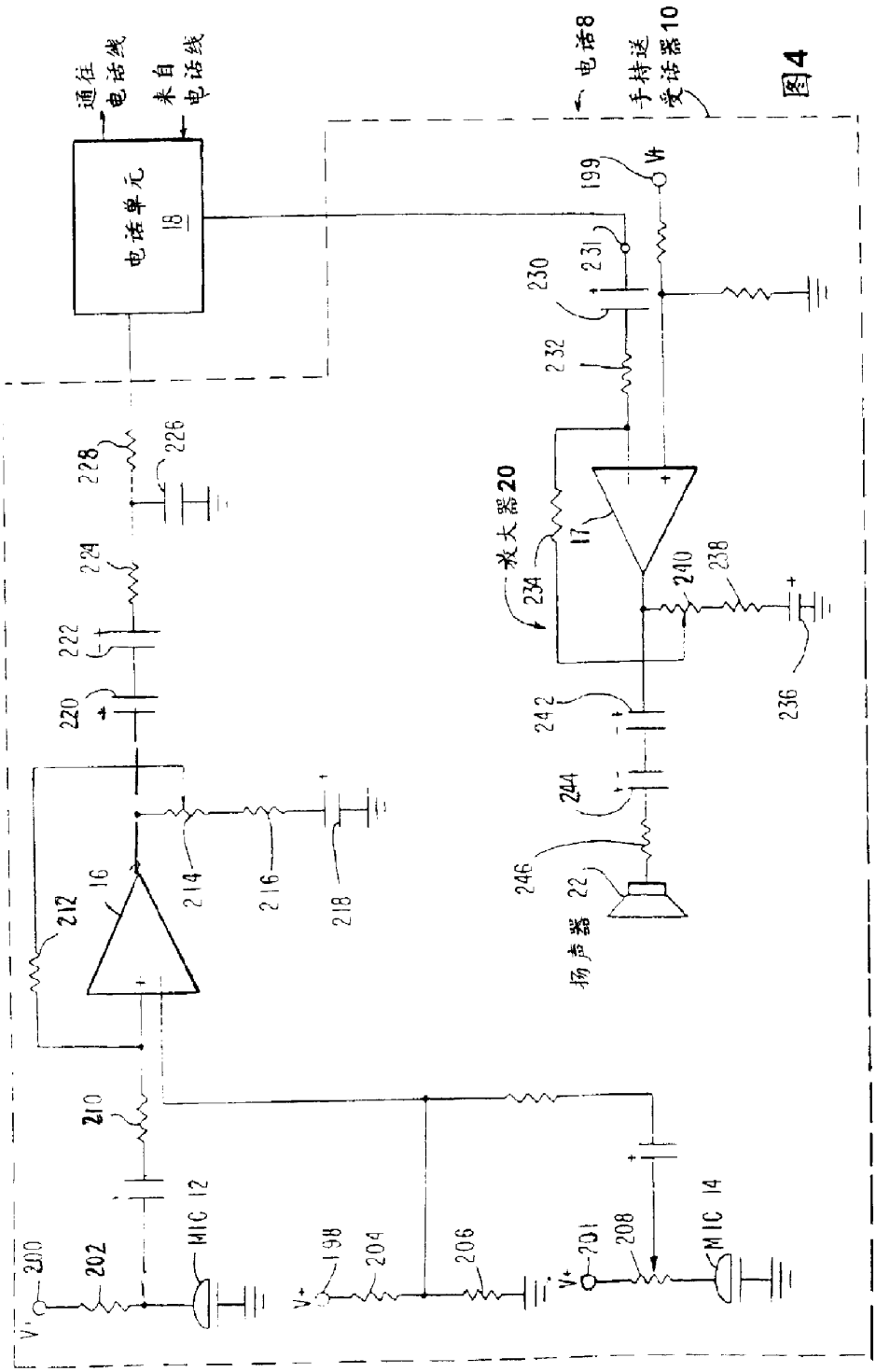


图4

Apple Inc. Exhibit 1015 Page 1681

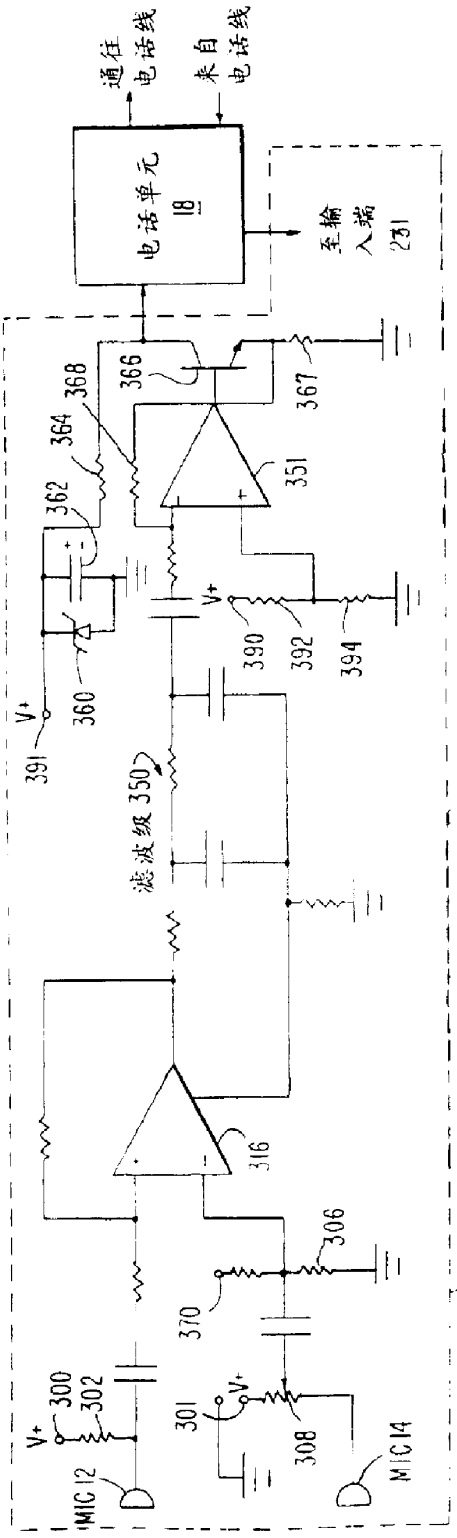


图5

Apple Inc. Exhibit 1015 Page 1682

98-02-06

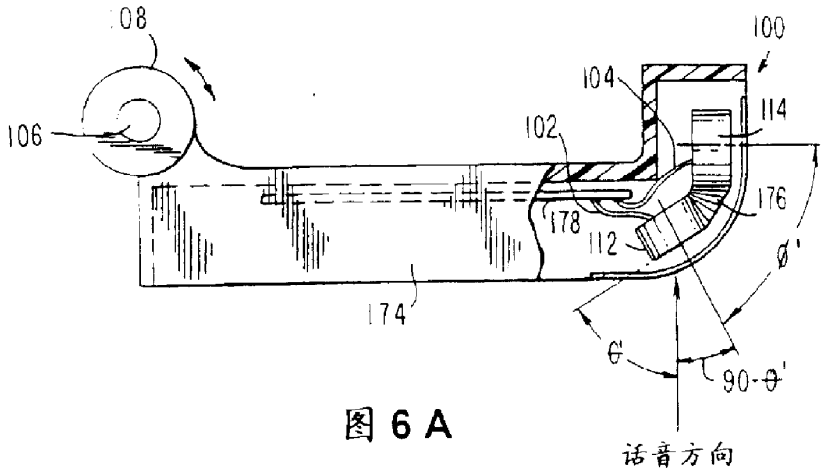


图 6 A

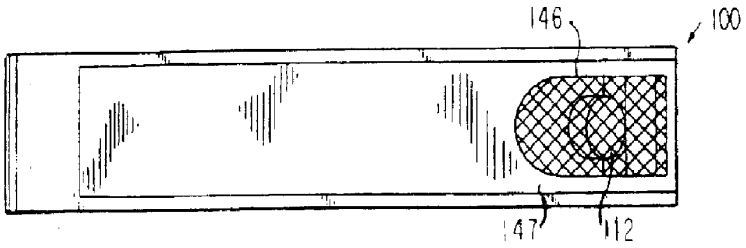


图6 B

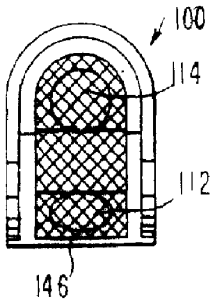
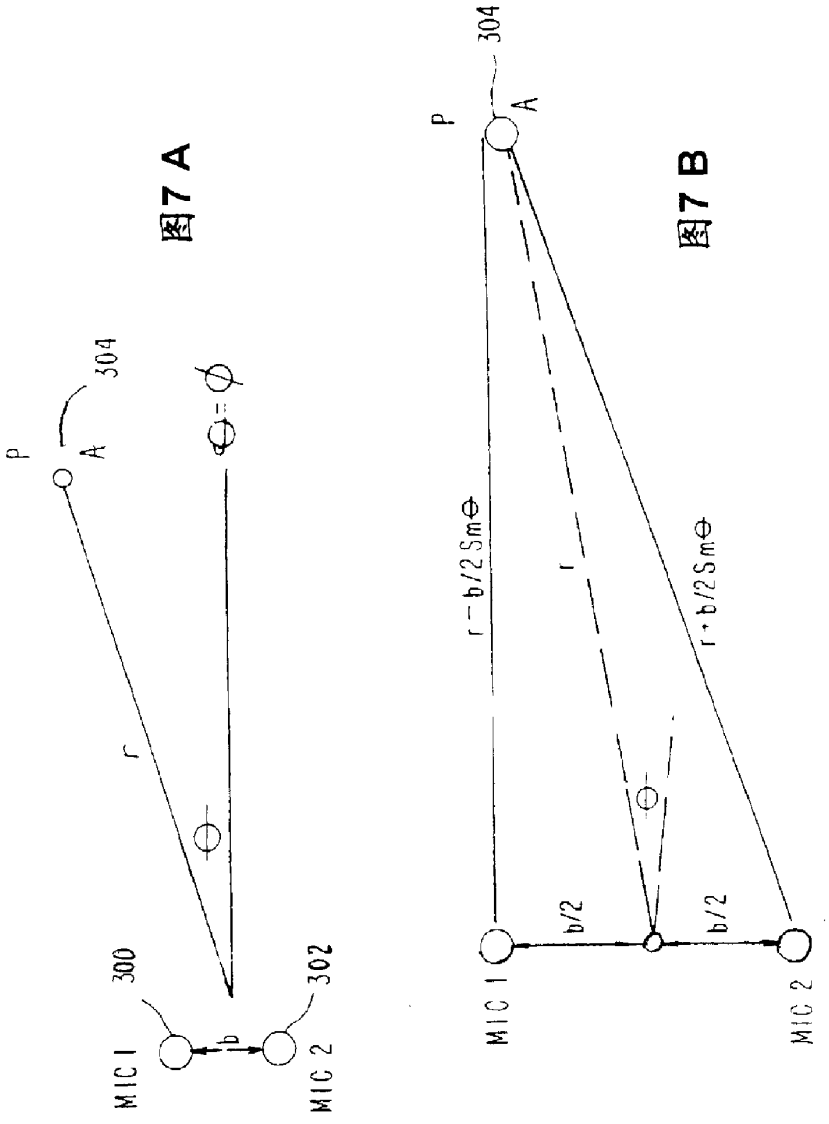


图 6 C

Apple Inc. Exhibit 1015 Page 1683



Apple Inc. Exhibit 1015 Page 1684

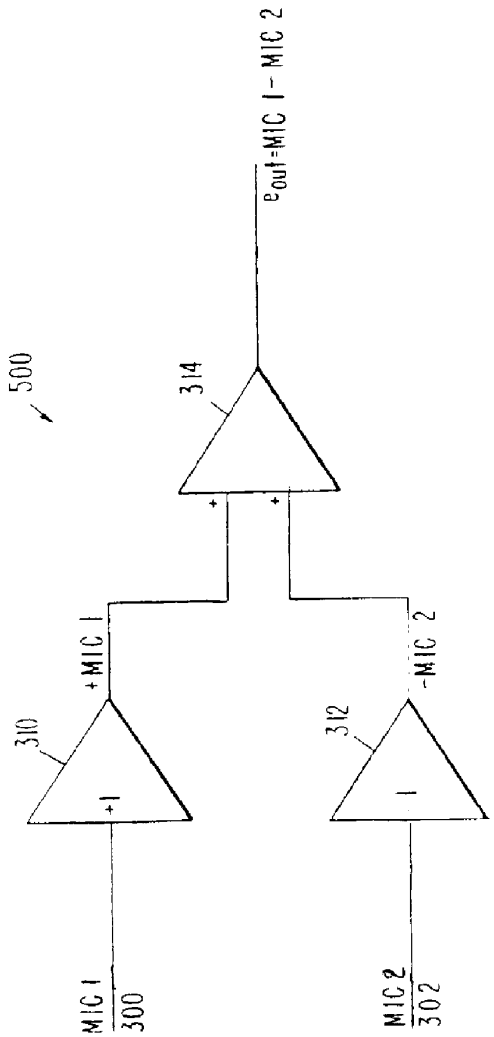


图 8

Apple Inc. Exhibit 1015 Page 1685

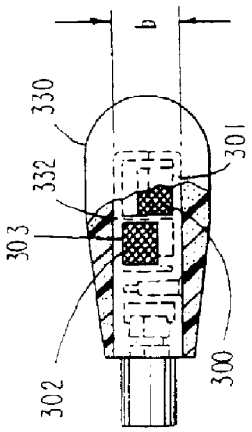


图 9 B

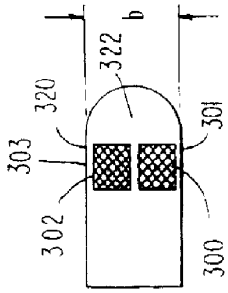


图 9 A

Apple Inc. Exhibit 1015 Page 1686

98-02-06

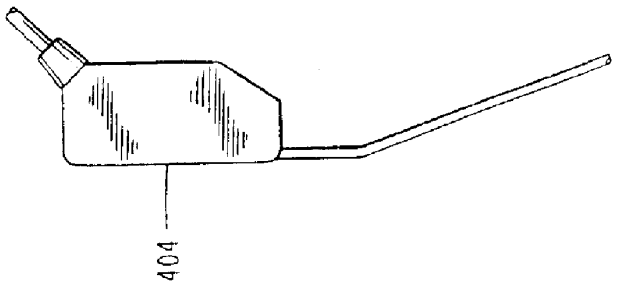


图9E

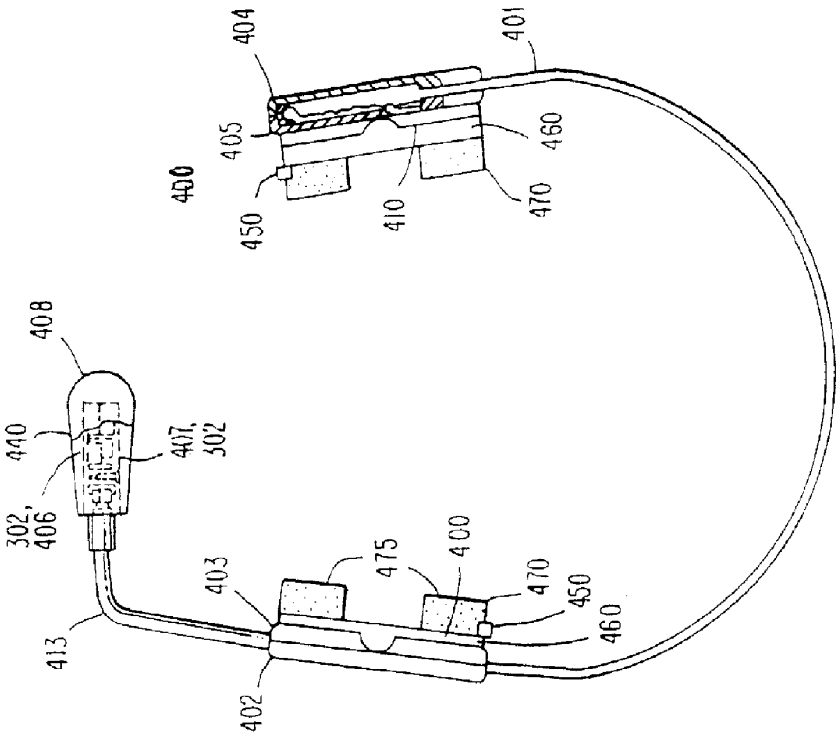


图9C

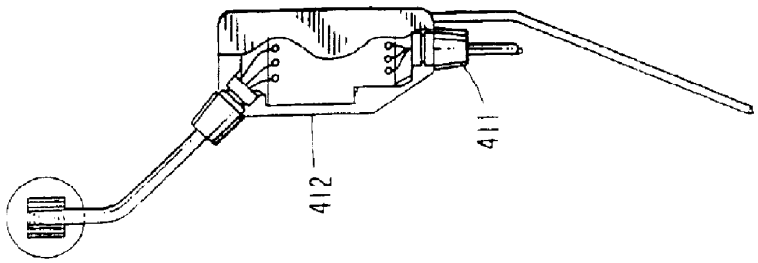


图9D

Apple Inc. Exhibit 1015 Page 1687

2006-02-08

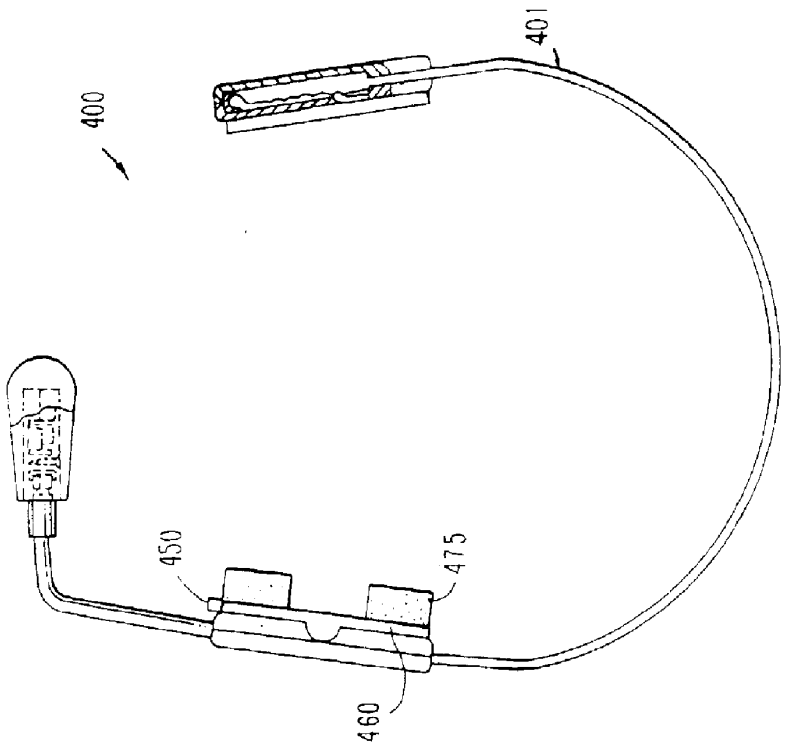


图 9 F

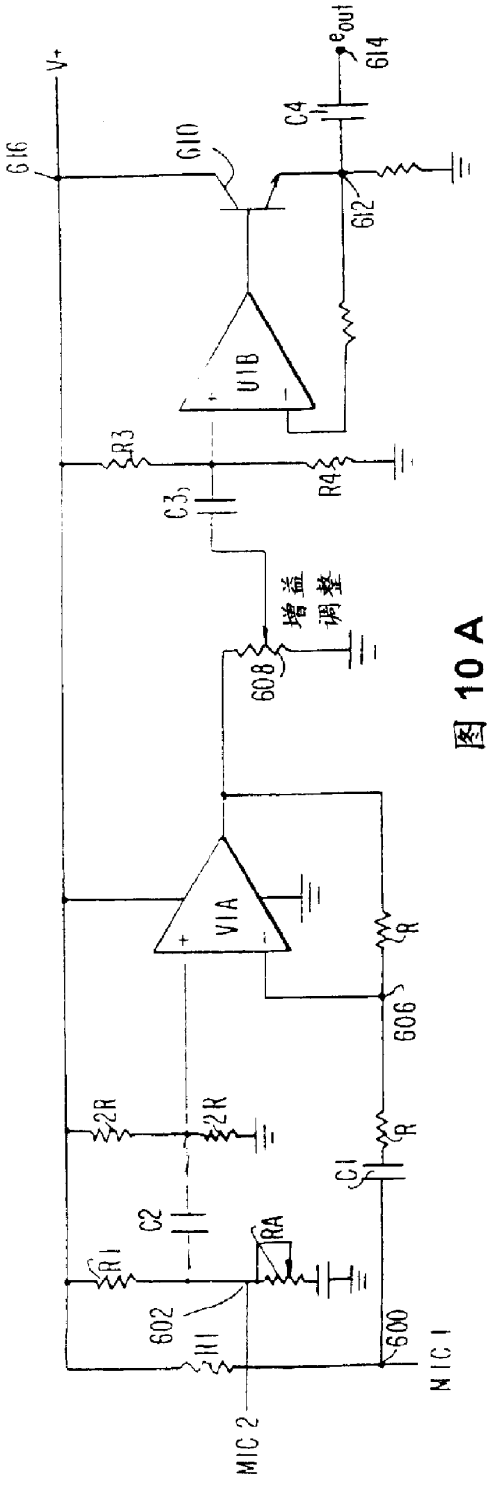

V+
616
610
612
614
e_{out}
C4
U1B
R3
R4
C3
增益
调整
608
V1A
R
606
2R
2R
C1
C2
R1
RA
602
R1
600
MIC 2
MIC 1

图 10 A

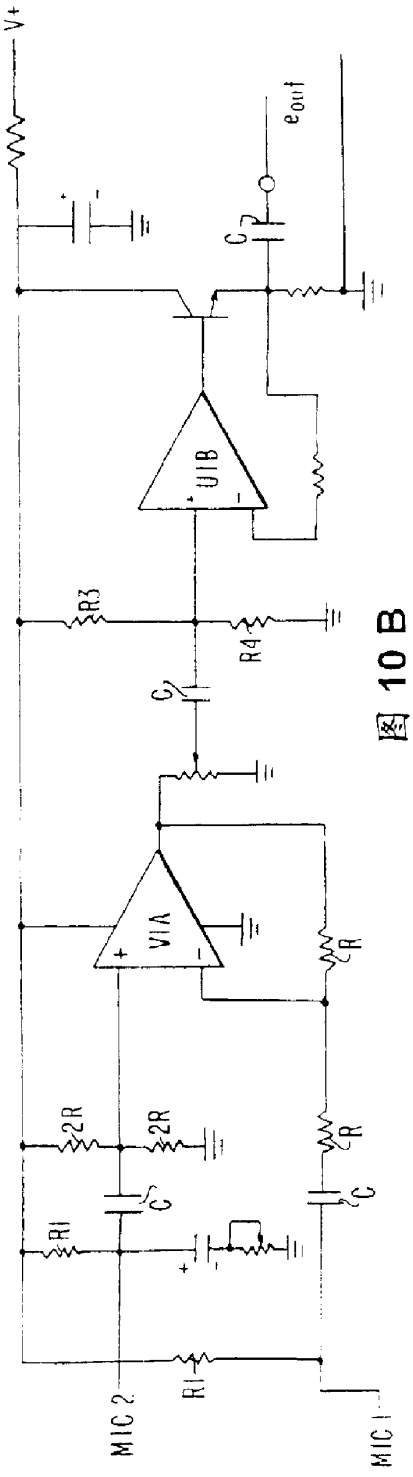

V+
e_{out}
C2
U1B
R3
R4
C
V1A
R
2R
2R
C
C
R1
R1
MIC 2
MIC 1

图 10 B

09-02-06

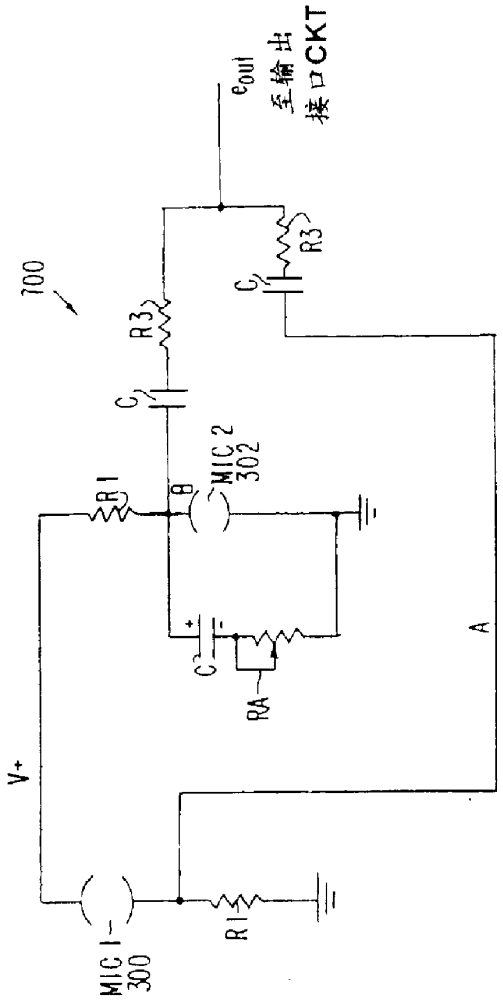


图 11

Apple Inc. Exhibit 1015 Page 1690

08·02·05

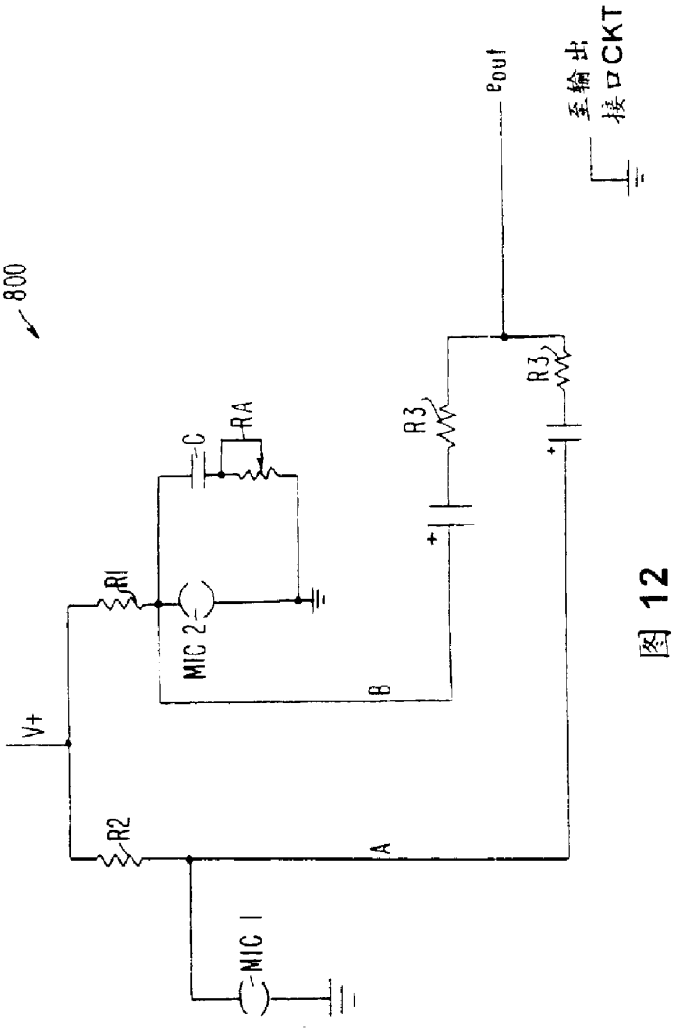
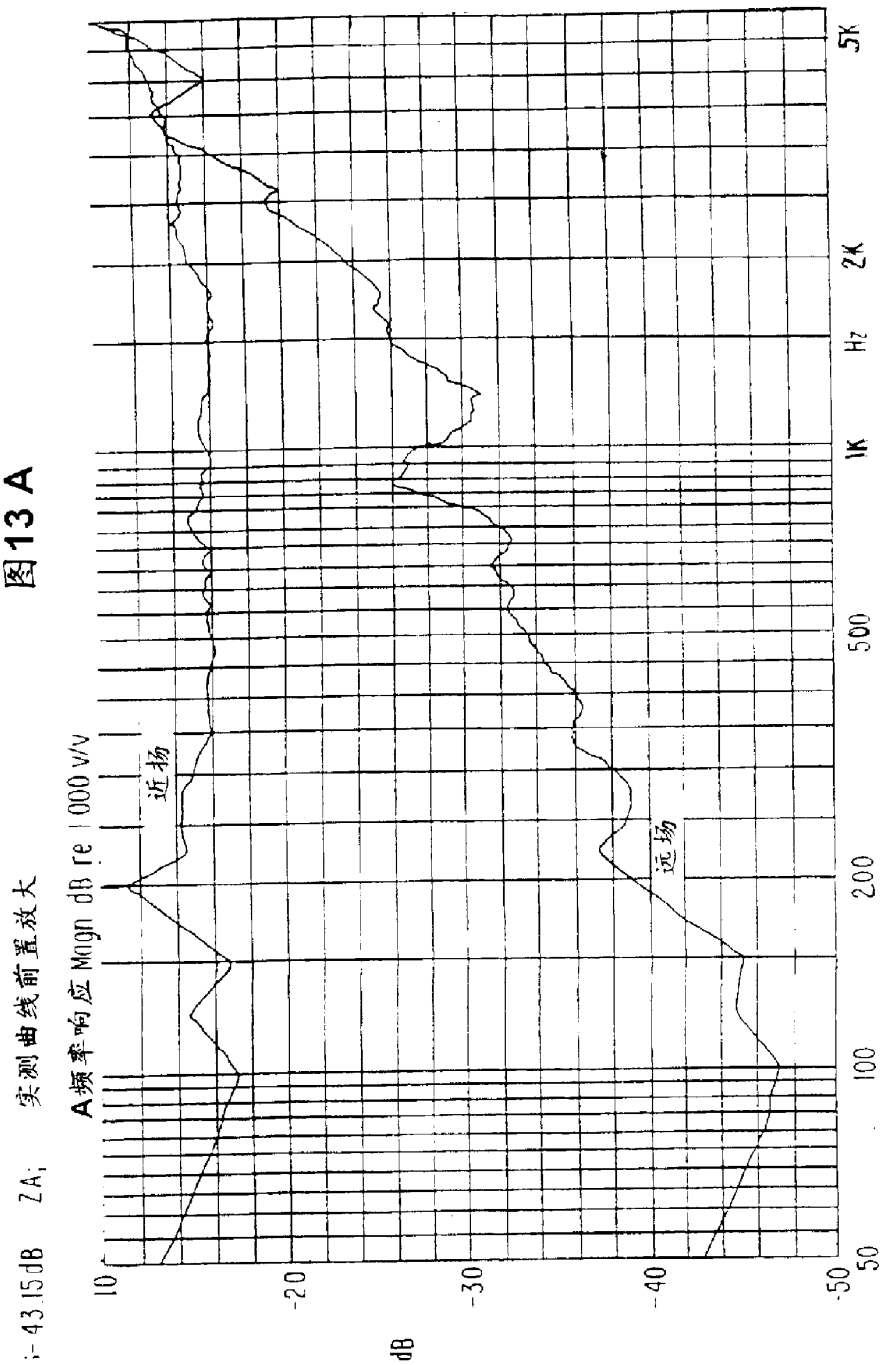


图 12

Apple Inc. Exhibit 1015 Page 1691

图13A



Apple Inc. Exhibit 1015 Page 1692

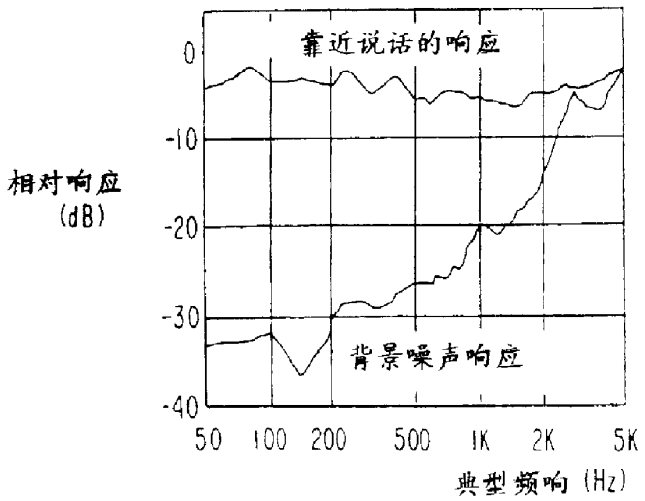
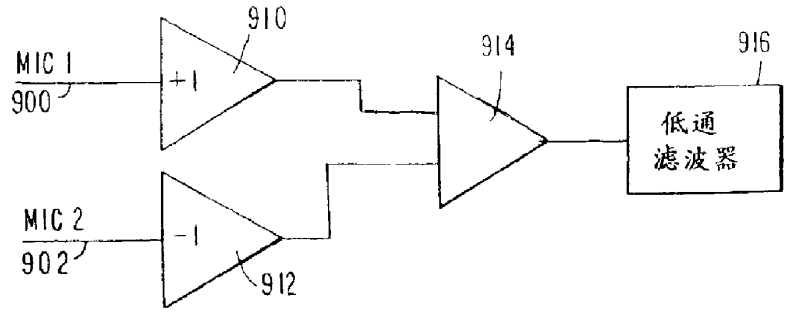


图 13 B

Apple Inc. Exhibit 1015 Page 1693



$$e_{out}(MIC\,1 - MIC\,2)\frac{K}{S+W}$$

图 14

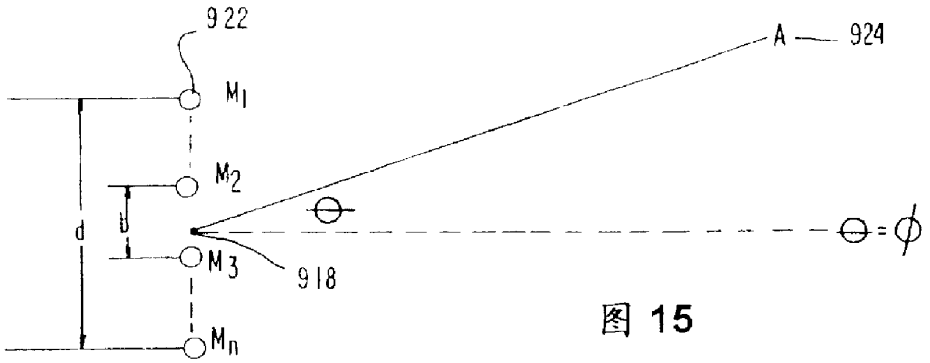


图 15

Apple Inc. Exhibit 1015 Page 1694

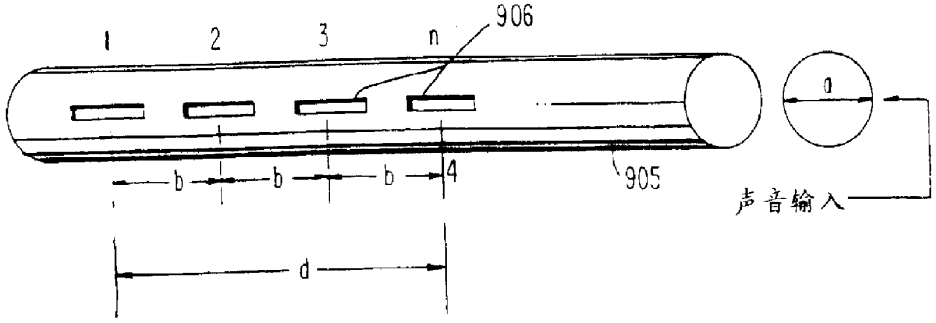


图16 A

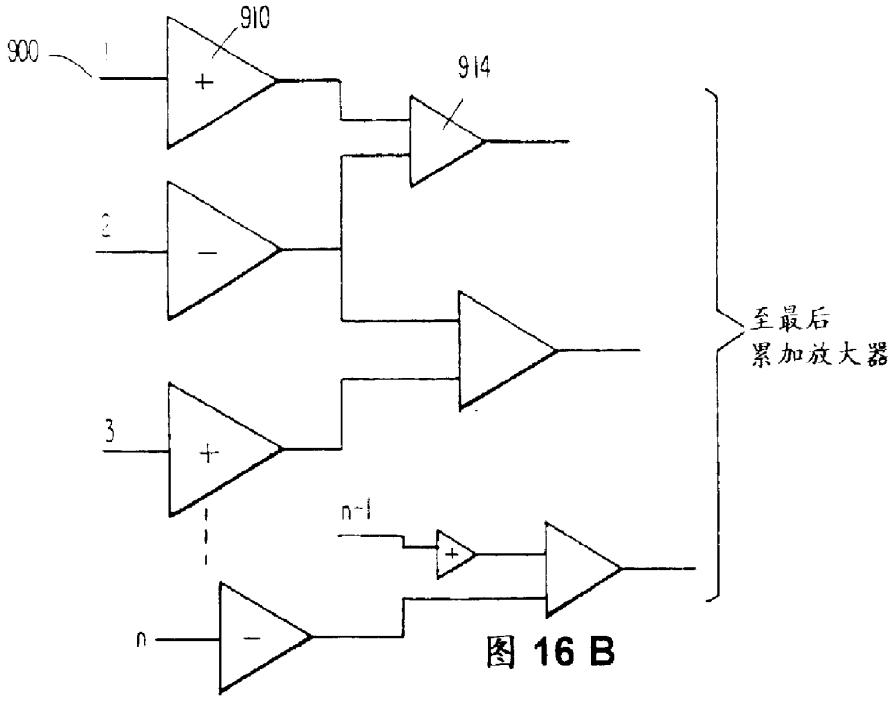


图 16 B

Apple Inc. Exhibit 1015 Page 1695

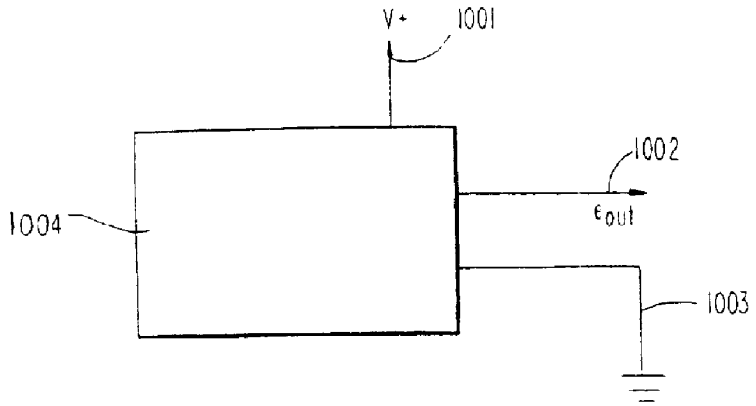


图17 A 现有技术

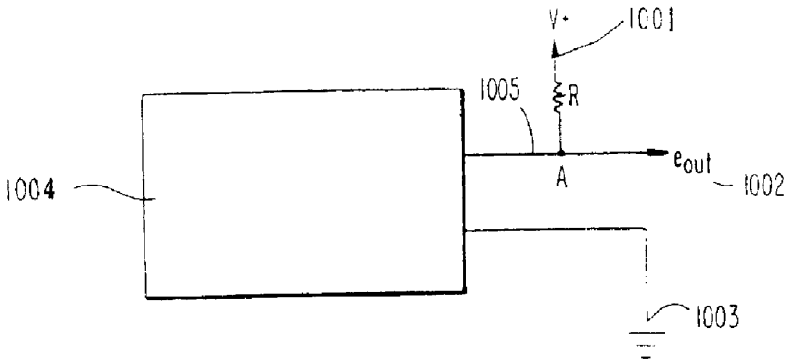


图17 B

Apple Inc. Exhibit 1015 Page 1696

09-02-06

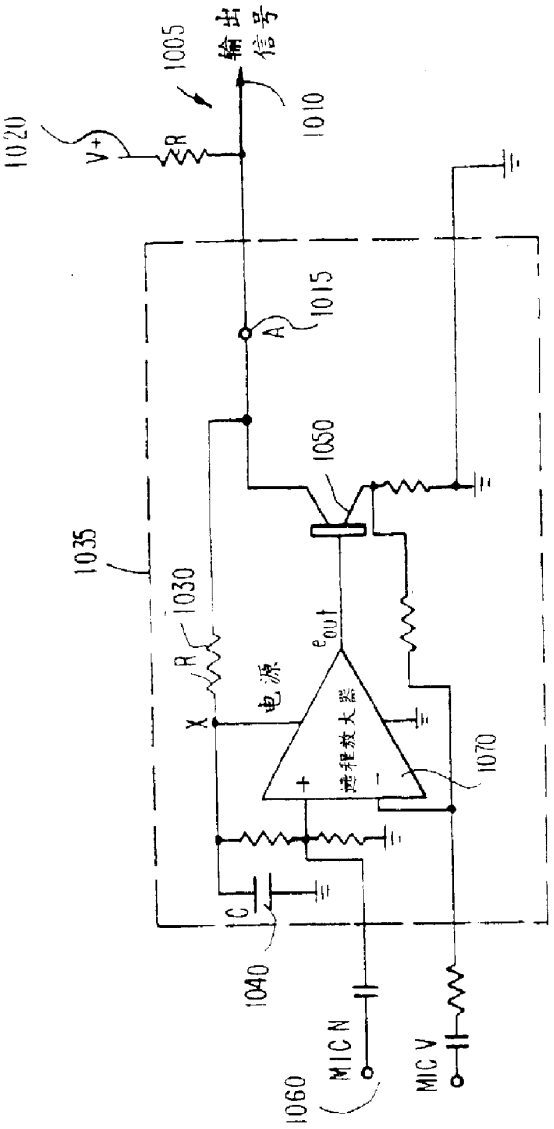


图 18

Apple Inc. Exhibit 1015 Page 1697

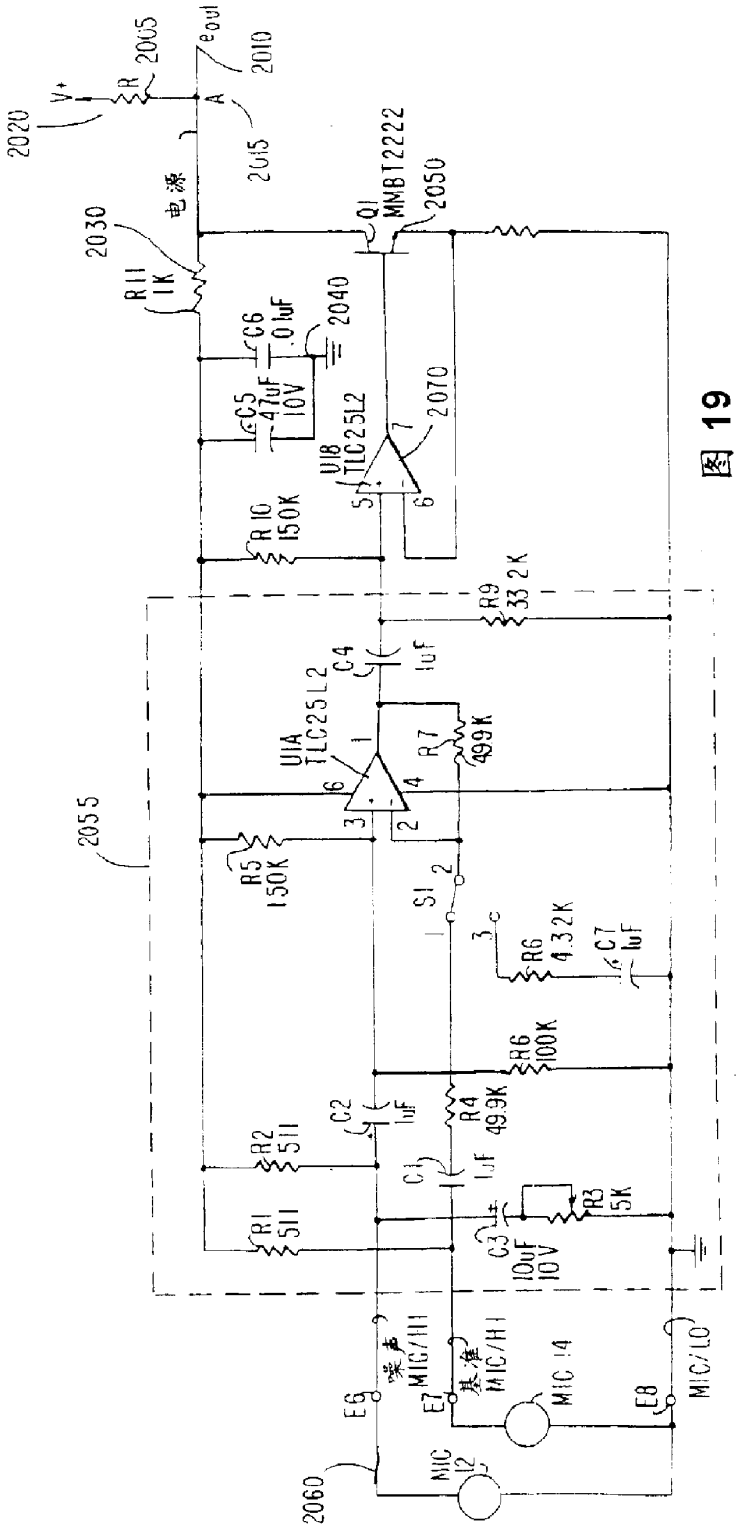


图 19

Apple Inc. Exhibit 1015 Page 1698

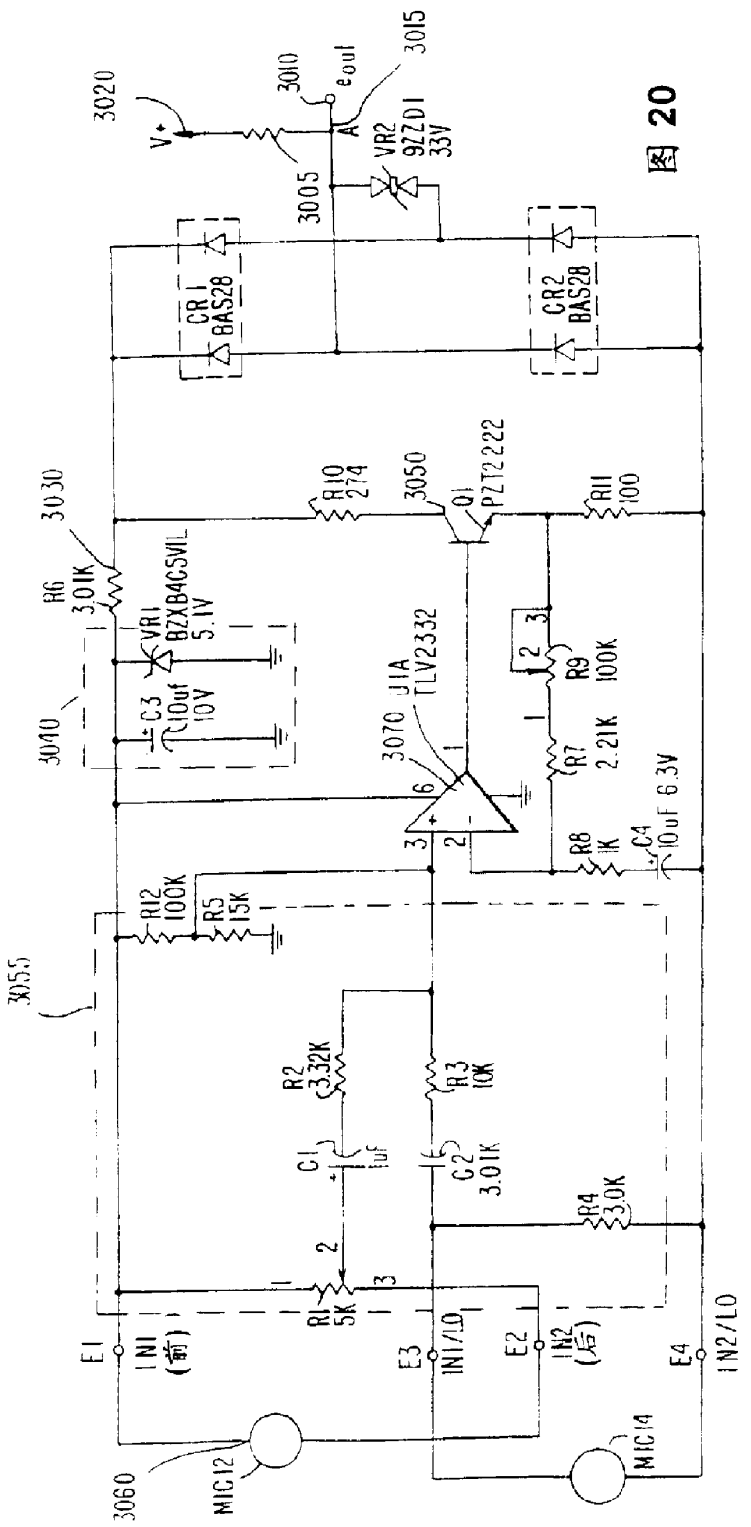


图 20

Apple Inc. Exhibit 1015 Page 1699

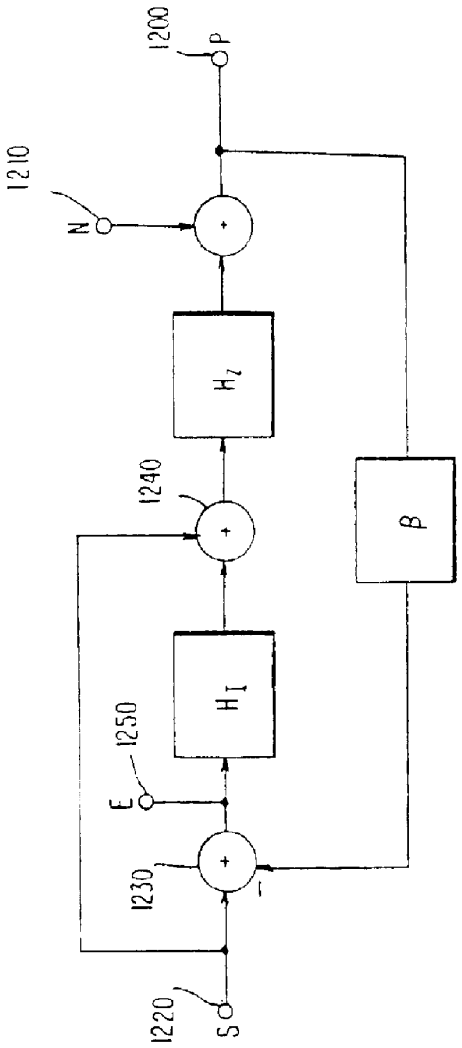


图 21 现有技术

Apple Inc. Exhibit 1015 Page 1700

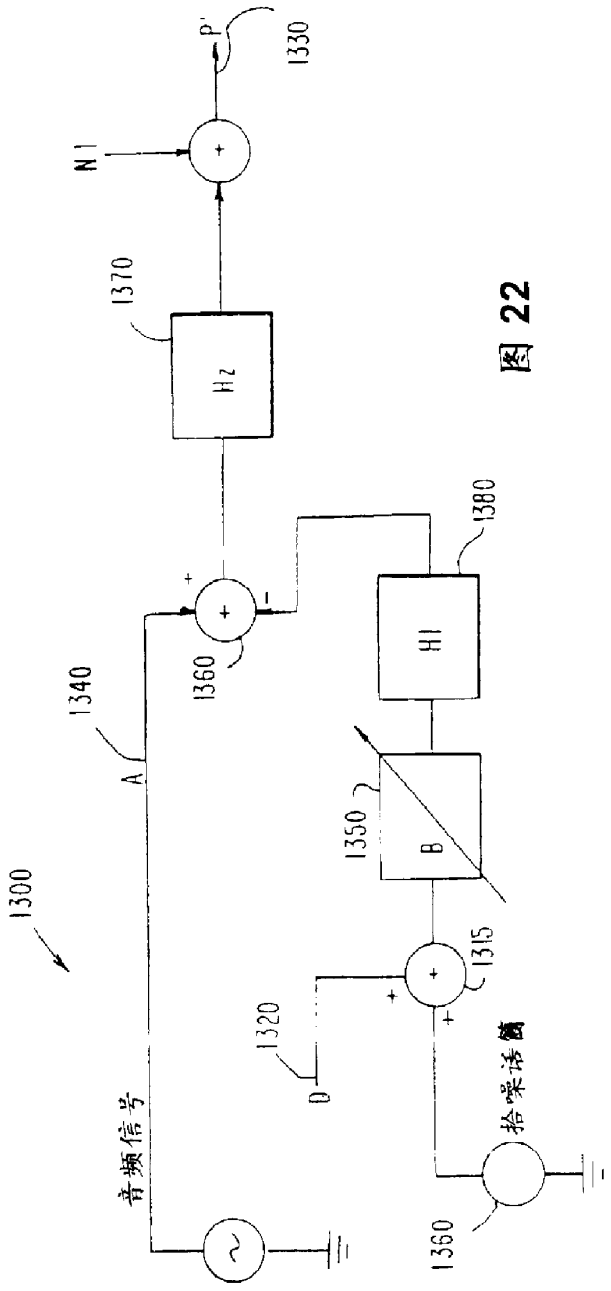


图 22

Apple Inc. Exhibit 1015 Page 1701

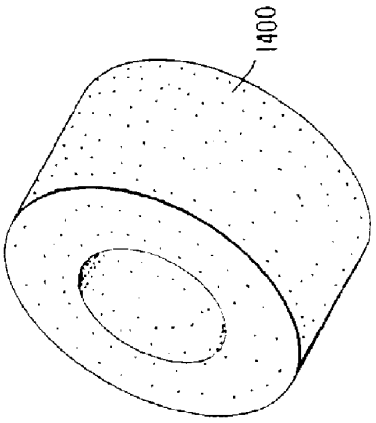


图23 B

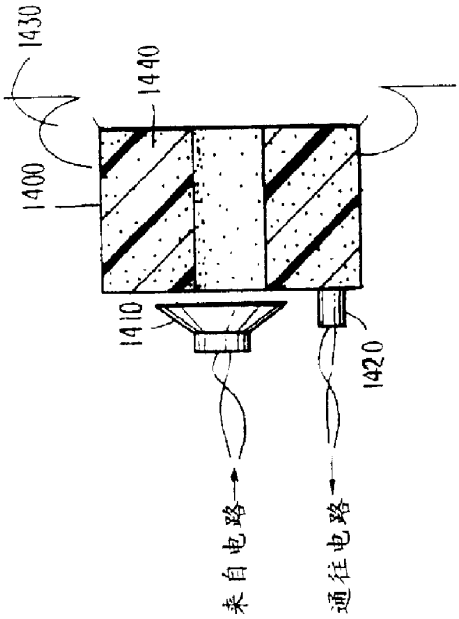


图 23 A

Apple Inc. Exhibit 1015 Page 1702

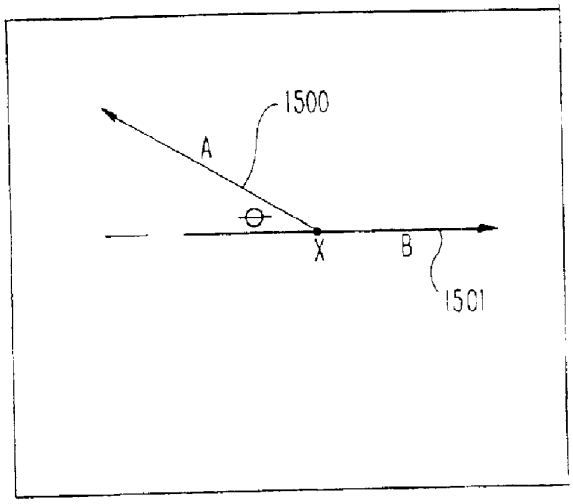
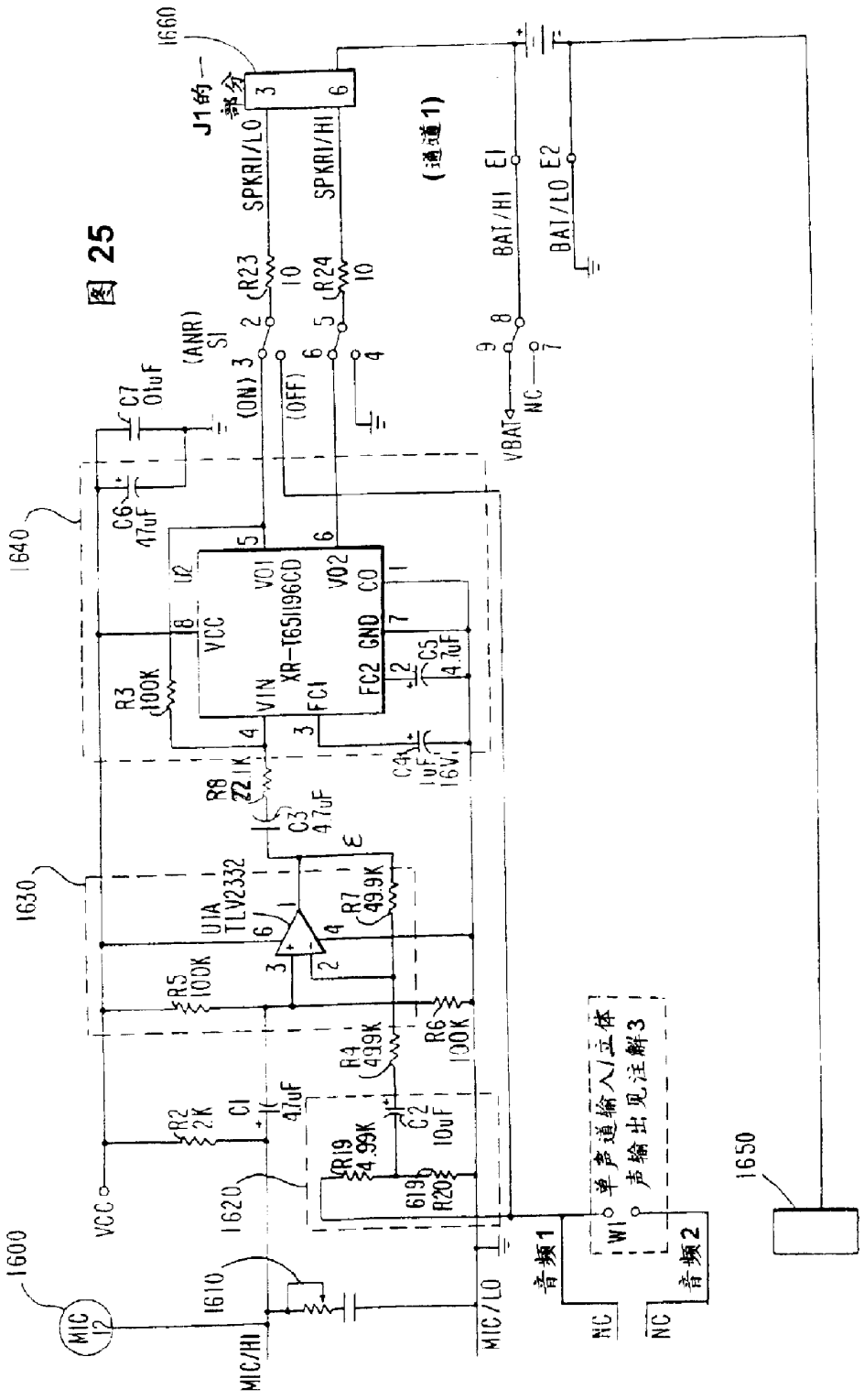
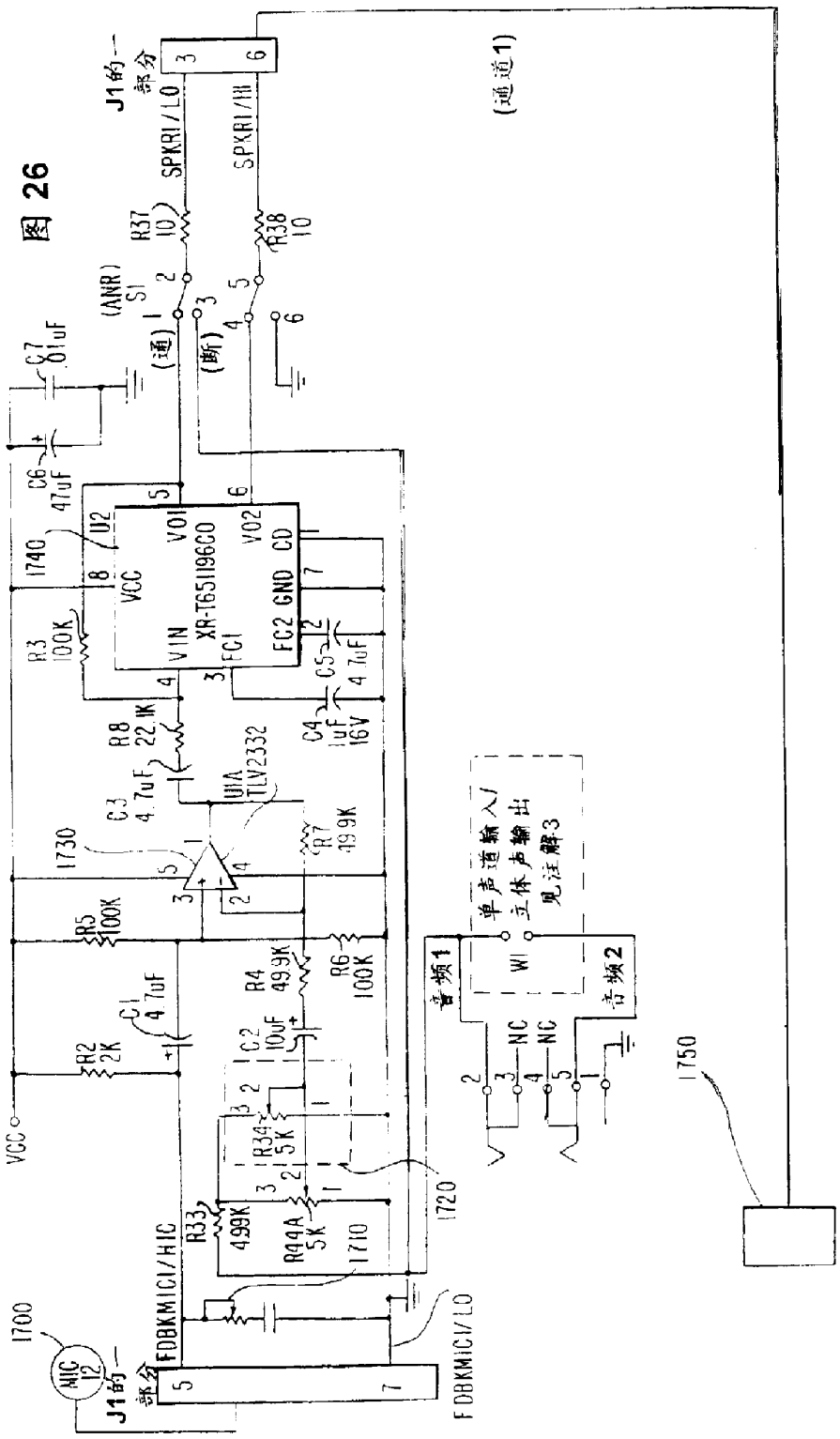


图 24

Apple Inc. Exhibit 1015 Page 1703



Apple Inc. Exhibit 1015 Page 1704



Apple Inc. Exhibit 1015 Page 1705

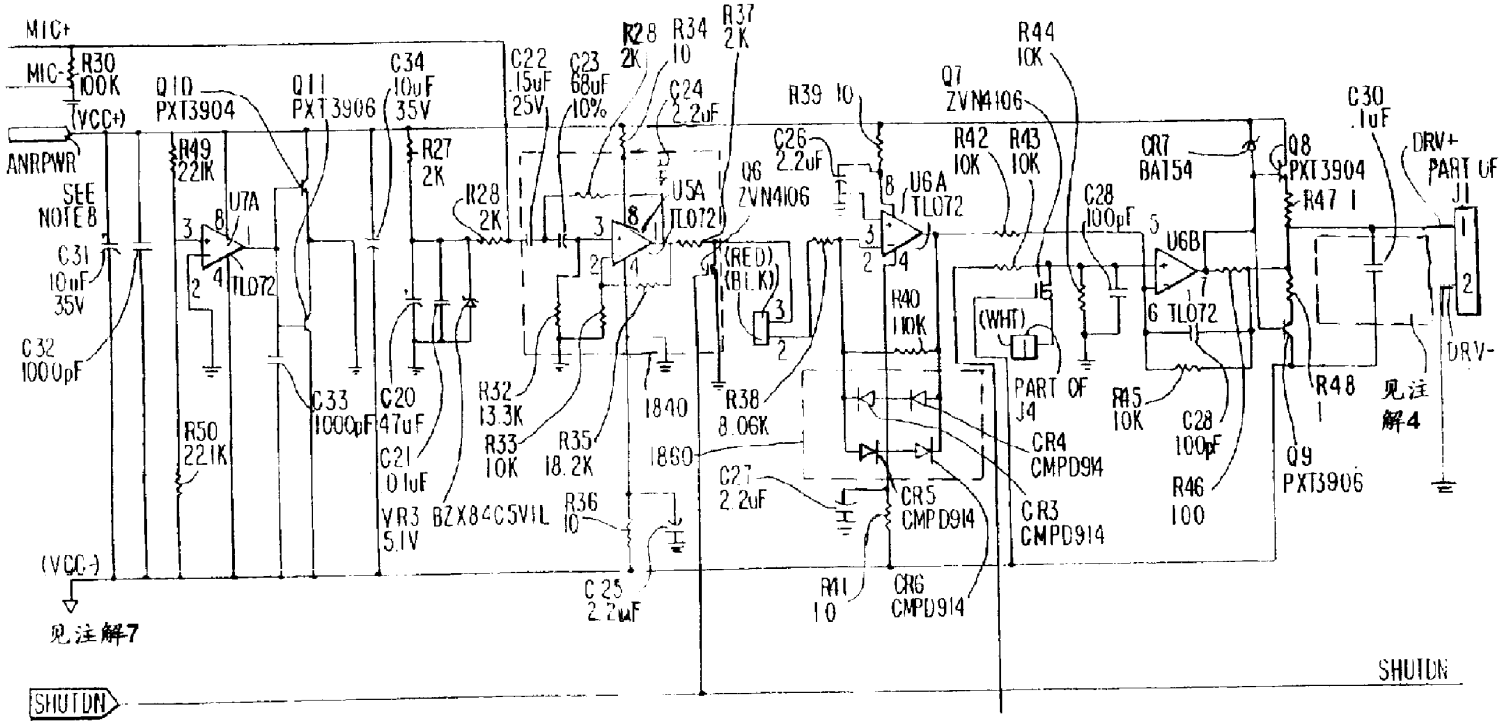


图 27

Apple Inc. Exhibit 1015 Page 1706

图 28

Apple Inc. Exhibit 1015 Page 1707

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/597,874	**12/04/2024 03:39:41 PM Z ET**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7223	FILED BY	Angela Nijim
PATENT CENTER #	68206554	FILING DATE	03/06/2024
CUSTOMER #	34071	FIRST NAMED INVENTOR	Thomas A. Howell
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Peter Tong

Documents

TOTAL DOCUMENTS: 9

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
IPVCP003X1C4X1C2_RCE_12-24.pdf	3	Request for Continued Examination (RCE)	1628 KB
IPVCP003X1C4X1C2_IDSTrans_12-24.pdf	2	Letter specifying the conditions for filing under 37 CFR 1.97	19 KB
IPVCP003X1C4X1C2_1449_12-24.pdf	2	Information Disclosure Statement (IDS) Form (SB08)	27 KB
Warning: This is not a USPTO supplied IDS fillable form. Data in the form cannot be automatically loaded to other USPTO systems.			
IPVCP003X1C4X1C2_AmdBTrans_12-24.pdf	1	Transmittal Letter	17 KB
IPVCP003X1C4X1C2_AmdB_AsFiled_12-24.pdf	36	Amendment Submitted/Entered with Filing	140 KB

		of Continued Prosecution Application (CPA)/Request for Continued Examination(RCE)	
CN1234895A.pdf	104	Foreign Reference	9803 KB
JP2004297256A_Kazunori_wTranslation.pdf	30	Foreign Reference	1011 KB
JP-2006209144A-Takegawa.pdf	29	Foreign Reference	3115 KB
WO8605891A1.pdf	15	Foreign Reference	1080 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

National Stage of an International Application under 35 U.S.C. 371

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

New International Application Filed with the USPTO as a Receiving Office

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: HOWELL et al.	Attorney Docket No.: IPVCP003X1C4X1C2
Application No.: 18/597,874	Examiner: LEI, JIE
Filed: March 6, 2024	Group: 2872

Title: SYSTEM FOR POWERING ~~CHARGING EMBEDDED BATTERY IN WIRELESS~~ HEAD-WORN PERSONAL ELECTRONIC APPARATUS [As Amended]

AMENDMENT B

Mail Stop _____
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Notice of Allowance dated September 11, 2024, please amend the above-identified patent application as follows:

Amendments to the Specification are reflected on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks/Arguments begin on page 36 of this paper.

AMENDMENTS TO THE SPECIFICATION

Please **AMEND** the Title of the application on page 1 before paragraph [0001] of the specification, as follows:

- -

SYSTEM FOR POWERING ~~CHARGING EMBEDDED BATTERY IN WIRELESS~~ HEAD-WORN PERSONAL ELECTRONIC APPARATUS

- -

Apple Inc. Exhibit 1015 Page 1712

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously Presented) A system, comprising:

a head-worn personal electronic apparatus, including at least:

a head-worn structure configured to be worn by a user;

a speaker at least partially contained within the head-worn structure, the speaker being configured to be worn proximate to an ear of the user when the head-worn structure is being worn by the user;

a motion detector at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus;

a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio input from at least the user;

a second microphone at least partially contained within the head-worn structure;

a piezoelectric device configured to receive a user input based on a force induced on the piezoelectric device, the piezoelectric device being contained within the head-worn structure, wherein the received user input operating to at least alter an operation of the head-worn personal electronic apparatus;

a rechargeable battery contained within the head-worn structure;

electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the rechargeable battery;

wireless communication circuitry at least partially contained within the head-worn structure, the wireless communication circuitry being electrically connected to at least the rechargeable battery; and

at least one conductive element at least partially included within the head-worn structure, the at least one conductive element being at least partially exposed to enable interconnection therewith, the at least one conductive element being electrically connected to at least the rechargeable battery; and

a charging apparatus having at least a charging connector,

wherein on placement of the head-worn personal electronic apparatus at least partially in the charging apparatus, electrical connection is configured to result at least from the at least one conductive element connecting with the charging connector, and thereby the rechargeable battery of the head-worn personal electronic apparatus is able to be recharged while the head-worn personal electronic apparatus is placed at least partially in the charging apparatus.

2. (Previously Presented) A head-worn personal electronic apparatus, comprising:

a head-worn structure configured to be worn by a user;

a speaker at least partially contained within the head-worn structure, the speaker being configured to be worn proximate to an ear of the user when the head-worn structure is being worn by the user;

a motion detector at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus;

a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio input from at least the user;

a second microphone at least partially contained within the head-worn structure;

a piezoelectric device configured to receive a user input based on a force induced on the piezoelectric device, the piezoelectric device being contained within the head-worn structure, wherein the received user input operating to at least alter an operation of the head-worn personal electronic apparatus;

a rechargeable battery contained within the head-worn structure;

electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the rechargeable battery; and

wireless communication circuitry at least partially contained within the head-worn structure.

3. (Currently Amended) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus comprises:

at least one conductive element at least partially included within the head-worn structure, the at least one conductive element being at least partially exposed to enable interconnection therewith, the at least one conductive element being electrically connected to at least the rechargeable battery.

4. (Canceled).

5. (Previously Presented) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus is configured to support audio output to the user via the speaker, and

wherein the operation of the head-worn personal electronic apparatus being altered concerns control of the audio output being provided to the user.

6. (Previously Presented) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus is configured to support voice calls to the user, and

wherein the operation of the head-worn personal electronic apparatus being altered concerns at least accepting or declining a voice call to the user.

7. (Previously Presented) A system as recited in claim 1, wherein the head-worn personal electronic apparatus is configured to support audio output to the user via the speaker, and

wherein the operation of the head-worn personal electronic apparatus being altered concerns control of the audio output being provided to the user.

8. (Previously Presented) A system as recited in claim 1, wherein the head-worn personal electronic apparatus is configured to support voice calls to the user, and

wherein the operation of the head-worn personal electronic apparatus being altered concerns at least accepting or declining a voice call to the user.

9. (New) A system as recited in claim 1,

wherein the system comprises:

a mobile communication device at least for supporting audio output, the mobile communication device configured to store at least a hearing profile associated with the user, the stored hearing profile associated with the user at least characterizes hearing impairment regarding the user's ability to hear, the mobile communication device configured to produce audio output signals customized for the user based on at least the stored hearing profile associated with the user such that the customized audio output signals at least compensate for the hearing impairment regarding the user's ability to hear, and the mobile communication device configured to transmit the customized audio output signals to the head-worn personal electronic apparatus,

wherein the speaker is configured to generate at least a portion of the customized audio output for the user in accordance with at least the portion of the

customized audio output signals being received by the head-worn personal electronic apparatus.

10. (New) A system as recited in claim 9, wherein the mobile communication device is configured to support establishment of the hearing profile for the user.

11. (New) A system as recited in claim 10, wherein the hearing profile for the user is established by the mobile communication device at least via generating audio tones and outputting such to at least the speaker and receiving a user indication corresponding to the user's ability to hear the generated audio tones.

12. (New) A system as recited in claim 9, wherein the mobile communication device is configured to produce the customized audio output signals using frequency-dependent amplification.

13. (New) A system as recited in claim 9,

wherein the mobile communication device is or includes a mobile phone, and

wherein the customized audio output includes music.

14. (New) A system as recited in claim 9,

wherein the mobile communication device is or includes a mobile phone, and

wherein the customized audio output includes a voice conversation.

15. (New) A system as recited in claim 9, wherein the customized audio output signals are produced based on amplifying or attenuating different frequency bands differently according to at least the stored hearing profile.

16. (New) A system as recited in claim 9,

wherein the mobile communication device includes computing capabilities and a storage device, the storage device storing at least a software program

executed by the mobile communication device to enable the user to establish the hearing profile associated with the user, and

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

17. (New) A system as recited in claim 16, wherein the software program at least interactively guides the user to establish the hearing profile for the user.

18. (New) A system as recited in claim 17, wherein the software program at least interactively guides the user to establish the hearing profile for the user by at least causing various audio tones to be output to the user via at least the speaker, prompting the user to provide a hearing input with respect to one or more of the various audio tones being output, and receiving the hearing input pertaining to one or more of the various audio tones being output.

19. (New) A system as recited in claim 18, wherein the mobile communication device is configured to wirelessly communicate with the head-worn personal electronic apparatus over a wireless network using the wireless communication circuitry.

20. (New) A system as recited in claim 9, wherein the head-worn personal electronic apparatus includes a plurality of circuit boards, each of the plurality of circuit boards including at least one integrated circuit mounted thereto.

21. (New) A system as recited in claim 20, wherein at least one of the plurality of circuit boards is a flexible printed circuit board.

22. (New) A system as recited in claim 20, wherein at least one of the plurality of circuit boards has at least one integrated circuit mounted on a first side of the at

least one of the plurality of circuit boards, and at least one integrated circuit mounted on a second side of the at least one of the plurality of circuit boards.

23. (New) A system as recited in claim 9, wherein the head-worn structure comprises:

an infrared emitter configured to at least direct infrared signals towards the user when at least the head-worn structure of the head-worn personal electronic apparatus is being worn; and

an infrared detector configured to detect infrared radiation reflected back from the user when at least the head-worn structure of the head-worn personal electronic apparatus is being worn.

24. (New) A system as recited in claim 23, wherein the electronic circuitry within the head-worn structure is configured to facilitate determining whether the head-worn structure is being worn by the user based on at least the detected infrared radiation.

25. (New) A system as recited in claim 9, wherein the head-worn structure comprises:

a physical condition sensor configured to acquire data pertaining to at least a physical condition of the user, the physical condition sensor being provided at least partially internal to the head-worn structure.

26. (New) A system as recited in claim 25, wherein the acquired data by the physical condition sensor includes data regarding temperature of the user.

27. (New) A system as recited in claim 25, wherein the acquired data by the physical condition sensor includes data regarding vital signs of the user.

Apple Inc. Exhibit 1015 Page 1719

28. (New) A head-worn personal electronic apparatus as recited in claim 2,

wherein the second microphone is configured to pick-up an environmental audio input, and

wherein the environmental audio input picked-up from at least the second microphone is used at least for noise cancelation, and at least a portion of the environmental audio input picked-up from the second microphone is subtracted from the audio input picked-up from the first microphone.

29. (New) A head-worn personal electronic apparatus as recited in claim 2,

wherein the second microphone is configured to pick-up an environmental audio input, and

wherein the electronic circuitry is configured to receive audio output signals to be output to the user via the speaker, and modify the audio output signals to be output to the user via the speaker to cancel at least a portion of noise associated with the environment, the modification of the audio output signals being dependent at least in part on the environmental audio input picked-up via the second microphone.

30. (New) A head-worn personal electronic apparatus as recited in claim 29, wherein the head-worn personal electronic apparatus comprises:

a physical condition sensor configured to acquire data pertaining to at least a physical condition of the user, the physical condition sensor being provided at least partially internal to the head-worn structure,

wherein the acquired data by the physical condition sensor includes data regarding vital signs or temperature of the user.

31. (New) A head-worn personal electronic apparatus as recited in claim 29, wherein the environmental audio input picked-up from at least the second microphone is used at least for noise cancelation, and at least a portion of the

Apple Inc. Exhibit 1015 Page 1720

environmental audio input picked-up from the second microphone is used to remove undesired noise from the audio input picked-up from the first microphone.

32. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the electronic circuitry is configured to:

determine an ambient noise level based on at least signals picked-up from at least the second microphone; and

modify at least a portion of audio output signals to be output to the user via the speaker, with the modification being at least in part dependent on the ambient noise level.

33. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the first microphone faces the user when the head-worn personal electronic apparatus is being worn.

34. (New) A head-worn personal electronic apparatus as recited in claim 33, wherein the second microphone faces away from the user when the head-worn personal electronic apparatus is being worn.

35. (New) A head-worn personal electronic apparatus as recited in claim 34,

wherein the second microphone is configured to pick-up an environmental audio input, and

wherein the electronic circuitry is configured to receive audio output signals to be output to the user via the speaker, and modify the audio output signals to be output to the user via the speaker to cancel at least a portion of noise associated with the environment, the modification of the audio output signals being dependent at least in part on the environmental audio input picked-up via the second microphone.

36. (New) A head-worn personal electronic apparatus as recited in claim 34,

wherein the second microphone is configured to pick-up an environmental audio input, and

wherein the environmental audio input picked-up from at least the second microphone is used at least for noise cancelation, and at least a portion of the environmental audio input picked-up from the second microphone is used to remove undesired noise from the audio input picked-up from the first microphone.

37. (New) A head-worn personal electronic apparatus as recited in claim 34, wherein the electronic circuitry is configured to:

determine an ambient noise level based on at least signals picked-up from at least the second microphone; and

modify at least a portion of audio output signals to be output to the user via the speaker, with the modification being at least in part dependent on the ambient noise level.

38. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus is configured to receive a voice input from the user via at least the first microphone, support or receive determination of a requested operation from the voice input using voice recognition, and control operation by the head-worn personal electronic apparatus based on the requested operation.

39. (New) A head-worn personal electronic apparatus as recited in claim 2,

wherein the head-worn personal electronic apparatus comprises:

an optical sensor contained within the head-worn structure and configured to capture optical sensor data,

wherein the head-worn personal electronic apparatus is configured to determine whether the head-worn personal electronic apparatus is being worn by the user based on the optical sensor data captured by the optical sensor.

40. (New) A head-worn personal electronic apparatus as recited in claim 39, wherein the optical sensor is configured to sense at least infrared radiation, and wherein the optical sensor data captured includes at least infrared radiation data.

41. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus comprises:

a radiation emitter at least partially contained within the head-worn structure and configured to at least direct radiation towards the user when the head-worn personal electronic apparatus is being worn; and

a radiation detector at least partially contained within the head-worn structure and configured to detect a portion of the radiation directed towards the user that is reflected back from the user when the head-worn personal electronic apparatus is being worn.

42. (New) A head-worn personal electronic apparatus as recited in claim 41, wherein the radiation detector comprises a photodetector.

43. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus comprises:

an optical sensor at least partially contained within the head-worn structure and configured to capture data, the captured data being indicative of whether the head-worn personal electronic apparatus is being worn by the user,

wherein the head-worn personal electronic apparatus is configured to at least alter operation of the head-worn personal electronic apparatus based at least in part on the captured data.

44. (New) A head-worn personal electronic apparatus as recited in claim 43, wherein the optical sensor is configured to sense at least infrared radiation.

45. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus comprises:

Apple Inc. Exhibit 1015 Page 1723

an infrared emitter contained within the head-worn structure and configured to emit infrared radiation towards the user when the head-worn personal electronic apparatus is being worn.

46. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus comprises:

at least a portion of a Hall effect detector at least partially contained within the head-worn structure, the Hall effect detector being configured to capture data associated with a magnetic characteristic.

47. (New) A head-worn personal electronic apparatus as recited in claim 2,

wherein the head-worn personal electronic apparatus is operable to at least output customized audio output,

wherein the wireless communication circuitry includes at least a wireless receiver configured to wirelessly receive audio output signals to be output to the user via the speaker,

wherein the electronic circuitry including at least an integrated circuit, the electronic circuitry being configured to (i) store hearing characteristics associated with the user; (ii) customize the received audio output signals to produce customized audio output signals for the user based on at least a portion of the stored hearing characteristics associated with the user such that the customized audio output signals at least compensate for hearing impairment regarding the user's ability to hear; and (iii) output the customized audio output signals to the speaker, and

wherein the speaker is configured to generate at least a portion of the customized audio output for the user in accordance with at least the portion of the customized audio output signals.

48. (New) A head-worn personal electronic apparatus as recited in claim 47, wherein the received audio output signals are wirelessly received from a mobile communication device associated with the user.

49. (New) A head-worn personal electronic apparatus as recited in claim 2,

wherein the head-worn personal electronic apparatus is operable to at least output customized audio output,

wherein the wireless communication circuitry includes at least a wireless receiver configured to wirelessly receive audio output signals to be output to the user via the speaker,

wherein the electronic circuitry including at least an integrated circuit, the electronic circuitry being configured to (i) store attributes associated with the user; (ii) customize the received audio output signals to produce customized audio output signals for the user based on at least a portion of the stored attributes associated with the user; and (iii) output the customized audio output signals to the speaker, and

wherein the speaker is configured to generate at least a portion of the customized audio output for the user in accordance with at least the portion of the customized audio output signals.

50. (New) A head-worn personal electronic apparatus as recited in claim 49, wherein the received audio output signals are wirelessly received from a mobile communication device associated with the user.

51. (New) A head-worn personal electronic apparatus as recited in claim 2,

wherein the head-worn personal electronic apparatus is operable to at least output customized audio output,

wherein the wireless communication circuitry includes at least a wireless receiver configured to wirelessly receive customized audio output signals for the user, the customized audio output signals having been customized based on at

least predetermined hearing characteristics associated with the user such that the customized audio output signals at least compensate for hearing impairment regarding the user's ability to hear, and

wherein the speaker is configured to generate at least a portion of the customized audio output for the user in accordance with at least the portion of the customized audio output signals.

52. (New) A head-worn personal electronic apparatus as recited in claim 51, wherein the customized audio output signals are wirelessly received from a mobile communication device associated with the user.

53. (New) A head-worn personal electronic apparatus as recited in claim 51,

wherein the first microphone is positioned to be directed towards the user when the head-worn personal electronic apparatus is being worn by the user; and

wherein the second microphone is configured to pick up at least ambient sound input associated with an environment in the vicinity of the head-worn personal electronic apparatus, the second microphone being positioned to be directed away from the user when the head-worn personal electronic apparatus is being worn by the user.

54. (New) A head-worn personal electronic apparatus as recited in claim 51,

wherein the second microphone is configured to pick up at least ambient sound input associated with an environment in the vicinity of the head-worn personal electronic apparatus, and

wherein the second microphone is positioned to be further away from mouth of the user than the first microphone when the head-worn personal electronic apparatus is being worn.

55. (New) A head-worn personal electronic apparatus as recited in claim 51,

wherein the second microphone is configured to pick up at least environmental audio input associated with an environment in the vicinity of the head-worn personal electronic apparatus, and

wherein the electronic circuitry is configured to process the audio input from at least the user picked-up via the first microphone to remove at least a portion of the environmental audio input associated with the environment picked-up via the second microphone.

56. (New) A head-worn personal electronic apparatus as recited in claim 54,

wherein the first microphone is positioned so as to be directed towards the user of the head-worn personal electronic apparatus, and

wherein the second microphone is positioned so as to be directed away from the user of the head-worn personal electronic apparatus, relative to the first microphone.

57. (New) A head-worn personal electronic apparatus as recited in claim 56, wherein the head-worn personal electronic apparatus comprises:

a physical condition sensor configured to acquire data pertaining to at least a physical condition of the user, the physical condition sensor being provided at least partially internal to the head-worn structure, the acquired data by the physical condition sensor includes (i) data regarding temperature of the user, or (ii) data regarding vital signs of the user.

58. (New) A head-worn personal electronic apparatus as recited in claim 50,

wherein the second microphone is configured to pick up at least ambient noise associated with an environment in the vicinity of the head-worn personal electronic apparatus, and

wherein the electronic circuitry is configured to:

determine an ambient noise level based on at least the ambient noise; and

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

59. (New) A head-worn personal electronic apparatus as recited in claim 50, wherein the head-worn personal electronic apparatus comprises:

a radiation emitter at least partially contained within the head-worn personal electronic apparatus and configured to at least direct radiation towards the user when at least the head-worn personal electronic apparatus of the head-worn personal electronic apparatus is being worn; and

a radiation detector at least partially contained within the head-worn personal electronic apparatus and configured to detect a portion of the radiation directed towards the user that is reflected back from the user when the head-worn structure of the head-worn personal electronic apparatus is being worn,

wherein the radiation detector is operatively connected to the electronic circuitry, and wherein the electronic circuitry is configured to facilitate determining whether the head-worn personal electronic apparatus is being worn by the user based on at least the detected radiation.

60. (New) A head-worn personal electronic apparatus as recited in claim 59, wherein the detected radiation is at least infrared radiation.

61. (New) A head-worn personal electronic apparatus as recited in claim 60, wherein the speaker is configured to be at least partially inserted into the ear of the user.

62. (New) A head-worn personal electronic apparatus as recited in claim 50, wherein the head-worn personal electronic apparatus is configured to receive a voice input, support a determination of a requested operation from the voice input using voice recognition, and control operation by the head-worn personal electronic apparatus based on the requested operation.

Apple Inc. Exhibit 1015 Page 1728

63. (New) A head-worn personal electronic apparatus as recited in claim 50, wherein the customized audio output includes music that was wirelessly received via the wireless receiver.

64. (New) A head-worn personal electronic apparatus as recited in claim 50, wherein the customized audio output signals result from amplifying or attenuating different frequency bands differently according to at least the predetermined hearing characteristics associated with the user.

65. (New) A head-worn personal electronic apparatus as recited in claim 64,

wherein the second microphone is positioned to pick up at least environmental audio input associated with an environment around the head-worn personal electronic apparatus, and

wherein the electronic circuitry is configured to modify the customized audio output signals to be output to the user via the at least one speaker to cancel at least a portion of noise associated with the environment, the modification of the customized audio output signals being dependent at least in part on the environmental audio input picked-up via the second microphone.

66. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus comprises:

a bone conducting electronic element at least partially contained within the head-worn structure.

67. (New) A head-worn personal electronic apparatus as recited in claim 66,

wherein the bone conducting electronic element associated with vibrations, and

wherein the bone conducting electronic element having electrical signals associated with the vibration.

Apple Inc. Exhibit 1015 Page 1729

68. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the motion detector includes at least an accelerometer.

69. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the wireless receiver is configured to operate with a Bluetooth network.

70. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the electronic circuitry includes at least a microprocessor.

71. (New) A head-worn personal electronic apparatus as recited in claim 2, wherein the head-worn personal electronic apparatus comprises:

an antenna contained within the head-worn structure of the head-worn personal electronic apparatus.

72. (New) A head-worn personal electronic apparatus, comprising:

a head-worn structure configured to be worn by a user;

a speaker at least partially contained within the head-worn structure, the speaker being configured to be worn proximate to an ear of the user when the head-worn structure is being worn by the user;

a motion detector at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus;

a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio input from at least the user;

a second microphone at least partially contained within the head-worn structure;

a piezoelectric device configured to receive a user input based on a force induced on the piezoelectric device, the piezoelectric device being contained within

the head-worn structure, wherein the received user input operating to at least alter an operation of the head-worn personal electronic apparatus;

a rechargeable battery contained within the head-worn structure;

electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the rechargeable battery;

wireless communication circuitry at least partially contained within the head-worn structure;

at least one conductive element at least partially included within the head-worn structure, the at least one conductive element being at least partially exposed to enable interconnection therewith, the at least one conductive element being electrically connected to at least the rechargeable battery; and

a radiation detector contained within the head-worn structure and configured to capture radiation data,

wherein the head-worn personal electronic apparatus is configured to determine whether the head-worn personal electronic apparatus is being worn by the user based on the radiation data captured by the radiation detector, and

wherein the second microphone is configured to at least pick-up an environmental audio input.

73. (New) A head-worn personal electronic apparatus as recited in claim 72, wherein the head-worn personal electronic apparatus is configured to receive a voice input from the user via at least the first microphone, support or receive determination of a requested operation from the voice input using voice recognition, and control operation by the head-worn personal electronic apparatus based on the requested operation.

74. (New) A head-worn personal electronic apparatus as recited in claim 73,

Apple Inc. Exhibit 1015 Page 1731

wherein the wireless communication circuitry includes at least a wireless receiver configured to wirelessly receive audio output signals to be output to the user via the speaker, and

wherein the electronic circuitry is configured to modify the audio output signals to be output to the user via the speaker to cancel at least a portion of environmental noise, the modification of the audio output signals being dependent at least in part on the environmental audio input picked-up via the second microphone.

75. (New) A head-worn personal electronic apparatus as recited in claim 74,

wherein the head-worn personal electronic apparatus is operable to at least output customized audio output,

wherein the electronic circuitry includes at least an integrated circuit, and the electronic circuitry being configured to (i) store hearing characteristics associated with the user; (ii) customize the received audio output signals to produce customized audio output signals for the user based on at least a portion of the stored hearing characteristics associated with the user such that the customized audio output signals at least compensate for hearing impairment regarding the user's ability to hear; and (iii) output the customized audio output signals to the speaker, and

wherein the speaker is configured to generate at least a portion of the customized audio output for the user in accordance with at least the portion of the customized audio output signals.

76. (New) A head-worn personal electronic apparatus as recited in claim 75,

wherein the head-worn personal electronic apparatus comprises:

a radiation emitter at least partially contained within the head-worn structure and configured to at least direct radiation towards the user when the head-worn personal electronic apparatus is being worn, and

Apple Inc. Exhibit 1015 Page 1732

wherein the radiation detector at least partially contained within the head-worn structure and configured to detect a portion of the radiation directed towards the user by the radiation emitter that is reflected back from the user when the head-worn personal electronic apparatus is being worn.

77. (New) A head-worn personal electronic apparatus as recited in claim 76,

wherein the head-worn personal electronic apparatus is configured to support control of (i) audio output to the user via the speaker and (ii) voice calls to the user, and

wherein the operation of the head-worn personal electronic apparatus being altered concerns at least control of the audio output being provided to the user and/or accepting or declining a voice call to the user.

78. (New) A head-worn personal electronic apparatus as recited in claim 77, wherein the head-worn personal electronic apparatus comprises:

at least a portion of a Hall effect detector at least partially contained within the head-worn personal electronic apparatus, the Hall effect detector being configured to capture data associated with a magnetic characteristic.

79. (New) A head-worn personal electronic apparatus as recited in claim 78, wherein the head-worn personal electronic apparatus comprises:

a bone conducting electronic element at least partially contained within the head-worn structure, the bone conducting electronic element being associated with vibrations, and the bone conducting electronic element utilizing electrical signals associated with the vibration.

80. (New) A head-worn personal electronic apparatus as recited in claim 72,

wherein the wireless communication circuitry includes at least a wireless receiver configured to wirelessly receive audio output signals to be output to the user via the speaker, and

wherein the electronic circuitry is configured to modify the audio output signals to be output to the user via the speaker to cancel at least a portion of environmental noise, the modification of the audio output signals being dependent at least in part on the environmental audio input picked-up via the second microphone.

81. (New) A head-worn personal electronic apparatus as recited in claim 80,

wherein the head-worn personal electronic apparatus is operable to at least output customized audio output,

wherein the electronic circuitry includes at least an integrated circuit, and the electronic circuitry being configured to (i) store attributes associated with the user; (ii) customize the received audio output signals to produce customized audio output signals for the user based on at least a portion of the stored attributes associated with the user; and (iii) output the customized audio output signals to the speaker, and

wherein the speaker is configured to generate at least a portion of the customized audio output for the user in accordance with at least the portion of the customized audio output signals.

82. (New) A head-worn personal electronic apparatus as recited in claim 81,

wherein the head-worn personal electronic apparatus comprises:

a radiation emitter at least partially contained within the head-worn structure and configured to at least direct radiation towards the user when the head-worn personal electronic apparatus is being worn, and

wherein the radiation detector at least partially contained within the head-worn structure and configured to detect a portion of the radiation directed towards the user by the radiation emitter that is reflected back from the user when the head-worn personal electronic apparatus is being worn.

83. (New) A head-worn personal electronic apparatus as recited in claim 82, wherein the head-worn personal electronic apparatus comprises:

at least a portion of a Hall effect detector at least partially contained within the head-worn personal electronic apparatus, the Hall effect detector being configured to capture data associated with a magnetic characteristic; and

a plurality of circuit boards, each of the plurality of circuit boards including at least one electrical component mounted thereto, at least one of the plurality of circuit boards being a flexible printed circuit board, at least one of the plurality of circuit boards has at least one integrated circuit mounted on a first side of the at least one of the plurality of circuit boards, and at least one integrated circuit mounted on a second side of the at least one of the plurality of circuit boards.

84. (New) A head-worn personal electronic apparatus as recited in claim 82,

wherein the head-worn personal electronic apparatus is configured to support control of (i) audio output to the user via the speaker and (ii) voice calls to the user, and

wherein the operation of the head-worn personal electronic apparatus being altered concerns at least control of the audio output being provided to the user and/or accepting or declining a voice call to the user.

85. (New) A head-worn personal electronic apparatus as recited in claim 84, wherein the head-worn personal electronic apparatus comprises:

at least a portion of a Hall effect detector at least partially contained within the head-worn personal electronic apparatus, the Hall effect detector being configured to capture data associated with a magnetic characteristic.

86. (New) A head-worn personal electronic apparatus as recited in claim 84, wherein the head-worn personal electronic apparatus comprises:

a bone conducting electronic element at least partially contained within the head-worn structure, the bone conducting electronic element being associated

with vibrations, and the bone conducting electronic element utilizing electrical signals associated with the vibration.

87. (New) A head-worn personal electronic apparatus as recited in claim 86, wherein the head-worn personal electronic apparatus comprises:

at least a portion of a Hall effect detector at least partially contained within the head-worn personal electronic apparatus, the Hall effect detector being configured to capture data associated with a magnetic characteristic.

88. (New) A head-worn personal electronic apparatus as recited in claim 84, wherein the head-worn personal electronic apparatus comprises:

a plurality of circuit boards, each of the plurality of circuit boards including at least one electrical component mounted thereto.

89. (New) A head-worn personal electronic apparatus as recited in claim 88, wherein at least one of the plurality of circuit boards is a flexible printed circuit board.

90. (New) A head-worn personal electronic apparatus as recited in claim 88, wherein at least one of the plurality of circuit boards has at least one integrated circuit mounted on a first side of the at least one of the plurality of circuit boards, and at least one integrated circuit mounted on a second side of the at least one of the plurality of circuit boards.

91. (New) A head-worn personal electronic apparatus as recited in claim 82, wherein the head-worn personal electronic apparatus comprises:

a touch sensitive surface at least partially contained within the head-worn structure and configured to sense a touch input associated with the user,

wherein at least the electronic circuitry is configured to facilitate determination at least whether the touch input associated with the user pertains to

a first sliding direction or a second sliding direction with respect to the touch sensitive surface.

92. (New) A head-worn personal electronic apparatus as recited in claim 91, wherein the touch input by the touch sensitive surface operates to at least control audio volume level of the customized audio output for the user via the speaker.

93. (New) A head-worn personal electronic apparatus as recited in claim 72, wherein the head-worn personal electronic apparatus comprises:

a touch sensitive surface at least partially contained within the head-worn structure and configured to sense a touch input associated with the user,

wherein at least the electronic circuitry is configured to facilitate determination at least whether the touch input associated with the user pertains to a first sliding direction or a second sliding direction with respect to the touch sensitive surface.

94. (New) A head-worn personal electronic apparatus as recited in claim 93, wherein the touch input by the touch sensitive surface operates to at least control audio volume level of audio output configured to be provided to the user via the speaker.

95. (New) A head-worn personal electronic apparatus, comprising:

a head-worn structure configured to be worn by a user, the head-worn structure including a front section and first and second temples;

a first speaker at least partially contained within the first temple of the head-worn structure;

a second speaker at least partially contained within the second temple of the head-worn structure;

Apple Inc. Exhibit 1015 Page 1737

a motion sensor at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus;

a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio input from at least the user;

a second microphone at least partially contained within the head-worn structure;

a display at least partially contained within the head-worn structure, the display configured to present information to the user of the head-worn personal electronic apparatus;

a rechargeable battery contained within the head-worn structure;

electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the rechargeable battery; and

wireless communication circuitry at least partially contained within the head-worn structure.

96. (New) A head-worn personal electronic apparatus as recited in claim 95, wherein the head-worn personal electronic apparatus comprises:

at least one lens through which the user at least partially sees through to see vicinity around the head-worn personal electronic apparatus when the head-worn structure is being worn by the user, the at least one lens being provided at the front section of the head-worn structure.

97. (New) A head-worn personal electronic apparatus as recited in claim 96, wherein the rechargeable battery is contained within the least the first temple.

98. (New) A head-worn personal electronic apparatus as recited in claim 97,

wherein the first temple includes a temple tip, and

Apple Inc. Exhibit 1015 Page 1738

wherein the head-worn personal electronic apparatus comprises an electrical connector at least partially contained within the temple tip.

99. (New) A head-worn personal electronic apparatus as recited in claim 98, wherein the head-worn personal electronic apparatus is configured to charge the rechargeable battery via a cable electrically connected with the electrical connector.

100. (New) A head-worn personal electronic apparatus, comprising:

a head-worn structure configured to be worn by a user, the head-worn structure including a front section and first and second temples;

a first speaker at least partially contained within the first temple of the head-worn structure;

a second speaker at least partially contained within the second temple of the head-worn structure;

a motion sensor at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus;

a microphone at least partially contained within the head-worn structure, the microphone being positioned to pick up at least audio input from at least the user;

a display at least partially contained within the head-worn structure, the display configured to present information to the user of the head-worn personal electronic apparatus;

electronic circuitry contained within the head-worn structure and configured to control the display to present the information to the user of the head-worn personal electronic apparatus; and

data communication circuitry at least partially contained within the head-worn structure.

101. (New) A head-worn personal electronic apparatus as recited in claim 100, wherein the head-worn personal electronic apparatus comprises:

a radiation sensor contained within the head-worn structure and configured to capture sensor data,

wherein the head-worn personal electronic apparatus is configured to determine whether the head-worn personal electronic apparatus is being worn by the user based on the sensor data captured by the radiation sensor.

102. (New) A head-worn personal electronic apparatus as recited in claim 101, wherein the head-worn personal electronic apparatus is configured to receive a voice input from the user via at least the microphone, support or receive determination of a requested operation from the voice input using voice recognition, and control operation by the head-worn personal electronic apparatus based on the requested operation.

103. (New) A head-worn personal electronic apparatus as recited in claim 102, wherein the head-worn personal electronic apparatus comprises:

at least one lens through which the user at least partially sees through to see vicinity of the head-worn personal electronic apparatus when the head-worn structure is being worn by the user, the at least one lens being provided at the front section of the head-worn structure.

104. (New) A head-worn personal electronic apparatus as recited in claim 101,

wherein at least one of the first temple and the second temple includes a temple tip, and

wherein the head-worn personal electronic apparatus comprises an electrical connector at least partially contained within the temple tip.

105. (New) A head-worn personal electronic apparatus as recited in claim 104, wherein the head-worn personal electronic apparatus is configured to receive power via a cable electrically connected with the electrical connector.

106. (New) A head-worn personal electronic apparatus as recited in claim 105, wherein with the cable coupled to a portable electronic device, the portable electronic device is configured to provide the power and computing capabilities to the head-worn personal electronic apparatus.

107. (New) A head-worn personal electronic apparatus as recited in claim 100, wherein the head-worn personal electronic apparatus couples via a cable to a portable electronic device, the portable electronic device including a rechargeable battery that provides power to the head-worn personal electronic apparatus, and the portable electronic device including a microprocessor that provides computing resources that are used by or for the head-worn personal electronic apparatus.

108. (New) A head-worn personal electronic apparatus, comprising:

a head-worn structure configured to be worn by a user, the head-worn structure including a front section and first and second temples, the front section having or coupled to a first extended endpiece and a second extended endpiece provided at opposite ends of the front section, the first temple coupling to the front section via the first extended endpiece, the second temple coupling to the front section via the second extended endpiece;

at least one lens through which the user at least partially sees through when the head-worn structure is being worn by the user, the at least one lens being provided at the front section of the head-worn structure;

a speaker at least partially contained within the head-worn structure, the speaker being configured to be proximate to an ear of the user when the head-worn structure is being worn by the user;

Apple Inc. Exhibit 1015 Page 1741

a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio input from at least the user;

a second microphone at least partially contained within the head-worn structure;

a first optical sensor at least partially contained within the first extended endpiece;

a second optical sensor at least partially contained within the second extended endpiece;

a rechargeable battery contained within the head-worn structure;

electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the rechargeable battery; and

wireless communication circuitry at least partially contained within the head-worn structure.

109. (New) A head-worn personal electronic apparatus as recited in claim 108, wherein the head-worn personal electronic apparatus comprises:

a processor at least partially contained within the head-worn structure and configured to control operation of the head-worn personal electronic apparatus; and

a motion sensor at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus.

110. (New) A head-worn personal electronic apparatus as recited in claim 108, wherein the at least one lens provides no magnification.

111. (New) A head-worn personal electronic apparatus as recited in claim 108, wherein the first optical sensor is at least part of a first camera, and wherein the second optical sensor is at least part of a second camera.

112. (New) A head-worn personal electronic apparatus as recited in claim 108, wherein the first optical sensor is configured to sense at least infrared radiation, and wherein the second optical sensor is configured to sense at least infrared radiation.

113. (New) A head-worn personal electronic apparatus as recited in claim 108, wherein the first temple is rotatably coupled to the first extended endpiece and foldable towards the front section, and wherein the second temple is rotatably coupled to the second extended endpiece and foldable towards the front section.

114. (New) A head-worn personal electronic apparatus as recited in claim 113, wherein the rechargeable battery is contained within the first temple.

115. (New) A head-worn personal electronic apparatus as recited in claim 114,

wherein the first temple includes a temple tip, and

wherein the head-worn personal electronic apparatus comprises an electrical connector at least partially contained within the temple tip.

116. (New) A head-worn personal electronic apparatus as recited in claim 115, wherein the head-worn personal electronic apparatus is configured to charge the rechargeable battery via a cable electrically connected with the electrical connector.

117. (New) A head-worn personal electronic apparatus as recited in claim 116,

wherein the head-worn personal electronic apparatus comprises:

Apple Inc. Exhibit 1015 Page 1743

a processor at least partially contained within the head-worn structure and configured to control operation of the head-worn personal electronic apparatus; and

a motion sensor at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus, and

wherein the first optical sensor is configured to sense at least infrared radiation, and wherein the second optical sensor is configured to sense at least infrared radiation.

118. (New) A head-worn personal electronic apparatus as recited in claim 117, wherein the motion sensor includes at least an accelerometer.

119. (New) A head-worn personal electronic apparatus as recited in claim 108,

wherein the first optical sensor is at least part of a first camera for imaging capture,

wherein the second optical sensor is at least part of a second camera for imaging capture,

wherein the head-worn personal electronic apparatus comprises:

a first infrared sensor at least partially contained within the first extended endpiece; and

a second infrared sensor at least partially contained within the second extended endpiece.

120. (New) A head-worn personal electronic apparatus as recited in claim 108,

wherein the head-worn personal electronic apparatus comprises:

a processor at least partially contained within the head-worn structure and configured to control operation of the head-worn personal electronic apparatus; and

Apple Inc. Exhibit 1015 Page 1744

a motion sensor at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus, and

wherein the first optical sensor is at least part of a first camera for imaging capture, and wherein the second optical sensor is at least part of a second camera for imaging capture.

Apple Inc. Exhibit 1015 Page 1745

REMARKS

Further to the Notice of Allowance, the tile has been amended, and claim 3 has been amended to further clarify the subject matter regarded as the invention. In addition, new claims 9-120 have been added to the application. Claims 1-3 and 5-120 are currently pending. Reconsideration of the application is respectfully requested based on the following remarks.

Reconsideration of the application and an early Notice of Allowance are earnestly solicited. If there are any issues remaining which the Examiner believes could be resolved through either a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned representative at the telephone number listed below.

Applicants hereby petition for an extension of time which may be required to maintain the pendency of this case, and any required fee for such extension or any further fee required in connection with the filing of this Amendment is to be charged to Deposit Account No. 503874 (Order No. IPVCP003X1C4X1C2).

Respectfully submitted,

/C. Douglass Thomas/

C. Douglass Thomas
Reg. No. 32,947

(650) 903-9200, x103

Apple Inc. Exhibit 1015 Page 1746

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 18/597,874	Filing Date 03/06/2024	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $480 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	12/04/2024	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 119	Minus	** 20	= 99		x $100 =	9900
	Independent (37 CFR 1.16(h))	* 6	Minus	*** 3	= 3		x $480 =	1440
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	11340

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/MARCUS A PRIDGEN/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
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www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/597,874	**10/18/2024 01:40:31 PM Z ET**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7223	FILED BY	Angela Nijim
PATENT CENTER #	67627408	FILING DATE	03/06/2024
CUSTOMER #	34071	FIRST NAMED INVENTOR	Thomas A. Howell
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	C Douglass Thomas

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
petition-request.pdf	3	Terminal Disclaimer-Filed (Electronic)	44 KB
grantLetter.pdf	1	Terminal Disclaimer-Electronic-Approved	18 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
petition-request.pdf	69434C737DEDAD38C6C70DB848F50F84D487F89439CFDD8D F9F5EDC9298A2DC0E74BA466515C97C13FB8250E798D7D12 3553551F1DCF0646898A5E6894DE8B3A

grantLetter.pdf

78DF1417938052F10E7EA7A6A0AA12FC463AF29FD1D5A3B6C
1B6C5419CB460CC3A18ABD9FFEDC9B5BAEF34807E36DE6A
B6D95FD4BBB4CE618E981162AF64F5DC

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

National Stage of an International Application under 35 U.S.C. 371

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

New International Application Filed with the USPTO as a Receiving Office

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

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TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A PRIOR PATENT

APPLICATION #	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET #
18597874	**03/06/2024**	**Thomas Howell**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

✓	Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action
✓	This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent interest
IngenioSpec, LLC	100%
Total	**100%**

The owner(s) of percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending reference Application Number(s)

Application #	Filing Date

as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the reference application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.
In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term of any patent granted on said reference application, "as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application," in the event that any such patent granted on the pending reference application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

The owner(s) of percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

Patent #
12044901

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.
In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.



I certify, in accordance with 37 CFR 1.4(d)(4) that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above identified application.

I hereby declare that all statements made herein of my own knowledge are true and that all statemnts made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I certify, in accordance with 37 CFR 1.4(d)(4) that I am: An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Signature	Name	Registration #
/C. Douglass Thomas/	C Douglass Thomas	32947

* Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner). Form PTO/SB/96 may be used for making this certification. See MPEP 324.

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Commissioner for Patents
United States Patent and Trademark Office
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APPROVAL LETTER

APPLICATION #	FILING DATE	APPLICANT/PATENT UNDER REEXAMINATION
18/597,874	03/06/2024	Thomas Howell

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Electronic terminal disclaimer filed on 10/18/2024

☑ Approved

This patent is subject to a Terminal Disclaimer

Approved / Disapproved by: Electronic Terminal Disclaimer automatically approved

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/597,874	**10/18/2024 01:10:43 PM Z ET**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7223	FILED BY	Angela Nijim
PATENT CENTER #	67627826	AUTHORIZED BY	C Douglass Thomas
CUSTOMER #	34071	FILING DATE	03/06/2024
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Thomas A. Howell

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 6752	**E20240HD13278825**	**Angela Nijim**

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
-	**37 CFR 1.16 (National application filing, search, and examination fees); 37 CFR 1.17 (Patent application and reexamination processing fees); 37 CFR 1.19 (Document supply fees); 37 CFR 1.20 (Post Issuance fees); 37 CFR 1.21 (Miscellaneous fees and charges)**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1814	STATUTORY DISCLAIMER, INCLUDING TERMINAL DISCLAIMER	170.00	1	170.00
			TOTAL AMOUNT:	**$170.00**

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

National Stage of an International Application under 35 U.S.C. 371

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

New International Application Filed with the USPTO as a Receiving Office

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

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/597,874	**10/18/2024 01:10:43 PM Z ET**	**IPVCP003X1C4X1C2**

Title of Invention

SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7223	FILED BY	Angela Nijim
PATENT CENTER #	67627826	FILING DATE	03/06/2024
CUSTOMER #	34071	FIRST NAMED INVENTOR	Thomas A. Howell
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	C Douglass Thomas

Documents

TOTAL DOCUMENTS: 0

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)

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371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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NOTICE OF ALLOWANCE AND FEE(S) DUE

34071 7590 09/11/2024

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

EXAMINER	
LEI, JIE	
ART UNIT	PAPER NUMBER
2872	

DATE MAILED: 09/11/2024

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/597,874	03/06/2024	Thomas A. Howell	IPVCP003X1C4X1C2	7223

TITLE OF INVENTION: SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	12/11/2024

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 11/23)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via the USPTO patent electronic filing system.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

34071 7590 09/11/2024

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

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via the USPTO patent electronic filing system or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/597,874	03/06/2024	Thomas A. Howell	IPVCP003X1C4X1C2	7223

TITLE OF INVENTION: SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	12/11/2024

EXAMINER	ART UNIT	CLASS-SUBCLASS
LEI, JIE	2872	351-158000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1_____
2_____
3_____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required)

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via the USPTO patent electronic filing system ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29
NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

❑ Applicant asserting small entity status. See 37 CFR 1.27
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

❑ Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Apple Inc. Exhibit 1015 Page 1759

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/597,874	03/06/2024	Thomas A. Howell	IPVCP003X1C4X1C2	7223

34071 7590 09/11/2024

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

EXAMINER	
LEI, JIE	

ART UNIT	PAPER NUMBER
2872	

DATE MAILED: 09/11/2024

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 11/23)

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/ owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013).
https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf

Routine uses of the information in this record may include disclosure to:

1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;
2) a federal, state, local, or international agency, in response to its request;
3) a contractor of the USPTO having need for the information in order to perform a contract;
4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;
5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;
6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;
7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;
8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));
9) the Office of Personnel Management (OPM) for personnel research purposes; and
10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

Notice of Allowability	Application No. 18/597,874	Applicant(s) Howell et al.	
	Examiner JIE LEI	Art Unit 2872	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to filing of 8/30/2024.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-3 and 5-8 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/JIE LEI/
Primary Examiner, Art Unit 2872

REASONS FOR ALLOWANCE

1. The present application is being examined under the pre-AIA first to invent provisions. This office action is in response to the filing of 8/30/2024.

Allowable Subject Matter

2. Claims 1-3 and 5-8 are allowed.

3. The following is an examiner's statement of reasons for allowance: the prior art taken singularly or in combination fails to anticipate or fairly suggest the limitations of the independent claims, in such a manner that a rejection under 35 U.S.C. 102 or 103 would be proper.

In regard to independent claims 1and 2, the closest prior art are US 6349001 of Spitzer, US 20050201585 of Jannard et al, US 20050052537 of Mizusawa and US 5835185 of Kallman et al.

Regarding Claims 1 and 2, Spitzer teaches a system, comprising: a head-worn personal electronic apparatus, including at least: a head-worn structure configured to be worn by a user; a speaker at least partially contained within the head-worn structure, the speaker being configured to be worn proximate to an ear of the user when the head-worn structure is being worn by the user; a position detector at least partially contained within the head-worn structure; a first microphone at least partially contained within the head-worn structure, the first microphone being positioned to pick up at least audio

input from at least the user; a second microphone at least partially contained within the head-worn structure; a battery contained within the head-worn structure; electronic circuitry contained within the head-worn structure, the electronic circuitry being electrically connected to at least the battery; wireless communication circuitry at least partially contained within the head-worn structure, the wireless communication circuitry being electrically connected to at least the battery; and at least one conductive element at least partially included within the head-worn structure, the at least one conductive element being electrically connected to at least the battery.

Jannard teaches a head-worn personal electronic apparatus, wherein a motion detector at least partially contained within the head-worn structure and configured to provide motion data pertaining to the head-worn personal electronic apparatus; a button device configured to receive a user input based on a force induced on the button device, the button device being at least partially contained within the head-worn structure, wherein the received user input operating to at least alter operation of the head-worn electronic personal audio apparatus; a rechargeable battery contained within the head-worn structure.

Mizusawa teaches a mounted imaging apparatus, wherein the button device is a piezoelectric device, and the piezoelectric device configured to receive a user input based on a force induced on the piezoelectric device.

Kallman teaches an eyewear system, wherein, a charging apparatus having at least a charging connector, at least one conductive element at least partially included within the head-worn structure, the at least one conductive element being at least partially exposed to enable interconnection therewith, the at least one conductive

element being electrically connected to at least the rechargeable battery; wherein on placement of the head-worn personal electronic apparatus in the charging apparatus, electrical connection results at least from the at least one conductive element connecting with the charging connector, and thereby the rechargeable battery of the head-worn personal electronic apparatus is able to be recharged while the head-worn personal electronic apparatus is placed in the charging apparatus.

But none of them teaches that wherein the piezoelectric device being contained within the head-worn structure.

The prior art taken either singly or in combination fails to anticipate or fairly suggest a system or a head-worn personal electronic apparatus further comprising:

wherein the piezoelectric device being contained within the head-worn structure,

as claimed; recited together in combination with the totality of particular features/limitations recited therein.

Claims 7-8 are also allowed due to their dependence on claim 1.

Claims 3 and 5-6 are also allowed due to their dependence on claim 2.

4. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

5. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Jie Lei whose telephone number is (571) 272 7231. The examiner can normally be reached on Mon.-Thurs. 8:00 am to 5:30 pm.

If attempts to reach the examiner by the telephone are unsuccessful, the examiner's supervisor, Thomas Pham can be reached on (571) 272 3689.The Fax number for the organization where this application is assigned is (571) 273 8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published application may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Services Representative or access to the automated information system, call 800-786-9199(In USA or Canada) or 571-272-1000.

/JIE LEI/
Primary Examiner, Art Unit 2872

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/597,874	Howell et al.
	Examiner	Art Unit
	JIE LEI	2872

CPC - Searched*		
Symbol	**Date**	**Examiner**
G02C 1/00, 11/10, 11/06, 5/00, 5/001, 5/02, 5/14, 5/22, 5/143, 5/146, 2200/08	05/15/2024	JL
G02B 27/01, 27/017, 27/0176; HO2J 7/0045	05/15/2024	JL
update search	09/04/2024	jl

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
351	158, 41, 111, 121, 123, 124	05/15/2024	JL
359	13, 629-633	05/15/2024	JL
381	381, 327, 328, 370, 380	05/15/2024	JL
	update search	09/04/2024	JL

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

/JIE LEI/ Primary Examiner, Art Unit 2872	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/597,874	Howell et al.
	Examiner	Art Unit
	JIE LEI	2872

Search Notes		
Search Notes	**Date**	**Examiner**
G02C 1/00, 11/10, 11/06, 5/00, 5/001, 5/02, 5/14, 5/22, 5/143, 5/146, 2200/08	05/15/2024	JL
G02B 27/01, 27/017, 27/0176; HO2J 7/0045	05/15/2024	JL
351/158, 41, 111, 121, 123, 124	05/15/2024	JL
359/13, 629-633	05/15/2024	JL
381/381, 327, 328, 370, 380	05/15/2024	JL
Inventor name search	05/15/2024	JL
NPL and foreign search (google scholar, google patent, globaldossier and Dialog search)	05/15/2024	JL
PE2E text search	05/15/2024	JL
Similarity search	05/15/2024	JL
update search	09/04/2024	jl

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
	USPGPUB, USPAT	05/15/2024	JL
	update search	09/04/2024	JL

/JIE LEI/ Primary Examiner, Art Unit 2872	

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/597,874	Howell et al.
	Examiner	**Art Unit**
	JIE LEI	2872

CPC						
Symbol					**Type**	**Version**
G02C	/	11	/	10	F	2013-01-01
G02C	/	5	/	143	I	2013-01-01
G02C	/	5	/	146	I	2013-01-01
H02J	/	7	/	0045	I	2013-01-01
G02C	/	11	/	06	I	2013-01-01
G02C	/	2200	/	08	A	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

Use images from artifact folder? ◉ Yes ○ No

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 7	
/JIE LEI/ Primary Examiner, Art Unit 2872 (Primary Examiner) 04 September 2024 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/597,874	Howell et al.
	Examiner	**Art Unit**
	JIE LEI	2872

INTERNATIONAL CLASSIFICATION					
CLAIMED					
G02C	/	11	/	00	
G02C	/	5	/	14	
G02C	/	11	/	06	
H02J	/	7	/	00	

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
351	158

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

Use images from artifact folder? ◉ Yes ○ No

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 7	
/JIE LEI/ Primary Examiner, Art Unit 2872 (Primary Examiner)	04 September 2024 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/597,874	Howell et al.
	Examiner	**Art Unit**
	JIE LEI	2872

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1														
4	2														
5	3														
-	4														
6	5														
7	6														
2	7														
3	8														

Use images from artifact folder? ◉ Yes ○ No

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 7	
/JIE LEI/ Primary Examiner, Art Unit 2872 (Primary Examiner)	04 September 2024 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Web Search History

date, time	web site	search string
8/30/2024 4:43:58 PM	Google Scholar	lens eyewear conductive sheet electrode conductive
8/30/2024 4:43:58 PM	Google Patents	Search Term 1 lens Search Term 2 eyewear Search Term 3 conductive sheet Search Term 4 electrode Search Term 5 conductive Before Priority Date: priority:20170919
8/30/2024 4:44:15 PM	Google Patents	Search Term 1 (electric eyewear)
8/30/2024 4:45:12 PM	Google	Electric eyewear glasses
8/30/2024 4:45:18 PM	Google	Best electric eyewear
8/30/2024 4:45:28 PM	Google	Electric Sunglasses Polarized
8/30/2024 4:45:31 PM	Google	Electric Dude Sunglasses
8/30/2024 4:46:07 PM	Google Scholar	single unit glasses temple piece frame
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Apple Inc. Exhibit 1015 Page 1772

date, time	web site	search string
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8/30/2024 5:07:00 PM	Google	Snapchat Spectacles 3
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date, time	web site	search string
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Apple Inc. Exhibit 1015 Page 1774

date, time	web site	search string
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Apple Inc. Exhibit 1015 Page 1775

date, time	web site	search string
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Apple Inc. Exhibit 1015 Page 1776

date, time	web site	search string
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date, time	web site	search string
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Apple Inc. Exhibit 1015 Page 1778

date, time	web site	search string
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date, time	web site	search string
8/30/2024 5:30:47 PM	Google Patents	Search Term 1 electro Search Term 2 lens Search Term 3 adapter Search Term 4 active Search Term 5 delete delete Before Priority Date: priority:20060623
8/30/2024 5:30:53 PM	Google Scholar	electro active temple frame spectacles
8/30/2024 5:30:53 PM	Google Patents	Search Term 1 electro Search Term 2 active Search Term 3 temple Search Term 4 frame Search Term 5 spectacles Before Priority Date: priority:20070504
8/30/2024 5:31:00 PM	Google Scholar	metal circuit board printed circuit adapter optical module
8/30/2024 5:31:00 PM	Google Patents	Search Term 1 metal Search Term 2 circuit board Search Term 3 printed circuit Search Term 4 adapter Search Term 5 optical module Before Priority Date: priority:20160428
8/30/2024 5:31:11 PM	Google Scholar	electro active eyewear frame conductive

Apple Inc. Exhibit 1015 Page 1780

date, time	web site	search string
8/30/2024 5:31:11 PM	Google Patents	Search Term 1 electro Search Term 2 active Search Term 3 eyewear Search Term 4 frame Search Term 5 conductive Before Priority Date: priority:20110817
8/30/2024 5:31:20 PM	Google Scholar	temple coil spring frame control unit hollow member
8/30/2024 5:31:20 PM	Google Patents	Search Term 1 temple Search Term 2 coil spring Search Term 3 frame Search Term 4 control unit Search Term 5 hollow member Before Priority Date: priority:20180322
8/30/2024 5:31:26 PM	Google Scholar	joining joining part spectacle frame curvature radius bridge
8/30/2024 5:31:26 PM	Google Patents	Search Term 1 joining Search Term 2 joining part Search Term 3 spectacle frame Search Term 4 curvature radius Search Term 5 bridge Before Priority Date: priority:20171108
8/30/2024 5:31:32 PM	Google Scholar	temple battery frame battery carrier wearable electronic

Apple Inc. Exhibit 1015 Page 1781

date, time	web site	search string
8/30/2024 5:31:32 PM	Google Patents	Search Term 1 temple Search Term 2 battery Search Term 3 frame Search Term 4 battery carrier Search Term 5 wearable electronic Before Priority Date: priority:20151030
8/30/2024 5:32:57 PM	Google Scholar	eyeglass interface system camera audio integrated circuits
8/30/2024 5:32:57 PM	Google Patents	Search Term 1 eyeglass Search Term 2 interface system Search Term 3 camera Search Term 4 audio Search Term 5 integrated circuits Before Priority Date: priority:19971030
8/30/2024 5:36:17 PM	Google Scholar	speaker audio device audio support wearable wireless
8/30/2024 5:36:17 PM	Google Patents	Search Term 1 speaker Search Term 2 audio device Search Term 3 audio Search Term 4 support Search Term 5 wearable wireless Before Priority Date: priority:20000602
8/30/2024 5:46:28 PM	Google Scholar	electronic lens recess electronic frame recesses

Apple Inc. Exhibit 1015 Page 1782

date, time	web site	search string
8/30/2024 5:46:28 PM	Google Patents	Search Term 1 electronic Search Term 2 lens Search Term 3 recess Search Term 4 electronic frame Search Term 5 recesses Before Priority Date: priority:20150924
8/30/2024 5:46:33 PM	Google Scholar	bridge lens electrical components power source frame
8/30/2024 5:46:33 PM	Google Patents	Search Term 1 bridge Search Term 2 lens Search Term 3 electrical components Search Term 4 power source Search Term 5 frame Before Priority Date: priority:20060503
8/30/2024 5:46:37 PM	Google Scholar	glasses frame layer plug connecting piece
8/30/2024 5:46:37 PM	Google Patents	Search Term 1 glasses Search Term 2 frame Search Term 3 layer Search Term 4 plug Search Term 5 connecting piece Before Priority Date: priority:20200824
8/30/2024 5:46:51 PM	Google Scholar	fpc plate plate pcb board glasses eyeglass holder

date, time	web site	search string
8/30/2024 5:46:51 PM	Google Patents	Search Term 1 fpc plate Search Term 2 plate Search Term 3 pcb board Search Term 4 glasses Search Term 5 eyeglass holder Before Priority Date: priority:20130411
8/30/2024 5:46:56 PM	Google Scholar	plate glasses pcb plate fpc fpc plate
8/30/2024 5:46:56 PM	Google Patents	Search Term 1 plate Search Term 2 glasses Search Term 3 pcb plate Search Term 4 fpc Search Term 5 fpc plate Before Priority Date: priority:20130411
8/30/2024 5:47:01 PM	Google Scholar	frame glasses layer plug connecting piece
8/30/2024 5:47:01 PM	Google Patents	Search Term 1 frame Search Term 2 glasses Search Term 3 layer Search Term 4 plug Search Term 5 connecting piece Before Priority Date: priority:20200824
8/30/2024 5:47:07 PM	Google Scholar	optical system lens unit optical axis eyeglass sidewall

date, time	web site	search string
8/30/2024 5:47:07 PM	Google Patents	Search Term 1 optical system Search Term 2 lens unit Search Term 3 optical axis Search Term 4 eyeglass Search Term 5 sidewall Before Priority Date: priority:20170713
8/30/2024 5:54:35 PM	Google Scholar	electronic temple optical element electronic components front body
8/30/2024 5:54:35 PM	Google Patents	Search Term 1 electronic Search Term 2 temple Search Term 3 optical element Search Term 4 electronic components Search Term 5 front body Before Priority Date: priority:20181214
8/30/2024 5:54:41 PM	Google Scholar	camera module conductive mounting mounting groove carrier
8/30/2024 5:54:41 PM	Google Patents	Search Term 1 camera module Search Term 2 conductive Search Term 3 mounting Search Term 4 mounting groove Search Term 5 carrier Before Priority Date: priority:20230525
8/30/2024 5:54:48 PM	Google Scholar	circuit pattern electronic circuit shell actuator pcb

date, time	web site	search string
8/30/2024 5:54:48 PM	Google Patents	Search Term 1 circuit pattern Search Term 2 electronic circuit Search Term 3 shell Search Term 4 actuator Search Term 5 pcb Before Priority Date: priority:20120629
8/30/2024 5:54:54 PM	Google Scholar	connecting portion magnet spectacles leg spectacle
8/30/2024 5:54:54 PM	Google Patents	Search Term 1 connecting portion Search Term 2 magnet Search Term 3 spectacles Search Term 4 leg Search Term 5 spectacle Before Priority Date: priority:20180323
8/30/2024 5:55:00 PM	Google Scholar	lens holder circuit board printed circuit base terminal
8/30/2024 5:55:00 PM	Google Patents	Search Term 1 lens holder Search Term 2 circuit board Search Term 3 printed circuit Search Term 4 base Search Term 5 terminal Before Priority Date: priority:20140120
8/30/2024 5:55:05 PM	Google Scholar	electronic device conductive outer structure inner structure opening

Apple Inc. Exhibit 1015 Page 1786

date, time	web site	search string
8/30/2024 5:55:05 PM	Google Patents	Search Term 1 electronic device Search Term 2 conductive Search Term 3 outer structure Search Term 4 inner structure Search Term 5 opening Before Priority Date: priority:20201113
8/30/2024 5:55:12 PM	Google Scholar	single unit glasses temple pair piece
8/30/2024 5:55:12 PM	Google Patents	Search Term 1 single unit Search Term 2 glasses Search Term 3 temple Search Term 4 pair Search Term 5 piece Before Priority Date: priority:20190222

Web Search History

date, time	web site	search string
9/3/2024 8:07:47 AM	Google Scholar	microphone audio wearer support audio device
9/3/2024 8:07:47 AM	Google Patents	Search Term 1 microphone Search Term 2 audio Search Term 3 wearer Search Term 4 support Search Term 5 audio device Before Priority Date: priority:20020726
9/3/2024 8:08:04 AM	Google Scholar	frame electronic device present pair optical photographic
9/3/2024 8:08:04 AM	Google Patents	Search Term 1 frame Search Term 2 electronic device Search Term 3 present Search Term 4 pair Search Term 5 optical photographic Before Priority Date: priority:20181127
9/3/2024 8:08:10 AM	Google Scholar	eyewear eyewear according temple frame control unit

Apple Inc. Exhibit 1015 Page 1788

date, time	web site	search string
9/3/2024 8:08:10 AM	Google Patents	Search Term 1 eyewear Search Term 2 eyewear according Search Term 3 temple Search Term 4 frame Search Term 5 control unit Before Priority Date: priority:20180322
9/3/2024 8:26:35 AM	Google Scholar	light projection projection engine frame assembly optical waveguide
9/3/2024 8:26:35 AM	Google Patents	Search Term 1 light projection Search Term 2 projection engine Search Term 3 frame Search Term 4 assembly Search Term 5 optical waveguide Before Priority Date: priority:20170823
9/3/2024 8:26:40 AM	Google Scholar	single unit temple pair frame lens
9/3/2024 8:26:40 AM	Google Patents	Search Term 1 single unit Search Term 2 temple Search Term 3 pair Search Term 4 frame Search Term 5 lens Before Priority Date: priority:20190222
9/3/2024 8:26:46 AM	Google Scholar	glasses fiber component continuous fiber carbon component

date, time	web site	search string
9/3/2024 8:26:46 AM	Google Patents	Search Term 1 glasses Search Term 2 fiber component Search Term 3 continuous fiber Search Term 4 carbon Search Term 5 component Before Priority Date: priority:20200527
9/3/2024 8:26:53 AM	Google Scholar	ana dar glasses aan ann
9/3/2024 8:26:53 AM	Google Patents	Search Term 1 ana Search Term 2 dar Search Term 3 glasses Search Term 4 aan Search Term 5 ann Before Priority Date: priority:20200917
9/3/2024 8:26:58 AM	Google Scholar	hinge antenna front frame wireless communication rotation position
9/3/2024 8:26:58 AM	Google Patents	Search Term 1 hinge Search Term 2 antenna Search Term 3 front frame Search Term 4 wireless communication Search Term 5 rotation position Before Priority Date: priority:20191114
9/3/2024 8:27:04 AM	Google Scholar	wearer lens head mounted eye display

Apple Inc. Exhibit 1015 Page 1790

date, time	web site	search string
9/3/2024 8:27:04 AM	Google Patents	Search Term 1 wearer Search Term 2 lens Search Term 3 head mounted Search Term 4 eye Search Term 5 display Before Priority Date: priority:20190930
9/3/2024 8:27:16 AM	Google Scholar	spectacle sensor predetermined identification control unit identification structure
9/3/2024 8:27:16 AM	Google Patents	Search Term 1 spectacle Search Term 2 sensor Search Term 3 predetermined identification Search Term 4 control unit Search Term 5 identification structure Before Priority Date: priority:20190808
9/3/2024 8:47:44 AM	Google Scholar	insert part metallic insert over plastic mass moulded
9/3/2024 8:47:44 AM	Google Patents	Search Term 1 insert part Search Term 2 metallic insert Search Term 3 over Search Term 4 plastic mass Search Term 5 moulded Before Priority Date: priority:20210809
9/3/2024 8:47:50 AM	Google Scholar	head frame polymer mounted device device defined

Apple Inc. Exhibit 1015 Page 1791

date, time	web site	search string
9/3/2024 8:47:50 AM	Google Patents	Search Term 1 head Search Term 2 frame Search Term 3 polymer Search Term 4 mounted device Search Term 5 device defined Before Priority Date: priority:20210921
9/3/2024 8:47:56 AM	Google Scholar	display frame lens electronic device fixed
9/3/2024 8:47:56 AM	Google Patents	Search Term 1 display Search Term 2 frame Search Term 3 lens Search Term 4 electronic device Search Term 5 fixed Before Priority Date: priority:20221207
9/3/2024 8:48:09 AM	Google Scholar	electronic device connecting member wearing antenna structure disposed
9/3/2024 8:48:09 AM	Google Patents	Search Term 1 electronic device Search Term 2 connecting member Search Term 3 wearing Search Term 4 antenna structure Search Term 5 disposed Before Priority Date: priority:20210909
9/3/2024 8:48:24 AM	Google Scholar	chassis display display device assembly waveguides

Apple Inc. Exhibit 1015 Page 1792

date, time	web site	search string
9/3/2024 8:48:24 AM	Google Patents	Search Term 1 chassis Search Term 2 display Search Term 3 display device Search Term 4 assembly Search Term 5 waveguides Before Priority Date: priority:20150120
9/3/2024 8:48:30 AM	Google Scholar	case rib head display device image display
9/3/2024 8:48:30 AM	Google Patents	Search Term 1 case Search Term 2 rib Search Term 3 head Search Term 4 display device Search Term 5 image display Before Priority Date: priority:20160215
9/3/2024 8:48:36 AM	Google Scholar	user frame display electronic device housing
9/3/2024 8:48:36 AM	Google Patents	Search Term 1 user Search Term 2 frame Search Term 3 display Search Term 4 electronic device Search Term 5 housing Before Priority Date: priority:20120307
9/3/2024 9:20:48 AM	Google Scholar	eyewear visor set forth frame electronics

date, time	web site	search string
9/3/2024 9:20:48 AM	Google Patents	Search Term 1 eyewear Search Term 2 visor Search Term 3 set forth Search Term 4 frame Search Term 5 electronics Before Priority Date: priority:20150227
9/3/2024 9:20:54 AM	Google Scholar	eyeglass side arm display user arm
9/3/2024 9:20:54 AM	Google Patents	Search Term 1 eyeglass Search Term 2 side arm Search Term 3 display Search Term 4 user Search Term 5 arm Before Priority Date: priority:20120330
9/3/2024 9:21:01 AM	Google Scholar	eyewear set forth electronics frame lens
9/3/2024 9:21:01 AM	Google Patents	Search Term 1 eyewear Search Term 2 set forth Search Term 3 electronics Search Term 4 frame Search Term 5 lens Before Priority Date: priority:20150227
9/3/2024 9:21:08 AM	Google Scholar	glass electronic device housing glass member display

date, time	web site	search string
9/3/2024 9:21:08 AM	Google Patents	Search Term 1 glass Search Term 2 electronic device Search Term 3 housing Search Term 4 glass member Search Term 5 display Before Priority Date: priority:20120125
9/3/2024 9:21:24 AM	Google Scholar	connection head mounted display connection opening earphone
9/3/2024 9:21:24 AM	Google Patents	Search Term 1 connection Search Term 2 head mounted Search Term 3 display Search Term 4 connection opening Search Term 5 earphone Before Priority Date: priority:20150927
9/3/2024 9:21:30 AM	Google Scholar	user housing module display equipment according
9/3/2024 9:21:30 AM	Google Patents	Search Term 1 user Search Term 2 housing Search Term 3 module Search Term 4 display Search Term 5 equipment according Before Priority Date: priority:20120105
9/3/2024 9:21:37 AM	Google Scholar	electronic device wearable electronic housing electronic component support structures

Apple Inc. Exhibit 1015 Page 1795

date, time	web site	search string
9/3/2024 9:21:37 AM	Google Patents	Search Term 1 electronic device Search Term 2 wearable electronic Search Term 3 housing Search Term 4 electronic component Search Term 5 support structures Before Priority Date: priority:20210203
9/3/2024 9:21:44 AM	Google Scholar	optical element semi vision system polarizing viewer
9/3/2024 9:21:44 AM	Google Patents	Search Term 1 optical element Search Term 2 semi Search Term 3 vision system Search Term 4 polarizing Search Term 5 viewer Before Priority Date: priority:20160704
9/3/2024 9:21:59 AM	Google Scholar	electronic device vent disposed housing heat dissipation
9/3/2024 9:21:59 AM	Google Patents	Search Term 1 electronic device Search Term 2 vent Search Term 3 disposed Search Term 4 housing Search Term 5 heat dissipation Before Priority Date: priority:20211019
9/3/2024 9:54:59 AM	Google Scholar	module light leg mounting lens

date, time	web site	search string
9/3/2024 9:54:59 AM	Google Patents	Search Term 1 module Search Term 2 light Search Term 3 leg Search Term 4 mounting Search Term 5 lens Before Priority Date: priority:20211229
9/3/2024 9:55:06 AM	Google Scholar	head display cover layer layer mounted device
9/3/2024 9:55:06 AM	Google Patents	Search Term 1 head Search Term 2 display Search Term 3 cover layer Search Term 4 layer Search Term 5 mounted device Before Priority Date: priority:20200921
9/3/2024 9:55:11 AM	Google Scholar	head display shroud mounted device ring
9/3/2024 9:55:11 AM	Google Patents	Search Term 1 head Search Term 2 display Search Term 3 shroud Search Term 4 mounted device Search Term 5 ring Before Priority Date: priority:20200921
9/3/2024 9:55:16 AM	Google Scholar	gate frame entities gates contrast

date, time	web site	search string
9/3/2024 9:55:16 AM	Google Patents	Search Term 1 gate Search Term 2 frame Search Term 3 entities Search Term 4 gates Search Term 5 contrast Before Priority Date: priority:20171110
9/3/2024 9:55:26 AM	Google Scholar	mirror mirror surface display housing display screen
9/3/2024 9:55:26 AM	Google Patents	Search Term 1 mirror Search Term 2 mirror surface Search Term 3 display Search Term 4 housing Search Term 5 display screen Before Priority Date: priority:20201027
9/3/2024 9:55:31 AM	Google Scholar	display lens layer frame lens body
9/3/2024 9:55:31 AM	Google Patents	Search Term 1 display Search Term 2 lens Search Term 3 layer Search Term 4 frame Search Term 5 lens body Before Priority Date: priority:20211123
9/3/2024 9:55:38 AM	Google Scholar	substrate eye examples light emitting micro light

date, time	web site	search string
9/3/2024 9:55:38 AM	Google Patents	Search Term 1 substrate Search Term 2 eye Search Term 3 examples Search Term 4 light emitting Search Term 5 micro light Before Priority Date: priority:20220711
9/3/2024 10:13:50 AM	Google Scholar	mounting surface wearable device disposed display mounting
9/3/2024 10:13:50 AM	Google Patents	Search Term 1 mounting surface Search Term 2 wearable device Search Term 3 disposed Search Term 4 display Search Term 5 mounting Before Priority Date: priority:20161230
9/3/2024 10:13:57 AM	Google Scholar	electronic device display module lens barrel wearable electronic optical unit
9/3/2024 10:13:57 AM	Google Patents	Search Term 1 electronic device Search Term 2 display module Search Term 3 lens barrel Search Term 4 wearable electronic Search Term 5 optical unit Before Priority Date: priority:20220725
9/3/2024 10:14:03 AM	Google Scholar	mini lens module lens module display

date, time	web site	search string
9/3/2024 10:14:03 AM	Google Patents	Search Term 1 mini Search Term 2 lens module Search Term 3 lens Search Term 4 module Search Term 5 display Before Priority Date: priority:20211018
9/3/2024 10:14:08 AM	Google Scholar	arm frame connector head accessory
9/3/2024 10:14:08 AM	Google Patents	Search Term 1 arm Search Term 2 frame Search Term 3 connector Search Term 4 head Search Term 5 accessory Before Priority Date: priority:20210924
9/3/2024 10:14:14 AM	Google Scholar	communication module sunglasses manufactured dimensional metal item
9/3/2024 10:14:14 AM	Google Patents	Search Term 1 communication module Search Term 2 sunglasses Search Term 3 manufactured Search Term 4 dimensional metal Search Term 5 item Before Priority Date: priority:20160823
9/3/2024 10:15:08 AM	Google Scholar	glasses temple connector user camera

Apple Inc. Exhibit 1015 Page 1800

date, time	web site	search string
9/3/2024 10:15:08 AM	Google Patents	Search Term 1 glasses Search Term 2 temple Search Term 3 connector Search Term 4 user Search Term 5 camera Before Priority Date: priority:20031009
9/3/2024 10:40:27 AM	Google Scholar	transmitter switch earphones antenna radio
9/3/2024 10:40:27 AM	Google Patents	Search Term 1 transmitter Search Term 2 switch Search Term 3 earphones Search Term 4 antenna Search Term 5 radio Before Priority Date: priority:19930119
9/3/2024 10:40:36 AM	Google Scholar	eyewear temple frame transceiver alarm
9/3/2024 10:40:36 AM	Google Patents	Search Term 1 eyewear Search Term 2 temple Search Term 3 frame Search Term 4 transceiver Search Term 5 alarm Before Priority Date: priority:20010430
9/3/2024 10:40:43 AM	Google Scholar	eyeglass bracket spectacles spectacle combined

Apple Inc. Exhibit 1015 Page 1801

date, time	web site	search string
9/3/2024 10:40:43 AM	Google Patents	**Search Term 1** eyeglass **Search Term 2** bracket **Search Term 3** spectacles **Search Term 4** spectacle **Search Term 5** combined **Before** Priority Date: priority:18850623
9/3/2024 10:40:49 AM	Google Scholar	globes globe lighting device facially annular
9/3/2024 10:40:49 AM	Google Patents	**Search Term 1** globes **Search Term 2** globe **Search Term 3** lighting device **Search Term 4** facially **Search Term 5** annular **Before** Priority Date: priority:18990707
9/3/2024 10:40:58 AM	Google Scholar	lamp frame spectacle socket opening
9/3/2024 10:40:58 AM	Google Patents	**Search Term 1** lamp **Search Term 2** frame **Search Term 3** spectacle **Search Term 4** socket **Search Term 5** opening **Before** Priority Date: priority:19160412
9/3/2024 10:41:05 AM	Google Scholar	fuse insert plug slots contact

Apple Inc. Exhibit 1015 Page 1802

date, time	web site	search string
9/3/2024 10:41:05 AM	Google Patents	Search Term 1 fuse Search Term 2 insert Search Term 3 plug Search Term 4 slots Search Term 5 contact Before Priority Date: priority:19310529
9/3/2024 10:41:14 AM	Google Scholar	head bone receiver hearing contact surface
9/3/2024 10:41:14 AM	Google Patents	Search Term 1 head Search Term 2 bone Search Term 3 receiver Search Term 4 hearing Search Term 5 contact surface Before Priority Date: priority:19330718
9/3/2024 10:41:30 AM	Google Scholar	light spectacle frame battery bulb frame
9/3/2024 10:41:30 AM	Google Patents	Search Term 1 light Search Term 2 spectacle frame Search Term 3 battery Search Term 4 bulb Search Term 5 frame Before Priority Date: priority:19490323
9/3/2024 11:00:49 AM	Google Scholar	hearing aid ear frame spectacles parts

Apple Inc. Exhibit 1015 Page 1803

date, time	web site	search string
9/3/2024 11:00:49 AM	Google Patents	Search Term 1 hearing aid Search Term 2 ear Search Term 3 frame Search Term 4 spectacles Search Term 5 parts Before Priority Date: priority:19530316
9/3/2024 11:00:57 AM	Google Scholar	radiation crystal impedance spectral ranges exciter
9/3/2024 11:00:57 AM	Google Patents	Search Term 1 radiation Search Term 2 crystal Search Term 3 impedance Search Term 4 spectral ranges Search Term 5 exciter Before Priority Date: priority:19531013
9/3/2024 11:01:04 AM	Google Scholar	earphone seating hearing aid automatic self
9/3/2024 11:01:04 AM	Google Patents	Search Term 1 earphone Search Term 2 seating Search Term 3 hearing Search Term 4 aid Search Term 5 automatic self Before Priority Date: priority:19541018
9/3/2024 11:01:10 AM	Google Scholar	mount temple temples hinge ophthalmic

date, time	web site	search string
9/3/2024 11:01:10 AM	Google Patents	Search Term 1 mount Search Term 2 temple Search Term 3 temples Search Term 4 hinge Search Term 5 ophthalmic Before Priority Date: priority:19550804
9/3/2024 11:01:21 AM	Google Scholar	lamp recess frame recesses spectacles
9/3/2024 11:01:21 AM	Google Patents	Search Term 1 lamp Search Term 2 recess Search Term 3 frame Search Term 4 recesses Search Term 5 spectacles Before Priority Date: priority:19570412
9/3/2024 11:01:27 AM	Google Scholar	optical device lens illuminated optical frame bulbs
9/3/2024 11:01:27 AM	Google Patents	Search Term 1 optical device Search Term 2 lens Search Term 3 illuminated optical Search Term 4 frame Search Term 5 bulbs Before Priority Date: priority:19590508
9/3/2024 11:01:33 AM	Google Scholar	output integrator sunburn switch solar radiation

date, time	web site	search string
9/3/2024 11:01:33 AM	Google Patents	Search Term 1 output Search Term 2 integrator Search Term 3 sunburn Search Term 4 switch Search Term 5 solar radiation Before Priority Date: priority:19690804
9/3/2024 11:01:47 AM	Google Scholar	spectacles ultraviolet pair bodies wearer
9/3/2024 11:01:47 AM	Google Patents	Search Term 1 spectacles Search Term 2 ultraviolet Search Term 3 pair Search Term 4 bodies Search Term 5 wearer Before Priority Date: priority:19691217
9/3/2024 11:08:31 AM	Google Scholar	glasses rotating shaft circuit board disposed vibration
9/3/2024 11:08:31 AM	Google Patents	Search Term 1 glasses Search Term 2 rotating shaft Search Term 3 circuit board Search Term 4 disposed Search Term 5 vibration Before Priority Date: priority:20180824
9/3/2024 11:11:55 AM	Google Scholar	electronic device wearable electronic disclosure housing electronic component

Apple Inc. Exhibit 1015 Page 1806

date, time	web site	search string
9/3/2024 11:11:55 AM	Google Patents	Search Term 1 electronic device Search Term 2 wearable electronic Search Term 3 disclosure Search Term 4 housing Search Term 5 electronic component Before Priority Date: priority:20210203
9/3/2024 11:14:39 AM	Google Scholar	temple electrically connected built display end piece
9/3/2024 11:14:39 AM	Google Patents	Search Term 1 temple Search Term 2 electrically connected Search Term 3 built Search Term 4 display Search Term 5 end piece Before Priority Date: priority:20221207
9/3/2024 11:22:11 AM	Google Scholar	porous film substrate carbon nanotubes partially porous heat sink
9/3/2024 11:22:11 AM	Google Patents	Search Term 1 porous film Search Term 2 substrate Search Term 3 carbon nanotubes Search Term 4 partially porous Search Term 5 heat sink Before Priority Date: priority:20090308
9/3/2024 11:22:17 AM	Google Scholar	user display frame electronic device brow

date, time	web site	search string
9/3/2024 11:22:17 AM	Google Patents	Search Term 1 user Search Term 2 display Search Term 3 frame Search Term 4 electronic device Search Term 5 brow Before Priority Date: priority:20110818
9/3/2024 11:22:29 AM	Google Scholar	user eye image data light illuminator
9/3/2024 11:22:29 AM	Google Patents	Search Term 1 user Search Term 2 eye Search Term 3 image data Search Term 4 light Search Term 5 illuminator Before Priority Date: priority:20130903
9/3/2024 11:22:36 AM	Google Scholar	distance value pupillary distance previously determined user inter
9/3/2024 11:22:36 AM	Google Patents	Search Term 1 distance value Search Term 2 pupillary distance Search Term 3 previously determined Search Term 4 user Search Term 5 inter Before Priority Date: priority:20141112
9/3/2024 11:22:49 AM	Google Scholar	face frame temples lenses grooves

Apple Inc. Exhibit 1015 Page 1808

date, time	web site	search string
9/3/2024 11:22:49 AM	Google Patents	Search Term 1 face Search Term 2 frame Search Term 3 temples Search Term 4 lenses Search Term 5 grooves Before Priority Date: priority:20070717
9/3/2024 11:22:55 AM	Google Scholar	worn device head worn leds microprocessor alzheimer
9/3/2024 11:22:55 AM	Google Patents	Search Term 1 worn device Search Term 2 head worn Search Term 3 leds Search Term 4 microprocessor Search Term 5 alzheimer Before Priority Date: priority:20170517
9/3/2024 11:23:02 AM	Google Scholar	circuit board stem frame head wearable apparatus
9/3/2024 11:23:02 AM	Google Patents	Search Term 1 circuit board Search Term 2 stem Search Term 3 frame Search Term 4 head Search Term 5 wearable apparatus Before Priority Date: priority:20171228
9/3/2024 11:23:09 AM	Google Scholar	recess hcp thickness temple bcs

date, time	web site	search string
9/3/2024 11:23:09 AM	Google Patents	Search Term 1 recess Search Term 2 hcp Search Term 3 thickness Search Term 4 temple Search Term 5 bcs Before Priority Date: priority:20170328
9/3/2024 11:23:16 AM	Google Scholar	upper hinge section open core knuckle temple
9/3/2024 11:23:16 AM	Google Patents	Search Term 1 upper hinge Search Term 2 section Search Term 3 open core Search Term 4 knuckle Search Term 5 temple Before Priority Date: priority:20151228

Web Search History

date, time	web site	search string
9/3/2024 3:18:09 PM	Google	Best electronics eyewear
9/3/2024 3:18:19 PM	Google	eSight glasses
9/3/2024 3:18:26 PM	Google	Men electronics eyewear
9/3/2024 3:18:33 PM	Google	Smart glasses
9/3/2024 3:18:57 PM	Google	Best electronic spectacles
9/3/2024 3:19:07 PM	Google	Smart glasses with display
9/3/2024 3:19:24 PM	Google	vr glasses
9/3/2024 3:19:35 PM	Google	Ar glasses
9/3/2024 3:19:46 PM	Google	spectacles review
9/3/2024 3:20:03 PM	Google	Best electronic spectacles reviews
9/3/2024 3:20:17 PM	Google	electronic spectacles reviews
9/3/2024 3:20:21 PM	Google	electronic spectacles
9/3/2024 3:20:25 PM	Google	electronics eyewears
9/3/2024 3:20:37 PM	Google	Best electronics eyewear reviews
9/3/2024 3:20:45 PM	Google	Smart glasses technology
9/3/2024 3:20:51 PM	Google	Smart glasses review
9/3/2024 3:20:53 PM	Google	electronics eyewear reviews
9/3/2024 3:21:16 PM	Google Scholar	eyewear temple frame permanent magnet hinge

Apple Inc. Exhibit 1015 Page 1811

date, time	web site	search string
9/3/2024 3:21:16 PM	Google Patents	Search Term 1 eyewear Search Term 2 temple Search Term 3 frame Search Term 4 permanent magnet Search Term 5 hinge Before Priority Date: priority:20171205
9/3/2024 3:44:45 PM	Google	Neck Hanging Magnetic Reading Glasses
9/3/2024 3:44:49 PM	Google	Men's magnet temples of spectacles
9/3/2024 3:44:53 PM	Google	Magnetic interchangeable glasses frames
9/3/2024 3:44:58 PM	Google	magnet temples of spectacles
9/3/2024 3:45:22 PM	Google	magnet temples of spectacles reviews
9/3/2024 3:50:04 PM	Google Scholar	temple frame connector electronics wearable device
9/3/2024 3:50:04 PM	Google Patents	Search Term 1 temple Search Term 2 frame Search Term 3 connector Search Term 4 electronics Search Term 5 wearable device Before Priority Date: priority:20150415
9/3/2024 3:51:40 PM	Google Scholar	temple track guide wearable device eyewear system

date, time	web site	search string
9/3/2024 3:51:40 PM	Google Patents	Search Term 1 temple Search Term 2 track Search Term 3 guide Search Term 4 wearable device Search Term 5 eyewear system Before Priority Date: priority:20150610
9/3/2024 4:03:09 PM	Google Scholar	magnets members magnetic connector set forth magnet
9/3/2024 4:03:09 PM	Google Patents	Search Term 1 magnets Search Term 2 members Search Term 3 magnetic connector Search Term 4 set forth Search Term 5 magnet Before Priority Date: priority:20051213
9/3/2024 4:03:15 PM	Google Scholar	temple recess temples magnet holder
9/3/2024 4:03:15 PM	Google Patents	Search Term 1 temple Search Term 2 recess Search Term 3 temples Search Term 4 magnet Search Term 5 holder Before Priority Date: priority:20080204
9/3/2024 4:03:29 PM	Google Scholar	connector temple frame eyewear electronics

date, time	web site	search string
9/3/2024 4:03:29 PM	Google Patents	Search Term 1 connector Search Term 2 temple Search Term 3 frame Search Term 4 eyewear Search Term 5 electronics Before Priority Date: priority:20150415
9/3/2024 4:03:37 PM	Google Scholar	temple frame coupling mechanism articulated joint pair
9/3/2024 4:03:37 PM	Google Patents	Search Term 1 temple Search Term 2 frame Search Term 3 coupling mechanism Search Term 4 articulated joint Search Term 5 pair Before Priority Date: priority:20150929
9/3/2024 4:03:43 PM	Google Scholar	temple frame member side pieces pair assembly
9/3/2024 4:03:43 PM	Google Patents	Search Term 1 temple Search Term 2 frame member Search Term 3 side pieces Search Term 4 pair Search Term 5 assembly Before Priority Date: priority:20160801
9/3/2024 4:05:18 PM	Google Scholar	groove protrusion temple frame jacket

date, time	web site	search string
9/3/2024 4:05:18 PM	Google Patents	Search Term 1 groove Search Term 2 protrusion Search Term 3 temple Search Term 4 frame Search Term 5 jacket Before Priority Date: priority:20140425
9/3/2024 4:06:45 PM	Google Scholar	magnet contact surface electrical contact eyewear electronic assembly
9/3/2024 4:06:45 PM	Google Patents	Search Term 1 magnet Search Term 2 contact surface Search Term 3 electrical contact Search Term 4 eyewear Search Term 5 electronic assembly Before Priority Date: priority:20181227
9/3/2024 4:06:51 PM	Google Scholar	contact hinge case wearable device temple piece
9/3/2024 4:06:51 PM	Google Patents	Search Term 1 contact Search Term 2 hinge Search Term 3 case Search Term 4 wearable device Search Term 5 temple piece Before Priority Date: priority:20210427
9/3/2024 4:07:11 PM	Google Scholar	frame bridge recited eyeglass device magnetic member

date, time	web site	search string
9/3/2024 4:07:11 PM	Google Patents	Search Term 1 frame Search Term 2 bridge Search Term 3 recited Search Term 4 eyeglass device Search Term 5 magnetic member Before Priority Date: priority:19961213
9/3/2024 4:07:16 PM	Google Scholar	spectacles primary auxiliary frame clip
9/3/2024 4:07:16 PM	Google Patents	Search Term 1 spectacles Search Term 2 primary Search Term 3 auxiliary Search Term 4 frame Search Term 5 clip Before Priority Date: priority:20020524
9/3/2024 4:07:21 PM	Google Scholar	frame magnetic receiving portion flip friction
9/3/2024 4:07:21 PM	Google Patents	Search Term 1 frame Search Term 2 magnetic Search Term 3 receiving portion Search Term 4 flip Search Term 5 friction Before Priority Date: priority:20040701
9/3/2024 4:10:48 PM	Google Scholar	eyeglasses temple frame front members magnetic interaction

date, time	web site	search string
9/3/2024 4:10:48 PM	Google Patents	Search Term 1 eyeglasses Search Term 2 temple Search Term 3 frame front Search Term 4 members Search Term 5 magnetic interaction Before Priority Date: priority:20130313
9/3/2024 4:37:37 PM	Google Scholar	frame temples lenses eyeglasses disposed
9/3/2024 4:37:37 PM	Google Patents	Search Term 1 frame Search Term 2 temples Search Term 3 lenses Search Term 4 eyeglasses Search Term 5 disposed Before Priority Date: priority:20070921
9/3/2024 4:37:47 PM	Google Scholar	support member front support camera flexible leg tail end
9/3/2024 4:37:47 PM	Google Patents	Search Term 1 support member Search Term 2 front support Search Term 3 camera Search Term 4 flexible leg Search Term 5 tail end Before Priority Date: priority:20030829
9/3/2024 4:37:53 PM	Google Scholar	docking station eyeglass display device docking wearable display

date, time	web site	search string
9/3/2024 4:37:53 PM	Google Patents	Search Term 1 docking station Search Term 2 eyeglass Search Term 3 display device Search Term 4 docking Search Term 5 wearable display Before Priority Date: priority:20150618
9/3/2024 4:38:03 PM	Google Scholar	temple eyewear electrical connector connector exposed
9/3/2024 4:38:03 PM	Google Patents	Search Term 1 temple Search Term 2 eyewear Search Term 3 electrical connector Search Term 4 connector Search Term 5 exposed Before Priority Date: priority:20190122
9/3/2024 4:38:07 PM	Google Scholar	bracket pivoting member vertical arm arm pivoting
9/3/2024 4:38:07 PM	Google Patents	Search Term 1 bracket Search Term 2 pivoting member Search Term 3 vertical arm Search Term 4 arm Search Term 5 pivoting Before Priority Date: priority:20160719
9/3/2024 4:38:15 PM	Google Scholar	microdisplay display body support member spectacles section

date, time	web site	search string
9/3/2024 4:38:15 PM	Google Patents	Search Term 1 microdisplay Search Term 2 display body Search Term 3 support member Search Term 4 spectacles Search Term 5 section Before Priority Date: priority:20060316
9/3/2024 4:38:21 PM	Google Scholar	display device bar joint small display slider
9/3/2024 4:38:21 PM	Google Patents	Search Term 1 display device Search Term 2 bar Search Term 3 joint Search Term 4 small display Search Term 5 slider Before Priority Date: priority:20050309
9/3/2024 4:52:50 PM	Google Scholar	base magnets display component computing device locations
9/3/2024 4:52:50 PM	Google Patents	Search Term 1 base Search Term 2 magnets Search Term 3 display component Search Term 4 computing device Search Term 5 locations Before Priority Date: priority:20121109
9/3/2024 4:52:55 PM	Google Scholar	side wall eyeshade magnet head display apparatus

date, time	web site	search string
9/3/2024 4:52:55 PM	Google Patents	Search Term 1 side wall Search Term 2 eyeshade Search Term 3 magnet Search Term 4 head Search Term 5 display apparatus Before Priority Date: priority:20150430
9/3/2024 4:53:00 PM	Google Scholar	lenses eyeglasses trough eyeglasses frame attached
9/3/2024 4:53:00 PM	Google Patents	Search Term 1 lenses Search Term 2 eyeglasses Search Term 3 trough Search Term 4 eyeglasses frame Search Term 5 attached Before Priority Date: priority:20071120
9/3/2024 4:53:06 PM	Google Scholar	glasses magnet auxiliary main body spectacles
9/3/2024 4:53:06 PM	Google Patents	Search Term 1 glasses Search Term 2 magnet Search Term 3 auxiliary Search Term 4 main body Search Term 5 spectacles Before Priority Date: priority:20040419
9/3/2024 4:53:15 PM	Google Scholar	base lid magnet lens pocket

Apple Inc. Exhibit 1015 Page 1820

date, time	web site	search string
9/3/2024 4:53:15 PM	Google Patents	Search Term 1 base Search Term 2 lid Search Term 3 magnet Search Term 4 lens Search Term 5 pocket Before Priority Date: priority:20120309
9/3/2024 4:53:20 PM	Google Scholar	eyeglasses pair bridge pad bridge segment
9/3/2024 4:53:20 PM	Google Patents	Search Term 1 eyeglasses Search Term 2 pair Search Term 3 bridge pad Search Term 4 bridge Search Term 5 segment Before Priority Date: priority:20120210
9/3/2024 4:53:25 PM	Google Scholar	spectacles auxiliary primary spring frame
9/3/2024 4:53:25 PM	Google Patents	Search Term 1 spectacles Search Term 2 auxiliary Search Term 3 primary Search Term 4 spring Search Term 5 frame Before Priority Date: priority:20020822
9/3/2024 4:53:31 PM	Google Scholar	eyeglasses section portal upper section bridge

Apple Inc. Exhibit 1015 Page 1821

date, time	web site	search string
9/3/2024 4:53:31 PM	Google Patents	Search Term 1 eyeglasses Search Term 2 section Search Term 3 portal Search Term 4 upper section Search Term 5 bridge Before Priority Date: priority:20170607
9/3/2024 5:08:53 PM	Google Scholar	camera magnet lens cylindrical housing lens cap
9/3/2024 5:08:53 PM	Google Patents	Search Term 1 camera Search Term 2 magnet Search Term 3 lens Search Term 4 cylindrical housing Search Term 5 lens cap Before Priority Date: priority:20210520
9/3/2024 5:08:58 PM	Google Scholar	magnet eyeglasses screw member male screw connecting shaft
9/3/2024 5:08:58 PM	Google Patents	Search Term 1 magnet Search Term 2 eyeglasses Search Term 3 screw member Search Term 4 male screw Search Term 5 connecting shaft Before Priority Date: priority:20010314
9/3/2024 5:09:04 PM	Google Scholar	magnetic lid display embedded goggles

Apple Inc. Exhibit 1015 Page 1822

date, time	web site	search string
9/3/2024 5:09:04 PM	Google Patents	Search Term 1 magnetic Search Term 2 lid Search Term 3 display Search Term 4 embedded Search Term 5 goggles Before Priority Date: priority:20070208
9/3/2024 5:09:09 PM	Google Scholar	eyewear temple electrical connector frame electronic device
9/3/2024 5:09:09 PM	Google Patents	Search Term 1 eyewear Search Term 2 temple Search Term 3 electrical connector Search Term 4 frame Search Term 5 electronic device Before Priority Date: priority:20190222
9/3/2024 5:09:34 PM	Google Scholar	temple eyewear frame hinge partially embedded
9/3/2024 5:09:34 PM	Google Patents	Search Term 1 temple Search Term 2 eyewear Search Term 3 frame Search Term 4 hinge Search Term 5 partially embedded Before Priority Date: priority:20171205
9/3/2024 5:09:41 PM	Google Scholar	temple piece configuration disposed catch stored configuration

date, time	web site	search string
9/3/2024 5:09:41 PM	Google Patents	Search Term 1 temple piece Search Term 2 configuration Search Term 3 disposed Search Term 4 catch Search Term 5 stored configuration Before Priority Date: priority:20190925
9/3/2024 5:09:52 PM	Google Scholar	lens bridge closure frame spectacle frame
9/3/2024 5:09:52 PM	Google Patents	Search Term 1 lens Search Term 2 bridge Search Term 3 closure Search Term 4 frame Search Term 5 spectacle frame Before Priority Date: priority:20081117
9/3/2024 5:09:58 PM	Google Scholar	magnets members magnetic magnetic connector eyewear
9/3/2024 5:09:58 PM	Google Patents	Search Term 1 magnets Search Term 2 members Search Term 3 magnetic Search Term 4 magnetic connector Search Term 5 eyewear Before Priority Date: priority:20051213
9/3/2024 5:10:10 PM	Google Scholar	eyeglasses arm magnetic magnetic element strike

date, time	web site	search string
9/3/2024 5:10:10 PM	Google Patents	Search Term 1 eyeglasses Search Term 2 arm Search Term 3 magnetic Search Term 4 magnetic element Search Term 5 strike Before Priority Date: priority:20170517
9/3/2024 5:10:17 PM	Google Scholar	temple hinge element lens frame magnets pivotable
9/3/2024 5:10:17 PM	Google Patents	Search Term 1 temple Search Term 2 hinge element Search Term 3 lens frame Search Term 4 magnets Search Term 5 pivotable Before Priority Date: priority:20060609
9/3/2024 5:16:23 PM	Google Scholar	eyeglass orientation eyeglass apparatus link eyeglass portion
9/3/2024 5:16:23 PM	Google Patents	Search Term 1 eyeglass Search Term 2 orientation Search Term 3 eyeglass apparatus Search Term 4 link Search Term 5 eyeglass portion Before Priority Date: priority:20131220
9/3/2024 5:16:27 PM	Google Scholar	eyeglasses ball temple temple arms lens frame

Apple Inc. Exhibit 1015 Page 1825

date, time	web site	search string
9/3/2024 5:16:27 PM	Google Patents	Search Term 1 eyeglasses Search Term 2 ball Search Term 3 temple Search Term 4 temple arms Search Term 5 lens frame Before Priority Date: priority:20060724
9/3/2024 5:16:37 PM	Google Scholar	temple front frame magnet exposed degrees
9/3/2024 5:16:37 PM	Google Patents	Search Term 1 temple Search Term 2 front frame Search Term 3 magnet Search Term 4 exposed Search Term 5 degrees Before Priority Date: priority:20080314
9/3/2024 5:16:59 PM	Google Scholar	frame base holding magnets pair
9/3/2024 5:16:59 PM	Google Patents	Search Term 1 frame Search Term 2 base Search Term 3 holding Search Term 4 magnets Search Term 5 pair Before Priority Date: priority:20070330
9/3/2024 5:17:04 PM	Google Scholar	glasses clip permanent magnet soft magnetic coupled

Apple Inc. Exhibit 1015 Page 1826

date, time	web site	search string
9/3/2024 5:17:04 PM	Google Patents	Search Term 1 glasses Search Term 2 clip Search Term 3 permanent magnet Search Term 4 soft magnetic Search Term 5 coupled Before Priority Date: priority:20090714
9/3/2024 5:17:09 PM	Google Scholar	temple tip tip body stop eyeglasses
9/3/2024 5:17:09 PM	Google Patents	Search Term 1 temple Search Term 2 tip Search Term 3 tip body Search Term 4 stop Search Term 5 eyeglasses Before Priority Date: priority:20040504
9/3/2024 5:17:13 PM	Google Scholar	lens main glasses lenses auxiliary lens
9/3/2024 5:17:13 PM	Google Patents	Search Term 1 lens Search Term 2 main Search Term 3 glasses Search Term 4 lenses Search Term 5 auxiliary lens Before Priority Date: priority:20120131
9/3/2024 5:34:10 PM	Google Scholar	film main frame elastic fixing sunglasses clip

Apple Inc. Exhibit 1015 Page 1827

date, time	web site	search string
9/3/2024 5:34:10 PM	Google Patents	Search Term 1 film Search Term 2 main frame Search Term 3 elastic fixing Search Term 4 sunglasses Search Term 5 clip Before Priority Date: priority:20160411
9/3/2024 5:34:15 PM	Google Scholar	frame primary frame auxiliary spectacles primary quick release
9/3/2024 5:34:15 PM	Google Patents	Search Term 1 frame Search Term 2 primary frame Search Term 3 auxiliary spectacles Search Term 4 primary Search Term 5 quick release Before Priority Date: priority:20190118
9/3/2024 5:34:20 PM	Google Scholar	aperture ornamental temple arm eyeglass frame ornamental insert
9/3/2024 5:34:20 PM	Google Patents	Search Term 1 aperture Search Term 2 ornamental Search Term 3 temple arm Search Term 4 eyeglass frame Search Term 5 ornamental insert Before Priority Date: priority:20111024
9/3/2024 5:34:29 PM	Google Scholar	glasses magnet pile head hanging connecting element

date, time	web site	search string
9/3/2024 5:34:29 PM	Google Patents	Search Term 1 glasses Search Term 2 magnet Search Term 3 pile head Search Term 4 hanging Search Term 5 connecting element Before Priority Date: priority:20190419
9/3/2024 5:34:33 PM	Google Scholar	glasses frame lanyard magnetic material disposed
9/3/2024 5:34:33 PM	Google Patents	Search Term 1 glasses Search Term 2 frame Search Term 3 lanyard Search Term 4 magnetic material Search Term 5 disposed Before Priority Date: priority:20151001
9/3/2024 5:34:38 PM	Google Scholar	temple gear pin leg working space concave
9/3/2024 5:34:38 PM	Google Patents	Search Term 1 temple Search Term 2 gear pin Search Term 3 leg Search Term 4 working space Search Term 5 concave Before Priority Date: priority:20091224
9/3/2024 5:34:44 PM	Google Scholar	leg embedded glasses leg spectacles support sheet

Apple Inc. Exhibit 1015 Page 1829

date, time	web site	search string
9/3/2024 5:34:44 PM	Google Patents	Search Term 1 leg Search Term 2 embedded Search Term 3 glasses leg Search Term 4 spectacles Search Term 5 support sheet Before Priority Date: priority:20170424
9/3/2024 5:42:53 PM	Google Scholar	main frame frame body magnet magnetic attraction mounting groove
9/3/2024 5:42:53 PM	Google Patents	Search Term 1 main frame Search Term 2 frame body Search Term 3 magnet Search Term 4 magnetic attraction Search Term 5 mounting groove Before Priority Date: priority:20210330
9/3/2024 5:42:58 PM	Google Scholar	lens recess eyewear mounting portion frame
9/3/2024 5:42:58 PM	Google Patents	Search Term 1 lens Search Term 2 recess Search Term 3 eyewear Search Term 4 mounting portion Search Term 5 frame Before Priority Date: priority:20121026
9/3/2024 5:43:03 PM	Google Scholar	rotation control frame control unit hinge magnet

Apple Inc. Exhibit 1015 Page 1830

date, time	web site	search string
9/3/2024 5:43:03 PM	Google Patents	Search Term 1 rotation control Search Term 2 frame Search Term 3 control unit Search Term 4 hinge Search Term 5 magnet Before Priority Date: priority:20120306
9/3/2024 5:43:09 PM	Google Scholar	mirror main auxiliary frame glasses
9/3/2024 5:43:09 PM	Google Patents	Search Term 1 mirror Search Term 2 main Search Term 3 auxiliary Search Term 4 frame Search Term 5 glasses Before Priority Date: priority:20210111
9/3/2024 5:43:21 PM	Google Scholar	eye frame frames split pin
9/3/2024 5:43:21 PM	Google Patents	Search Term 1 eye Search Term 2 frame Search Term 3 frames Search Term 4 split Search Term 5 pin Before Priority Date: priority:19521125
9/3/2024 5:43:25 PM	Google Scholar	face frame according ear branches frame

Apple Inc. Exhibit 1015 Page 1831

date, time	web site	search string
9/3/2024 5:43:25 PM	Google Patents	Search Term 1 face Search Term 2 frame according Search Term 3 ear Search Term 4 branches Search Term 5 frame Before Priority Date: priority:19820416
9/3/2024 5:43:31 PM	Google Scholar	frame eyewear lens earpiece securing means
9/3/2024 5:43:31 PM	Google Patents	Search Term 1 frame Search Term 2 eyewear Search Term 3 lens Search Term 4 earpiece Search Term 5 securing means Before Priority Date: priority:19921112
9/3/2024 5:43:36 PM	Google Scholar	front frame post temples hinge system hinge
9/3/2024 5:43:36 PM	Google Patents	Search Term 1 front frame Search Term 2 post Search Term 3 temples Search Term 4 hinge system Search Term 5 hinge Before Priority Date: priority:19930607
9/3/2024 5:51:58 PM	Google Scholar	frame temple hinge ear stem attached

date, time	web site	search string
9/3/2024 5:51:58 PM	Google Patents	Search Term 1 frame Search Term 2 temple Search Term 3 hinge Search Term 4 ear stem Search Term 5 attached Before Priority Date: priority:19960311
9/3/2024 5:52:03 PM	Google Scholar	lens frame spectacles temple arm temple pivot
9/3/2024 5:52:03 PM	Google Patents	Search Term 1 lens frame Search Term 2 spectacles Search Term 3 temple arm Search Term 4 temple Search Term 5 pivot Before Priority Date: priority:20020816
9/3/2024 5:52:08 PM	Google Scholar	leg end piece magnets hinge glasses
9/3/2024 5:52:08 PM	Google Patents	Search Term 1 leg Search Term 2 end piece Search Term 3 magnets Search Term 4 hinge Search Term 5 glasses Before Priority Date: priority:20110531
9/3/2024 5:52:14 PM	Google Scholar	lenses lens frame sun glasses pairs

date, time	web site	search string
9/3/2024 5:52:14 PM	Google Patents	Search Term 1 lenses Search Term 2 lens Search Term 3 frame Search Term 4 sun glasses Search Term 5 pairs Before Priority Date: priority:19630820
9/3/2024 5:52:24 PM	Google Scholar	piece rod temple locking rod shield
9/3/2024 5:52:24 PM	Google Patents	Search Term 1 piece Search Term 2 rod Search Term 3 temple Search Term 4 locking rod Search Term 5 shield Before Priority Date: priority:19891226
9/3/2024 5:52:29 PM	Google Scholar	temple cavity forward end insert structure grasping
9/3/2024 5:52:29 PM	Google Patents	Search Term 1 temple Search Term 2 cavity Search Term 3 forward end Search Term 4 insert structure Search Term 5 grasping Before Priority Date: priority:20000323
9/3/2024 5:52:44 PM	Google Scholar	eyewire latch magnetic eyewear lens

Apple Inc. Exhibit 1015 Page 1834

date, time	web site	search string
9/3/2024 5:52:44 PM	Google Patents	Search Term 1 eyewire Search Term 2 latch Search Term 3 magnetic Search Term 4 eyewear Search Term 5 lens Before Priority Date: priority:20190228
9/3/2024 5:52:51 PM	Google Scholar	temple eyeglass spring temples frame
9/3/2024 5:52:51 PM	Google Patents	Search Term 1 temple Search Term 2 eyeglass Search Term 3 spring Search Term 4 temples Search Term 5 frame Before Priority Date: priority:20100827
9/3/2024 5:52:56 PM	Google Scholar	clips fulcrum female eyeglass frame
9/3/2024 5:52:56 PM	Google Patents	Search Term 1 clips Search Term 2 fulcrum Search Term 3 female Search Term 4 eyeglass Search Term 5 frame Before Priority Date: priority:20110408

IP Office	Application	Applicant	Title	Application Date	Priority Number	Publication Number	Publication Date
US	10822218			04/12/2004	US 60527565 US 60462591 US 10822218 US 60509631	US 20060003803 A1 US 7792552 B2	01/05/2006 09/07/2010
US	10964011			10/12/2004	US 60527565 US 60583169 US 60509631 US 10964011 US 60562798 US 60618107 US 60462591 US 60605191 US 60592045	US 20050078274 A1 US 7192136 B2	04/14/2005 03/20/2007
US	11006343			12/07/2004	US 11006343 US 60527565	US 20050124324 A1 US 7116976 B2	06/09/2005 10/03/2006
US	11078857			03/11/2005	US 60647826 US 60583169 US 60562798 US 60620238 US 60618107 US 60605191 US 11078857 US 60592045 US 60647836	US 20050230596 A1	10/20/2005
US	11078855			03/11/2005	US 60647826 US 60583169 US 11078855 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20090059159 A1 US 7500746 B1	03/05/2009 03/10/2009
CN	200510067143			04/14/2005	US 60562798	CN 1700059 A CN 100580507 C	11/23/2005 01/13/2010
CN	200520016479			04/14/2005	US 60562798	CN 2859575 Y	01/17/2007

IP Office	Application	Applicant	Title	Application Date	Priority Number	Publication Number	Publication Date
US	11183269			07/15/2005	US 60647826 US 60527565 US 60583169 US 11183269 US 60509631 US 10964011 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20050264752 A1 US 7922321 B2	12/01/2005 04/12/2011
US	11183263			07/15/2005	US 60647826 US 60527565 US 60583169 US 60509631 US 10964011 US 60562798 US 60620238 US 60618107 US 60605191 US 11183263 US 60592045 US 60647836	US 20060001827 A1 US 7380936 B2	01/05/2006 06/03/2008
US	11183256			07/15/2005	US 60647826 US 60527565 US 60583169 US 60509631 US 10964011 US 60562798 US 60620238 US 60618107 US 60605191 US 11183256 US 60592045 US 60647836	US 20060023158 A1 US 7500747 B2	02/02/2006 03/10/2009
US	11183262			07/15/2005	US 60647826 US 60527565 US 60583169 US 60509631 US 10964011 US 60562798 US 11183262 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20050248717 A1 US 7760898 B2	11/10/2005 07/20/2010
US	11183283			07/15/2005	US 60647826 US 60527565 US 60583169 US 60509631 US 11183283 US 10964011 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20050248719 A1	11/10/2005

IP Office	Application	Applicant	Title	Application Date	Priority Number	Publication Number	Publication Date
US	11183276			07/15/2005	US 60647826 US 60527565 US 60583169 US 11183276 US 60509631 US 10964011 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20050248718 A1 US 7255437 B2	11/10/2005 08/14/2007
US	PCT/US06/22015			06/07/2006	US 60689686	WO 2006135614 A2 WO 2006135614 A3 WO 2006135614 A8 WO 2006135614 A9	12/21/2006 03/22/2007 07/10/2008 12/11/2008
CN	200680027964			06/07/2006	US 60689686	CN 101297191 A	10/29/2008
US	11452115			06/12/2006	US 11452115 US 60689686 US 11006343 US 60527565	US 20060259565 A1 US 7729688 B2	11/16/2006 06/01/2010
US	11497651			08/02/2006	US 11006343 US 60527565 US 11497651	US 20060276210 A1 US 7376434 B2	12/07/2006 05/20/2008
US	11521256			09/13/2006	US 11521256 US 60527565 US 60583169 US 60509631 US 10964011 US 60562798 US 60605191 US 60592045	US 7438410 B1	10/21/2008

IP Office	Application	Applicant	Title	Application Date	Priority Number	Publication Number	Publication Date
US	11580222			10/11/2006	US 60583169 US 60725896 US 11183269 US 60787850 US 60846150 US 10964011 US 60725999 US 60527565 US 60509631 US 60562798 US 60620238 US 11580222 US 60618107 US 60605191 US 60592045 US 60647836	US 20070046887 A1 US 7581833 B2	03/01/2007 09/01/2009
US	11546685			10/11/2006	US 60583169 US 60725896 US 11546685 US 60787850 US 60846150 US 10964011 US 60725999 US 11183256 US 60647826 US 60527565 US 60509631 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20070030442 A1 US 7806525 B2	02/08/2007 10/05/2010
US	11650626			01/06/2007	US 11650626 US 60583169 US 60787850 US 60846150 US 10964011 US 11183256 US 60647826 US 60527565 US 60509631 US 60763854 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20070109491 A1 US 7677723 B2	05/17/2007 03/16/2010
US	11700550			01/30/2007	US 60583169 US 11700550 US 11078855 US 60787850 US 60846150 US 60647826 US 60763854 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20070186330 A1	08/16/2007

IP Office	Application	Applicant	Title	Application Date	Priority Number	Publication Number	Publication Date
CN	200710090621			04/02/2007	US 60787850	CN 101046557 A	10/03/2007
US	11891411			08/09/2007	US 60583169 US 11183276 US 10964011 US 11891411 US 60647826 US 60527565 US 60509631 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20070279584 A1 US 7401918 B2	12/06/2007 07/22/2008
US	11903512			09/20/2007	US 60846150 US 11903512	US 20080068559 A1 US 7543934 B2	03/20/2008 06/09/2009
US	12074302			03/03/2008	US 11521256 US 60527565 US 60583169 US 60509631 US 10964011 US 60562798 US 12074302 US 60605191 US 60592045	US 20080151179 A1 US 7621634 B2	06/26/2008 11/24/2009
US	12074961			03/07/2008	US 11497651 US 12074961 US 11006343 US 60527565	US 7890128 B1	02/15/2011
US	12152480			05/13/2008	US 60647826 US 60620238 US 60618107 US 60605191 US 11183263 US 12152480 US 60592045 US 60647836	US 20080218684 A1 US 8337013 B2	09/11/2008 12/25/2012
US	12214435			06/19/2008	US 60583169 US 11183276 US 10964011 US 11891411 US 60647826 US 60527565 US 60509631 US 60562798 US 60620238 US 60618107 US 12214435 US 60605191 US 60592045 US 60647836	US 20080278678 A1 US 7481531 B2	11/13/2008 01/27/2009

IP Office	Application	Applicant	Title	Application Date	Priority Number	Publication Number	Publication Date
US	12317043			12/18/2008	US 60583169 US 11183276 US 10964011 US 11891411 US 12317043 US 60647826 US 60527565 US 60509631 US 60562798 US 60620238 US 60618107 US 12214435 US 60605191 US 60592045 US 60647836	US 20090141233 A1 US 7771046 B2	06/04/2009 08/10/2010
US	12322377			02/02/2009	US 60647826 US 60583169 US 12322377 US 11078855 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20090147215 A1 US 8770742 B2	06/11/2009 07/08/2014
US	12462286			07/31/2009	US 60583169 US 60725896 US 11183269 US 60787850 US 60846150 US 10964011 US 60725999 US 60647826 US 60527565 US 60509631 US 60562798 US 60620238 US 11580222 US 60618107 US 60605191 US 12462286 US 60592045 US 60647836	US 20090296044 A1 US 8109629 B2	12/03/2009 02/07/2012
US	12798995			04/14/2010	US 11452115 US 60689686 US 11006343 US 60527565 US 12798995	US 20100205272 A1 US 8744407 B2	08/12/2010 06/03/2014

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US	12803732			07/01/2010	US 60583169 US 60725896 US 11546685 US 60787850 US 60846150 US 10964011 US 12803732 US 60725999 US 11183256 US 60647826 US 60527565 US 60509631 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20110102734 A1 US 8434863 B2	05/05/2011 05/07/2013
US	12806312			08/10/2010	US 60583169 US 60725896 US 60787850 US 10822218 US 11891411 US 60647826 US 60527565 US 12214435 US 60605191 US 12462286 US 60592045 US 60647836 US 11183269 US 11183276 US 60846150 US 10964011 US 12806312 US 60725999 US 12317043 US 60509631 US 60562798 US 60620238 US 11580222 US 60618107 US 60462591	US 20100309426 A1 US 8465151 B2	12/09/2010 06/18/2013
US	12987018			01/07/2011	US 12987018 US 11497651 US 12074961 US 11006343 US 60527565	US 8112104 B1	02/07/2012
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US	13291020			11/07/2011	US 60583169 US 60725896 US 11546685 US 60787850 US 60846150 US 10964011 US 12803732 US 60725999 US 11183256 US 60647826 US 60527565 US 60509631 US 60562798 US 60620238 US 60618107 US 13291020 US 60605191 US 60592045 US 60647836	US 20120050668 A1 US 8430507 B2	03/01/2012 04/30/2013
US	13363360			01/31/2012	US 12987018 US 11497651 US 12074961 US 11006343 US 60527565 US 13363360	US 8280419 B1	10/02/2012
US	13367346			02/06/2012	US 60583169 US 60725896 US 11078855 US 60787850 US 13367346 US 10822218 US 60647826 US 60527565 US 60605191 US 12462286 US 60592045 US 60647836 US 11183269 US 11183276 US 11546685 US 60846150 US 10964011 US 60725999 US 11183256 US 11006343 US 60509631 US 11183283 US 60562798 US 11183262 US 60620238 US 11580222 US 60618107 US 11078857 US 11183263	US 20120133885 A1 US 9033493 B2	05/31/2012 05/19/2015
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IP Office	Application	Applicant	Title	Application Date	Priority Number	Publication Number	Publication Date
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US	13831512			03/14/2013	US 60583169 US 60725896 US 11078855 US 60787850 US 10822218 US 11891411 US 60647826 US 60527565 US 12214435 US 60605191 US 13831512 US 12462286 US 60592045 US 60647836 US 11183269 US 11183276 US 11546685 US 60846150 US 10964011 US 12806312 US 60725999 US 11183256 US 12317043 US 11006343 US 60509631 US 11183283 US 60562798 US 11183262 US 60620238 US 11580222 US 60618107 US 60462591 US 11078857 US 11183263	US 20130201440 A1 US 9690121 B2	08/08/2013 06/27/2017
US	13831455			03/14/2013	US 13831455	US 20140278782 A1	09/18/2014

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US	13831419			03/14/2013	US 60583169 US 60725896 US 11078855 US 60787850 US 10822218 US 60647826 US 60527565 US 13291020 US 60605191 US 13831419 US 60592045 US 60647836 US 11183269 US 11183276 US 11546685 US 60846150 US 10964011 US 12803732 US 60725999 US 11183256 US 11006343 US 60509631 US 11183283 US 60562798 US 11183262 US 60620238 US 11580222 US 60618107 US 11078857 US 11183263	US 20140268008 A1 US 20160246075 A9 US 10345625 B2	09/18/2014 08/25/2016 07/09/2019
US	13955336			07/31/2013	US 60583169 US 11078855 US 11183269 US 11183276 US 10964011 US 13955336 US 10822218 US 13085402 US 11183256 US 60647826 US 11006343 US 60527565 US 60509631 US 11183283 US 60562798 US 11183262 US 60620238 US 60618107 US 60605191 US 11078857 US 11183263 US 60592045 US 60647836	US 20130308089 A1 US 8905542 B2	11/21/2013 12/09/2014
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US	14286976			05/23/2014	US 12987018 US 11497651 US 13593483 US 11006343 US 60527565 US 13363360 US 14286976 US 12074961	US 20140256293 A1 US 11019199 B2	09/11/2014 05/25/2021
US	14313989			06/24/2014	US 14313989 US 60583169 US 12322377 US 11078855 US 10964011 US 10822218 US 60647826 US 11006343 US 60562798 US 60620238 US 60618107 US 60605191 US 11078857 US 60592045 US 60647836	US 20140361185 A1 US 9488520 B2	12/11/2014 11/08/2016
US	14557409			12/01/2014	US 60583169 US 11078855 US 11183269 US 11183276 US 10964011 US 13955336 US 10822218 US 13085402 US 11183256 US 14557409 US 60647826 US 11006343 US 60527565 US 60509631 US 11183283 US 60562798 US 11183262 US 60620238 US 60618107 US 60605191 US 11078857 US 11183263 US 60592045 US 60647836	US 20150085245 A1 US 9547184 B2	03/26/2015 01/17/2017
HK	14112801			12/22/2014	US 13831455	HK 1199316 A1	06/26/2015

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US	14922344			10/26/2015	US 14922344 US 11006343 US 60527565 US 14272632 US 11452115 US 60689686 US 12798995	US 20160044474 A1 US 9736664 B2	02/11/2016 08/15/2017
US	15343472			11/04/2016	US 14313989 US 60583169 US 12322377 US 11078855 US 10964011 US 10822218 US 60647826 US 15343472 US 11006343 US 60562798 US 60620238 US 60618107 US 60605191 US 11078857 US 60592045 US 60647836	US 20170074721 A1 US 10060790 B2	03/16/2017 08/28/2018

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US	15469440			03/24/2017	US 14922344 US 11006343 US 60527565 US 14272632 US 15469440 US 11452115 US 60689686 US 12798995	US 20170201872 A1 US 10142810 B2	07/13/2017 11/27/2018
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US	16049120			07/30/2018	US 60583169 US 11183269 US 10964011 US 13955336 US 13085402 US 16049120 US 14557409 US 60647826 US 60527565 US 60509631 US 15375423 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20180335650 A1 US 11243416 B2	11/22/2018 02/08/2022
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US	16182969			11/07/2018	US 14715501 US 60583169 US 60725896 US 60787850 US 13367346 US 10822218 US 13085402 US 11891411 US 60647826 US 15409723 US 60527565 US 15375423 US 12214435 US 60605191 US 13831512 US 12462286 US 60592045 US 60647836 US 16182969 US 11183269 US 11183276 US 60846150 US 10964011 US 13955336 US 12806312 US 16049120 US 60725999 US 16127957 US 12317043 US 14557409 US 60509631 US 60562798 US 60620238 US 11580222 US 60618107 US 60462591	US 20190187492 A1 US 20210364827 A9	06/20/2019 11/25/2021
US	16424018			05/28/2019	US 60583169 US 60725896 US 11546685 US 60787850 US 60846150 US 10964011 US 12803732 US 60725999 US 11183256 US 60647826 US 60527565 US 16424018 US 60509631 US 60562798 US 60620238 US 60618107 US 13291020 US 60605191 US 13831419 US 60592045 US 60647836	US 20190278110 A1 US 11630331 B2	09/12/2019 04/18/2023

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US	16446710			06/20/2019	US 12987018 US 11497651 US 13593483 US 11006343 US 60527565 US 13363360 US 14286976 US 12074961 US 16446710	US 20190306305 A1 US 11711459 B2	10/03/2019 07/25/2023
US	16556205			08/29/2019	US 14922344 US 11006343 US 60527565 US 14272632 US 15469440 US 11452115 US 60689686 US 15704181 US 12798995 US 16556205	US 20190387371 A1 US 10708727 B2	12/19/2019 07/07/2020

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US	16703805			12/04/2019	US 14313989 US 60583169 US 12322377 US 11078855 US 16102859 US 16426351 US 16703805 US 60647826 US 15343472 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20200109986 A1 US 11326941 B2	04/09/2020 05/10/2022
US	16794458			02/19/2020	US 14922344 US 11006343 US 60527565 US 14272632 US 16794458 US 15469440 US 11452115 US 60689686 US 15704181 US 12798995 US 16556205	US 20200186975 A1 US 11800329 B2	06/11/2020 10/24/2023
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US	17681593			02/25/2022	US 14313989 US 60583169 US 12322377 US 11078855 US 16102859 US 16426351 US 16703805 US 17681593 US 60647826 US 15343472 US 60562798 US 60620238 US 60618107 US 60605191 US 60592045 US 60647836	US 20220178743 A1 US 11644361 B2	06/09/2022 05/09/2023

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US	17737866			05/05/2022	US 14715501 US 60725896 US 17737866 US 60787850 US 60846150 US 13367346 US 11580222 US 17395509 US 12462286 US 60725999 US 16127957	US 20220260859 A1 US 11733549 B2	08/18/2022 08/22/2023
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IP Office	Application	Applicant	Title	Application Date	Priority Number	Publication Number	Publication Date
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US	18129660			03/31/2023	US 60583169 US 60725896 US 11546685 US 60787850 US 60846150 US 10964011 US 12803732 US 60725999 US 11183256 US 60647826 US 18129660 US 60527565 US 16424018 US 60509631 US 60562798 US 60620238 US 60618107 US 13291020 US 60605191 US 13831419 US 60592045 US 60647836	US 20230236444 A1 US 11803069 B2	07/27/2023 10/31/2023
US	18144557			05/08/2023	US 17484080 US 18144557 US 11183269 US 13955336 US 13085402 US 16049120 US 14557409 US 60647826 US 15375423 US 17873104 US 60620238 US 60618107 US 16574254 US 60605191 US 60592045 US 60647836	US 20230273464 A1 US 11921355 B2	08/31/2023 03/05/2024

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US	18224793			07/21/2023	US 60725896 US 11546685 US 60787850 US 60846150 US 12803732 US 60725999 US 18224793 US 11183256 US 60647826 US 18129660 US 16424018 US 60620238 US 60618107 US 13291020 US 60605191 US 13831419 US 60592045 US 60647836	US 20230359266 A1 US 11829518 B1	11/09/2023 11/28/2023
US	18238467			08/26/2023	US 14715501 US 60725896 US 60787850 US 60846150 US 13367346 US 11580222 US 17395509 US 12462286 US 60725999 US 18238467 US 16127957	US 20230408850 A1	12/21/2023
US	18375893	1)Howell, Thomas A., 2)Chao, David ,3)Thomas, C. Douglass,4)Tong, Peter P.	SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS	10/02/2023	US 14715501 US 18375893 US 16182969 US 60725896 US 60787850 US 60846150 US 13955336 US 12806312 US 13367346 US 13085402 US 16049120 US 60725999 US 11891411 US 16127957 US 12317043 US 14557409 US 15409723 US 15375423 US 11580222 US 12214435 US 13831512 US 12462286	US 20240036361 A1 US 12044901 B2	02/01/2024 07/23/2024
US	18377911			10/09/2023	US 14922344 US 11006343 US 60527565 US 14272632 US 16794458 US 15469440 US 11452115 US 60689686 US 15704181 US 12798995 US 16556205 US 18377911	US 20240040345 A1	02/01/2024

IP Office	Application	Applicant	Title	Application Date	Priority Number	Publication Number	Publication Date
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Bibliographic Data

Application No: 18/597,874

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /JIE LEI/ (Examiner's Signature) | (Initials)

Title: SYSTEM FOR CHARGING EMBEDDED BATTERY IN WIRELESS HEAD-WORN PERSONAL ELECTRONIC APPARATUS

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
03/06/2024	351	2872	IPVCP003X1C4X1C2
RULE			

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CONTINUING DATA

This application is a CON of 18375893 10/02/2023 PAT 12044901

18375893 is a CON of 16182969 11/07/2018 PAT 12078870

16182969 is a CON of 16127957 09/11/2018 PAT 11086147

16182969 is a CON of 16049120 07/30/2018 PAT 11243416

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FOREIGN APPLICATIONS

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PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	1	"18594662"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/05/14 09:39 AM
L1	1	"18597874"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/05/15 08:33 AM
L2	5	"18375893"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/05/15 08:34 AM
L4	3	"18144557"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY,	OR	ON	ON	2024/05/14 09:42 AM

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L4	1	"89665263".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/15 08:34 AM
L5	5	"83901364".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/14 09:42 AM
L7	2	"37803583".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/15 08:36 AM
L10	6	"46326291".fmid.	(US-PGPUB; USPAT;	OR	ON	ON	2024/05/14

			USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)				09:50 AM
L10	12	"46332221".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/15 08:37 AM
L13	10	"48951410".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/14 10:06 AM
L14	4	"17949029"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM

L16	5	"16821810"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L18	17	"46304853".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/02/05 01:07 PM
L19	1	"27539742".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/14 10:07 AM
L20	8	"17484080"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2024/02/05 01:07 PM

			VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L22	11	"16574254"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L23	103494	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L24	82071	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L25	77662	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2024/02/05 01:07 PM

Apple Inc. Exhibit 1015 Page 1865

		control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4	EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L26	49408	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L27	46211	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND (communicat$4 near10 wireless$4) AND (audio OR speak$4) AND embed$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L28	20279	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3 ("David")) OR (("THOMAS") near3 ("C")) OR (("TONG") near3 ("Peter"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L29	144	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3 ("David")) OR (("THOMAS") near3 ("C")) OR (("TONG")	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM

Apple Inc. Exhibit 1015 Page 1866

		near3 ("Peter"))).INV. AND (eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4					
L30	129	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3 ("David")) OR (("THOMAS") near3 ("C")) OR (("TONG") near3 ("Peter"))).INV. AND (eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4)	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L31	125	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3 ("David")) OR (("THOMAS") near3 ("C")) OR (("TONG") near3 ("Peter"))).INV. AND (eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L32	125	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3 ("David")) OR (("THOMAS") near3 ("C")) OR (("TONG") near3 ("Peter"))).INV. AND (eyewear$4 OR glasses$4 OR	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM

		spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND (communicat$4 near10 wireless$4) AND (audio OR speak$4) AND embed$4					
L33	103	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3 ("David")) OR (("THOMAS") near3 ("C")) OR (("TONG") near3 ("Peter"))).INV. AND (eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L34	84	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3 ("David")) OR (("THOMAS") near3 ("C")) OR (("TONG") near3 ("Peter"))).INV. AND (eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L35	84	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM

		("David")) OR (("THOMAS") near3 ("C")) OR (("TONG") near3 ("Peter"))).INV. AND (eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second					
L36	84	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3 ("David")) OR (("THOMAS") near3 ("C")) OR (("TONG") near3 ("Peter"))).INV. AND (eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L37	79	((("HOWELL") near3 ("Thomas")) OR (("CHAO") near3 ("David")) OR (("THOMAS") near3 ("C")) OR (("TONG") near3 ("Peter"))).INV. AND (eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM

Apple Inc. Exhibit 1015 Page 1869

		(memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4					
L43	4184	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND speaker$2 AND (sound WITH guid$4)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L44	1509	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND (speaker$2 SAME (sound WITH guid$4))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L45	622	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND temple AND ((speaker$2 OR audio) SAME (sound WITH guid$4))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO;	OR	ON	ON	2024/02/05 01:07 PM

Apple Inc. Exhibit 1015 Page 1870

			JPO; DERWENT; IBM_TDB)				
L46	296	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND ((temples SAME speakers) AND (sound WITH guid$4))	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L47	13637	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND temple AND (speakers AND audio)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L48	1282	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND (temple SAME (speakers WITH audio))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L49	316	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND (circuit near10 board) AND (electric$4	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM

		WITH control$4) AND (memor$4 OR stor$4) AND (batter$4 near10 rechargeable) AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4 AND impair$4					
L50	302	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND (circuit near10 board) AND (electric$4 WITH control$4) AND (memor$4 OR stor$4) AND (batter$4 near10 rechargeable) AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4 AND impair$4 AND compensat$4 AND amplif$6	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L51	302	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND (circuit near10 board) AND (electric$4 WITH control$4) AND (memor$4 OR stor$4) AND (batter$4 near10 rechargeable) AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4 AND impair$4 AND compensat$4 AND	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM

Apple Inc. Exhibit 1015 Page 1872

		amplif$6 AND customiz$4					
L52	3	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND (circuit near10 board) AND (electric$4 WITH control$4) AND (memor$4 OR stor$4) AND (batter$4 near10 rechargeable) AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4 AND impair$4 AND compensat$4 AND (amplif$6 WITH customiz$4)	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L53	17	"46304853".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/02/05 01:07 PM
L54	103494	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L55	82071	(eyewear$4 OR	(US-PGPUB; USPAT;	OR	ON	ON	2024/02/05

		glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4)	USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				01:07 PM
L56	77662	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L57	49408	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM
L58	46211	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND (communicat$4 near10	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2024/02/05 01:07 PM

Apple Inc. Exhibit 1015 Page 1874

		wireless$4) AND (audio OR speak$4) AND embed$4	NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L59	17504	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L60	11615	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L61	3610	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND circuit AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L62	1920	(eyewear$4 OR glasses$4 OR spetacl$4 OR	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM

		eyegalss$4) AND frame AND (circuit near10 board) AND control$4 AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4					
L63	1402	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND (circuit near10 board) AND (electric$4 WITH control$4) AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L64	722	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND (circuit near10 board) AND (electric$4 WITH control$4) AND (memor$4 OR stor$4) AND batter$4 AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4 AND rechargeable	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM
L65	710	(eyewear$4 OR glasses$4 OR spetacl$4 OR eyegalss$4) AND frame AND (circuit near10 board) AND (electric$4	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM

		WITH control$4) AND (memor$4 OR stor$4) AND (batter$4 near10 rechargeable) AND connect$4 AND communicat$4 AND (audio OR speak$4) AND wireless$4 AND embed$4 AND microphone AND left AND right AND first AND second AND bridge AND partial$4					
L66	12657	L1 AND ((G02B27/017 OR G02B2027/0178 OR G02B27/0172 OR G02B2027/014 OR G02B2027/0138 OR G02B2027/0187 OR G02B27/0093 OR G02B27/0176 OR G02B2027/0118 OR G02B2027/0134 OR G02B27/0179 OR G02B2027/0141 OR G02B2027/0174 OR G02B27/0101 OR G02B27/01 OR G02B2027/0132 OR G02B2027/0127 OR G02B2027/0123 OR G02B30/24 OR G02B2027/0156 OR G02B2027/0112 OR G02B2027/0147 OR G02B27/0081 OR G02B3/14 OR G02B2027/011 OR G02B2027/0185 OR G02B6/005 OR G02B30/34 OR G02B2027/0154 OR G02B6/34 OR G02B26/101 OR G02B5/32 OR G02B2027/0125 OR G02B7/28 OR G02B2027/0181 OR G02B27/30 OR G02B27/646 OR G02B2027/015 OR G02B27/02 OR G02B6/0016 OR G02B26/0833 OR G02B30/00 OR G02B5/30 OR G02B27/4205 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM

		G02B6/0038 OR G02B30/25 OR G02B26/001 OR G02B13/0045 OR G02B26/10 OR G02B5/208 OR G02B2027/0159 OR G02B6/0036 OR G02B6/0076 OR G02B27/0075 OR G02B7/09 OR G02B2027/0152 OR G02B27/022 OR G02B2027/0116 OR G02B27/0149 OR G02B3/0081 OR G02B2027/0169 OR G02B6/0035 OR G02B27/283 OR G02B7/285 OR G02B13/06 OR G02B6/0065 OR G02B7/08 OR G02B5/3025 OR G02B2027/012 OR G02B27/0103 OR G02B5/1857 OR G02B6/00 OR G02B2027/013 OR G02B6/0023 OR G02B30/27 OR G02B27/00 OR G02B6/0068 OR G02B6/0055 OR G02B27/028 OR G02B7/023 OR G02B2027/0114 OR G02B26/005 OR G02B2027/0161 OR G02B26/105 OR G02B7/04 OR G02B7/102 OR G02B27/4272 OR G02B6/0011 OR G02B2027/0105 OR G02B5/23 OR G02B6/0088 OR G02B7/12 OR G02B7/02 OR G02B6/003 OR G02B3/0056 OR G02B5/08 OR G02B2027/0163 OR G02B21/365 OR G02B30/23 OR G02B5/20 OR G02B27/286 OR G02B6/006 OR					

		G02B6/10 OR G02B7/021 OR G02B27/1086 OR G02B6/0001 OR G02B6/0018 OR G02B3/0006 OR G02B5/005 OR G02B2027/0194 OR G02B2027/0198 OR G02B26/0816 OR G02B27/42 OR G02B6/0028 OR G02B13/009 OR G02B27/0018 OR G02B30/40 OR G02B6/0053 OR G02B5/1866 OR G02B9/64 OR G02B13/004 OR G02B19/0057 OR G02B21/0012 OR G02B26/004 OR G02B27/4227 OR G02B7/008 OR G02B3/0062 OR G02B5/1871 OR G02B13/18 OR G02B26/02 OR G02B5/18 OR G02B27/141 OR G02B26/0875 OR G02B27/0006 OR G02B6/002 OR G02B6/1226 OR G02B9/60 OR G02B2027/0158 OR G02B3/12 OR G02B5/223 OR G02B6/0051 OR G02B13/0035 OR G02B2027/0107 OR G02B21/06 OR G02B5/1823 OR G02B5/201 OR G02B5/3083 OR G02B6/29325 OR G02B9/62 OR G02B13/02 OR G02B2027/0136 OR G02B26/06 OR G02B2027/0143 OR G02B1/002 OR G02B1/11 OR G02B2027/0129 OR G02B26/00 OR G02B6/124 OR G02B26/0841 OR G02B30/36 OR					

		G02B3/0075 OR G02B5/0252 OR G02B6/4206 OR G02B19/0014 OR G02B27/0955 OR G02B5/1842 OR G02B27/1026 OR G02B6/0031 OR G02B1/041 OR G02B6/0026 OR G02B7/002 OR G02B13/0065 OR G02B26/0808 OR G02B26/0825 OR G02B27/0189 OR G02B27/106 OR G02B30/52 OR G02B13/14 OR G02B23/18 OR G02B27/0905 OR G02B30/33 OR G02B5/3016 OR G02B1/02 OR G02B2006/12107 OR G02B25/02 OR G02B26/026 OR G02B9/34 OR G02B27/0977 OR G02B27/145 OR G02B3/0043 OR G02B9/12 OR G02B2027/0183 OR G02B27/0988 OR G02B27/1066 OR G02B30/35 OR G02B6/0056 OR G02B6/4204 OR G02B13/00 OR G02B17/086 OR G02B25/001 OR G02B25/004 OR G02B27/0025 OR G02B27/48 OR G02B30/56 OR G02B6/0061 OR G02B6/1221 OR G02B27/102 OR G02B6/1225 OR G02B6/42 OR G02B13/001 OR G02B2006/12164 OR G02B3/0037 OR G02B6/0025 OR G02B6/0045 OR G02B6/0078 OR G02B6/0083 OR G02B6/12004 OR G02B6/12007 OR				

		G02B7/06 OR G02B27/44 OR G02B30/30 OR G02B6/0021 OR G02B21/362 OR G02B27/0994 OR G02B27/10 OR G02B6/0085 OR G02B9/04 OR G02B26/007 OR G02B27/20 OR G02B27/64 OR G02B3/00 OR G02B3/0031 OR G02B3/02 OR G02B3/08 OR G02B30/31 OR G02B7/003 OR G02B2006/12147 OR G02B21/025 OR G02B23/125 OR G02B6/13 OR G02B6/32 OR G02B13/0015 OR G02B19/0042 OR G02B27/0916 OR G02B27/0972 OR G02B30/26 OR G02B5/1809 OR G02B6/4214 OR G02B1/045 OR G02B2027/0109 OR G02B2027/0196 OR G02B27/0037 OR G02B27/0068 OR G02B27/1006 OR G02B5/04 OR G02B5/3058 OR G02B6/0046 OR G02B6/2848 OR G02B7/34 OR G02B13/007 OR G02B2003/0093 OR G02B26/08 OR G02B27/18 OR G02B3/04 OR G02B5/1861 OR G02B6/2706 OR G02B19/0028 OR G02B2027/0145 OR G02B27/143 OR G02B27/58 OR G02B27/62 OR G02B3/0068 OR G02B3/0087 OR G02B5/10 OR G02B5/28 OR G02B6/0015 OR					

		G02B6/0073 OR G02B6/122 OR G02B6/125 OR G02B6/4215 OR G02B7/022 OR G02B7/36 OR G02B1/10 OR G02B13/0075 OR G02B17/08 OR G02B19/0066 OR G02B21/36 OR G02B23/00 OR G02B27/0961 OR G02B27/144 OR G02B30/10 OR G02B5/00 OR G02B5/1847 OR G02B5/1852 OR G02B6/0006 OR G02B7/10 OR G02B13/008 OR G02B15/00 OR G02B19/0023 OR G02B19/0076 OR G02B21/22 OR G02B2207/101 OR G02B3/005 OR G02B6/001 OR G02B6/0033 OR G02B6/0058 OR G02B6/02 OR G02B7/028).cpc.)					
L67	4141	L1 AND ((G02C11/10 OR G02C7/101 OR G02C7/083 OR G02C11/06 OR G02C7/04 OR G02C11/00 OR G02C11/04 OR G02C5/143 OR G02C7/02 OR G02C5/14 OR G02C7/06 OR G02C7/08 OR G02C7/102 OR G02C5/146 OR G02C2202/16 OR G02C2202/20 OR G02C7/049 OR G02C7/022 OR G02C5/22 OR G02C2202/18 OR G02C5/001 OR G02C2202/22 OR G02C7/081 OR G02C2200/08 OR G02C7/085 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM

		G02C7/061 OR G02C7/16 OR G02C2200/02 OR G02C5/16 OR G02C7/066 OR G02C7/12 OR G02C2202/12 OR G02C3/003 OR G02C7/086 OR G02C2202/24 OR G02C9/00 OR G02C5/02 OR G02C5/12 OR G02C7/10 OR G02C7/041 OR G02C7/104 OR G02C11/08 OR G02C13/003 OR G02C7/088 OR G02C1/00 OR G02C5/20 OR G02C9/04 OR G02C7/00 OR G02C2202/10 OR G02C5/008 OR G02C1/06 OR G02C5/2209 OR G02C5/124 OR G02C11/02 OR G02C13/001 OR G02C5/10 OR G02C5/2227 OR G02C7/105 OR G02C13/005 OR G02C2200/10 OR G02C13/00 OR G02C2200/06 OR G02C5/2254 OR G02C5/006 OR G02C5/126 OR G02C1/10 OR G02C5/04 OR G02C5/2218 OR G02C5/2272 OR G02C9/02 OR G02C2200/18 OR G02C5/122 OR G02C7/108 OR G02C3/04 OR G02C5/00 OR G02C7/021 OR G02C5/08 OR G02C7/027).cpc.)					
L68	9842	L2 AND ((G02B27/017 OR G02B2027/0178 OR G02B27/0172 OR G02B2027/014 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2024/02/05 01:07 PM

Apple Inc. Exhibit 1015 Page 1883

		G02B2027/0138 OR G02B2027/0187 OR G02B27/0093 OR G02B27/0176 OR G02B2027/0118 OR G02B2027/0134 OR G02B2027/0141 OR G02B27/0179 OR G02B27/0101 OR G02B27/01 OR G02B2027/0127 OR G02B2027/0174 OR G02B2027/0132 OR G02B2027/0123 OR G02B2027/0156 OR G02B2027/0147 OR G02B27/0081 OR G02B2027/0185 OR G02B2027/0112 OR G02B2027/011 OR G02B6/34 OR G02B6/005 OR G02B2027/0154 OR G02B26/101 OR G02B27/646 OR G02B3/14 OR G02B2027/0125 OR G02B2027/0181 OR G02B13/0045 OR G02B26/001 OR G02B6/0016 OR G02B27/30 OR G02B30/34 OR G02B5/30 OR G02B6/0038 OR G02B6/0036 OR G02B7/09 OR G02B2027/015 OR G02B27/0075 OR G02B27/4205 OR G02B5/208 OR G02B27/022 OR G02B7/08 OR G02B6/0035 OR G02B2027/012 OR G02B5/1857 OR G02B6/0076 OR G02B2027/0169 OR G02B2027/0152 OR G02B27/283 OR G02B2027/0159 OR G02B26/0833 OR G02B13/06 OR G02B26/10 OR G02B5/3025 OR G02B27/02 OR G02B27/028 OR G02B30/24 OR	CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				

Apple Inc. Exhibit 1015 Page 1884

		G02B27/4272 OR G02B5/32 OR G02B6/0065 OR G02B27/0149 OR G02B2027/0114 OR G02B6/00 OR G02B7/04 OR G02B6/0068 OR G02B27/286 OR G02B6/10 OR G02B2027/0116 OR G02B26/105 OR G02B6/0088 OR G02B2027/0161 OR G02B30/27 OR G02B5/08 OR G02B6/0001 OR G02B2027/0105 OR G02B21/365 OR G02B6/0011 OR G02B6/0023 OR G02B5/1866 OR G02B7/023 OR G02B27/42 OR G02B30/40 OR G02B27/00 OR G02B27/0018 OR G02B7/021 OR G02B7/102 OR G02B7/12 OR G02B9/64 OR G02B2027/0198 OR G02B27/4227 OR G02B6/0053 OR G02B6/0055 OR G02B7/02 OR G02B3/0006 OR G02B5/1871 OR G02B6/003 OR G02B13/009 OR G02B13/18 OR G02B2027/0163 OR G02B13/004 OR G02B26/005 OR G02B7/008 OR G02B3/0062 OR G02B9/60 OR G02B3/0056 OR G02B6/0028 OR G02B27/1086 OR G02B5/1823 OR G02B6/29325 OR G02B9/62 OR G02B13/0035 OR G02B13/02 OR G02B21/06 OR G02B26/0875 OR G02B30/00 OR					

		G02B6/0018 OR G02B6/006 OR G02B2027/0136 OR G02B5/18 OR G02B5/3083 OR G02B26/004 OR G02B30/23 OR G02B5/005 OR G02B6/0051 OR G02B7/28 OR G02B3/0075 OR G02B2027/0107 OR G02B2027/013 OR G02B2027/0194 OR G02B5/1842 OR G02B5/20 OR G02B6/002 OR G02B21/0012 OR G02B26/06 OR G02B27/0103 OR G02B2027/0129 OR G02B26/0841 OR G02B3/12 OR G02B1/002 OR G02B1/11 OR G02B30/25 OR G02B5/201 OR G02B2027/0143 OR G02B27/0955 OR G02B6/0026 OR G02B9/34 OR G02B1/041 OR G02B13/14 OR G02B26/026 OR G02B26/0825 OR G02B27/0977 OR G02B3/0043 OR G02B5/223 OR G02B9/12 OR G02B2027/0183 OR G02B26/02 OR G02B30/56 OR G02B2027/0158 OR G02B26/00 OR G02B6/0031 OR G02B6/0056 OR G02B6/4204 OR G02B13/00 OR G02B27/0025 OR G02B5/3016 OR G02B6/0078 OR G02B19/0057 OR G02B6/0083 OR G02B6/0085 OR G02B9/04 OR G02B13/0065 OR G02B17/086 OR G02B26/007 OR					

		G02B27/10 OR G02B30/52 OR G02B6/0021 OR G02B21/025 OR G02B3/0031 OR G02B30/31 OR G02B30/35 OR G02B30/36 OR G02B7/002 OR G02B26/0816 OR G02B27/0916 OR G02B3/08 OR G02B7/003 OR G02B27/0037 OR G02B27/44 OR G02B3/0037 OR G02B6/0025 OR G02B6/0061 OR G02B13/001 OR G02B13/0015 OR G02B13/007 OR G02B27/0006 OR G02B27/48 OR G02B3/02 OR G02B30/33 OR G02B6/2706 OR G02B6/32 OR G02B2027/0145 OR G02B26/08 OR G02B27/64 OR G02B5/04 OR G02B6/0045 OR G02B6/124 OR G02B19/0066 OR G02B21/36 OR G02B21/362 OR G02B27/102 OR G02B3/00 OR G02B3/0068 OR G02B5/1847 OR G02B5/1852 OR G02B6/12007 OR G02B6/122 OR G02B13/008 OR G02B19/0076 OR G02B23/18 OR G02B27/0189 OR G02B27/20 OR G02B27/62 OR G02B3/04 OR G02B30/10 OR G02B5/1861 OR G02B5/23 OR G02B6/0033 OR G02B6/0046 OR G02B7/34 OR G02B13/003 OR G02B15/142 OR					

		G02B19/009 OR G02B2003/0093 OR G02B2027/0196 OR G02B25/001 OR G02B27/0972 OR G02B27/1033 OR G02B27/141 OR G02B27/425 OR G02B30/30 OR G02B6/0006 OR G02B6/0008 OR G02B6/0073 OR G02B6/009 OR G02B6/02085 OR G02B6/29316 OR G02B6/29328 OR G02B6/4206 OR G02B6/443 OR G02B6/4471 OR G02B7/028 OR G02B9/36 OR G02B1/10 OR G02B13/002 OR G02B13/006 OR G02B15/00 OR G02B15/10 OR G02B15/20 OR G02B17/0605 OR G02B19/0028 OR G02B19/0047 OR G02B2027/0109 OR G02B27/04 OR G02B27/144 OR G02B3/0087 OR G02B30/50 OR G02B5/10 OR G02B7/10 OR G02B13/0055 OR G02B13/04 OR G02B17/06 OR G02B17/08 OR G02B27/0961 OR G02B27/281 OR G02B5/0252 OR G02B5/12 OR G02B5/1809 OR G02B5/26 OR G02B5/281 OR G02B6/001 OR G02B6/02 OR G02B6/105 OR G02B7/182 OR G02B7/36).cpc.)					
L69	2404	L2 AND ((G02C11/10 OR G02C11/06 OR G02C7/04 OR G02C7/101 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2024/02/05 01:07 PM

		G02C11/00 OR G02C5/143 OR G02C5/14 OR G02C7/083 OR G02C11/04 OR G02C5/001 OR G02C5/146 OR G02C2200/02 OR G02C3/003 OR G02C5/16 OR G02C5/22 OR G02C7/086 OR G02C5/02 OR G02C7/06 OR G02C2200/08 OR G02C7/16 OR G02C7/02 OR G02C5/20 OR G02C9/00 OR G02C5/12 OR G02C7/00 OR G02C7/085 OR G02C13/003 OR G02C9/04 OR G02C7/08 OR G02C7/081 OR G02C2202/10 OR G02C7/12 OR G02C2200/10 OR G02C2202/24 OR G02C7/049 OR G02C5/124 OR G02C5/2227 OR G02C5/2254 OR G02C1/00 OR G02C1/06 OR G02C1/10 OR G02C2200/06 OR G02C2200/18 OR G02C7/102 OR G02C11/08 OR G02C7/104 OR G02C2202/22 OR G02C5/2209 OR G02C5/2218 OR G02C7/088 OR G02C7/105 OR G02C3/006 OR G02C7/021 OR G02C9/02 OR G02C11/02 OR G02C5/2263 OR G02C2200/26 OR G02C5/122 OR G02C7/10).cpc.)	CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L70	5079	L4 AND ((G02B27/017 OR G02B2027/0178	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2024/02/05 01:07 PM

		OR G02B27/0172 OR G02B2027/014 OR G02B2027/0138 OR G02B2027/0187 OR G02B27/0093 OR G02B27/0176 OR G02B2027/0134 OR G02B2027/0141 OR G02B27/01 OR G02B2027/0118 OR G02B27/0179 OR G02B27/0101 OR G02B2027/0127 OR G02B2027/0174 OR G02B2027/0132 OR G02B2027/0123 OR G02B2027/0156 OR G02B2027/0185 OR G02B2027/0147 OR G02B6/34 OR G02B26/001 OR G02B13/0045 OR G02B27/0081 OR G02B26/101 OR G02B27/646 OR G02B6/005 OR G02B2027/0112 OR G02B2027/0125 OR G02B27/022 OR G02B30/34 OR G02B27/0075 OR G02B2027/0169 OR G02B7/09 OR G02B2027/0181 OR G02B13/06 OR G02B27/028 OR G02B2027/0154 OR G02B5/208 OR G02B27/4205 OR G02B5/30 OR G02B6/0035 OR G02B26/0833 OR G02B5/3025 OR G02B27/283 OR G02B6/0036 OR G02B6/0038 OR G02B6/0076 OR G02B6/10 OR G02B6/0001 OR G02B2027/012 OR G02B2027/011 OR G02B27/286 OR G02B2027/0114 OR G02B27/42 OR G02B5/32 OR G02B7/023 OR G02B2027/0105 OR G02B27/4227 OR	AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				

Apple Inc. Exhibit 1015 Page 1890

		G02B3/14 OR G02B9/64 OR G02B30/24 OR G02B6/0016 OR G02B6/0023 OR G02B7/08 OR G02B13/004 OR G02B27/0018 OR G02B27/30 OR G02B7/021 OR G02B5/08 OR G02B6/0068 OR G02B9/60 OR G02B7/02 OR G02B27/02 OR G02B27/00 OR G02B30/40 OR G02B7/008 OR G02B6/0053 OR G02B26/10 OR G02B26/105 OR G02B27/1086 OR G02B5/1823 OR G02B5/1857 OR G02B5/1866 OR G02B5/1871 OR G02B6/29325 OR G02B9/62 OR G02B2027/0161 OR G02B5/005 OR G02B13/02 OR G02B13/009 OR G02B7/102 OR G02B2027/0159 OR G02B30/00 OR G02B2027/015 OR G02B3/0006 OR G02B6/0055 OR G02B6/0088 OR G02B2027/0136 OR G02B21/365 OR G02B6/003 OR G02B2027/0194 OR G02B2027/0198 OR G02B6/0011 OR G02B6/0065 OR G02B7/04 OR G02B2027/0163 OR G02B21/06 OR G02B5/3083 OR G02B9/34 OR G02B13/18 OR G02B27/0977 OR G02B6/00 OR G02B2027/013 OR G02B27/0149 OR G02B27/4272 OR G02B2027/0152 OR					

		G02B5/201 OR G02B6/0051 OR G02B1/002 OR G02B5/20 OR G02B7/12 OR G02B26/0841 OR G02B27/0025 OR G02B27/0955 OR G02B1/041 OR G02B26/005 OR G02B30/56 OR G02B2027/0183 OR G02B27/0103 OR G02B13/0065 OR G02B26/00 OR G02B26/007 OR G02B26/026 OR G02B30/23 OR G02B30/52 OR G02B7/28 OR G02B2027/0116 OR G02B6/0018 OR G02B6/002 OR G02B6/0028 OR G02B6/0078 OR G02B9/04 OR G02B19/0057 OR G02B27/0916 OR G02B5/3016 OR G02B2027/0107 OR G02B2027/0129 OR G02B3/02 OR G02B5/223 OR G02B6/0056 OR G02B6/2706 OR G02B13/00 OR G02B13/001 OR G02B13/0035 OR G02B26/004 OR G02B30/27 OR G02B6/0021 OR G02B2027/0143 OR G02B26/0825 OR G02B3/00 OR G02B3/08 OR G02B6/32 OR G02B7/002 OR G02B13/0015 OR G02B13/008 OR G02B27/0037 OR G02B30/35 OR G02B6/0031 OR G02B6/0033 OR G02B1/11 OR G02B13/003 OR G02B13/14 OR G02B19/009 OR G02B26/0816 OR					

		G02B27/0006 OR G02B27/10 OR G02B27/102 OR G02B3/0037 OR G02B3/0056 OR G02B30/36 OR G02B5/04 OR G02B5/18 OR G02B6/0006 OR G02B6/0008 OR G02B6/0025 OR G02B6/009 OR G02B6/12007 OR G02B6/29316 OR G02B6/29328 OR G02B6/4204 OR G02B6/443 OR G02B6/4471 OR G02B9/36 OR G02B13/002 OR G02B13/006 OR G02B15/142 OR G02B17/0605 OR G02B2027/0145 OR G02B27/141 OR G02B27/64 OR G02B3/0068 OR G02B6/0073 OR G02B7/10 OR G02B9/12 OR G02B17/086 OR G02B27/425 OR G02B27/48 OR G02B3/12 OR G02B30/25 OR G02B5/26 OR G02B6/006 OR G02B6/0083 OR G02B6/105 OR G02B6/124 OR G02B7/003 OR G02B7/182 OR G02B27/0068 OR G02B27/0972 OR G02B27/144 OR G02B5/23 OR G02B6/001 OR G02B6/0046 OR G02B13/04 OR G02B15/10 OR G02B17/08 OR G02B2027/0196 OR G02B26/08 OR G02B27/0961 OR G02B27/1033 OR G02B27/281 OR G02B3/0087 OR G02B30/10 OR					

		G02B5/124 OR G02B6/0015 OR G02B6/0086 OR G02B6/02066 OR G02B6/29356 OR G02B6/325 OR G02B6/4206 OR G02B7/285 OR G02B13/0005 OR G02B13/0055 OR G02B2003/0093 OR G02B2027/0109 OR G02B23/00 OR G02B25/001 OR G02B27/005 OR G02B27/04 OR G02B27/149 OR G02B27/62 OR G02B30/31 OR G02B5/1809 OR G02B5/1842 OR G02B5/1847 OR G02B5/206 OR G02B6/0026 OR G02B6/0045 OR G02B6/122 OR G02B6/1221 OR G02B6/274 OR G02B6/2766 OR G02B6/42).cpc.)					
L71	1210	L4 AND ((G02C11/10 OR G02C11/06 OR G02C7/04 OR G02C11/00 OR G02C7/101 OR G02C5/14 OR G02C5/143 OR G02C5/001 OR G02C5/146 OR G02C2200/02 OR G02C3/003 OR G02C5/22 OR G02C11/04 OR G02C7/083 OR G02C5/16 OR G02C2200/08 OR G02C5/12 OR G02C7/00 OR G02C9/00 OR G02C7/081 OR G02C5/02 OR G02C7/02 OR G02C2200/10 OR G02C7/049 OR G02C7/086 OR G02C7/12 OR G02C7/08 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM

Apple Inc. Exhibit 1015 Page 1894

		G02C9/04 OR G02C7/16 OR G02C1/00 OR G02C1/10 OR G02C7/06 OR G02C1/06 OR G02C7/104 OR G02C5/20 OR G02C2202/10 OR G02C7/021 OR G02C7/085 OR G02C9/02 OR G02C7/105 OR G02C5/006 OR G02C5/045 OR G02C7/022 OR G02C7/041 OR G02C7/10).cpc.)					
L72	9435	L17 AND ((G02B27/017 OR G02B2027/0178 OR G02B27/0172 OR G02B2027/014 OR G02B2027/0138 OR G02B2027/0187 OR G02B27/0093 OR G02B27/0176 OR G02B2027/0141 OR G02B2027/0134 OR G02B27/01 OR G02B27/0179 OR G02B27/0101 OR G02B2027/0127 OR G02B2027/0118 OR G02B2027/0174 OR G02B2027/0132 OR G02B2027/0185 OR G02B2027/0156 OR G02B2027/0123 OR G02B26/001 OR G02B13/0045 OR G02B6/34 OR G02B27/0081 OR G02B2027/0147 OR G02B26/101 OR G02B6/005 OR G02B2027/0112 OR G02B27/646 OR G02B27/022 OR G02B30/34 OR G02B2027/0125 OR G02B2027/0169 OR G02B7/09 OR G02B13/06 OR G02B2027/0181 OR G02B27/028 OR G02B2027/0154 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM

		G02B27/0075 OR G02B5/208 OR G02B27/4205 OR G02B6/0036 OR G02B6/0038 OR G02B27/283 OR G02B6/0076 OR G02B5/3025 OR G02B6/10 OR G02B6/0001 OR G02B2027/012 OR G02B2027/0114 OR G02B27/42 OR G02B5/32 OR G02B7/023 OR G02B26/0833 OR G02B27/4227 OR G02B2027/0105 OR G02B6/0035 OR G02B9/64 OR G02B5/30 OR G02B13/004 OR G02B27/0018 OR G02B27/30 OR G02B30/24 OR G02B5/08 OR G02B6/0016 OR G02B6/0023 OR G02B6/0068 OR G02B9/60 OR G02B27/286 OR G02B7/02 OR G02B7/021 OR G02B2027/011 OR G02B27/02 OR G02B30/40 OR G02B7/008 OR G02B26/10 OR G02B26/105 OR G02B27/1086 OR G02B5/1823 OR G02B5/1857 OR G02B5/1866 OR G02B5/1871 OR G02B6/0053 OR G02B6/29325 OR G02B7/08 OR G02B9/62 OR G02B5/005 OR G02B13/02 OR G02B7/102 OR G02B2027/0161 OR G02B3/14 OR G02B2027/0159 OR G02B27/00 OR G02B30/00 OR G02B2027/015 OR G02B21/365 OR					

		G02B6/0055 OR G02B6/0088 OR G02B13/009 OR G02B2027/0198 OR G02B7/04 OR G02B2027/0136 OR G02B2027/0163 OR G02B2027/0194 OR G02B21/06 OR G02B6/0011 OR G02B6/0065 OR G02B9/34 OR G02B13/18 OR G02B2027/013 OR G02B27/0149 OR G02B27/0977 OR G02B5/3083 OR G02B5/201 OR G02B6/0051 OR G02B1/002 OR G02B3/0006 OR G02B5/20 OR G02B26/0841 OR G02B27/0955 OR G02B7/12 OR G02B1/041 OR G02B2027/0152 OR G02B27/0025 OR G02B2027/0183 OR G02B26/005 OR G02B27/0103 OR G02B27/4272 OR G02B6/00 OR G02B13/0065 OR G02B26/00 OR G02B26/007 OR G02B26/026 OR G02B30/23 OR G02B30/52 OR G02B2027/0116 OR G02B30/56 OR G02B6/0078 OR G02B9/04 OR G02B19/0057 OR G02B27/0916 OR G02B6/0028 OR G02B6/003 OR G02B2027/0107 OR G02B6/0018 OR G02B6/002 OR G02B2027/0129 OR G02B3/02 OR G02B5/3016 OR G02B6/0056 OR G02B13/0035 OR G02B6/0021 OR G02B6/2706 OR G02B13/00 OR					

		G02B26/004 OR G02B3/08 OR G02B13/0015 OR G02B13/008 OR G02B2027/0143 OR G02B27/0037 OR G02B6/0031 OR G02B6/0033 OR G02B7/002 OR G02B7/28 OR G02B13/003 OR G02B13/14 OR G02B19/009 OR G02B27/0006 OR G02B27/102 OR G02B3/00 OR G02B3/0037 OR G02B3/0056 OR G02B30/36 OR G02B5/04 OR G02B5/223 OR G02B6/0025 OR G02B6/009 OR G02B6/12007 OR G02B6/29316 OR G02B6/29328 OR G02B9/36 OR G02B1/11 OR G02B13/002 OR G02B15/142 OR G02B2027/0145 OR G02B27/141 OR G02B3/0068 OR G02B6/0073 OR G02B9/12 OR G02B13/001 OR G02B13/006 OR G02B17/086 OR G02B27/425 OR G02B27/48 OR G02B27/64 OR G02B3/12 OR G02B30/25 OR G02B30/35 OR G02B5/18 OR G02B6/0083 OR G02B6/124 OR G02B6/32 OR G02B7/10 OR G02B7/182 OR G02B26/0816 OR G02B27/0068 OR G02B27/0972 OR G02B27/10 OR G02B5/26 OR G02B6/001 OR G02B6/006 OR G02B7/003 OR				

		G02B13/04 OR G02B15/10 OR G02B17/08 OR G02B26/08 OR G02B27/0961 OR G02B27/281 OR G02B3/0087 OR G02B5/124 OR G02B6/0015 OR G02B6/0046 OR G02B6/0086 OR G02B6/29356 OR G02B6/4206 OR G02B13/0055 OR G02B17/0605 OR G02B2003/0093 OR G02B2027/0109 OR G02B23/00 OR G02B25/001 OR G02B27/005 OR G02B27/62 OR G02B30/27 OR G02B30/31 OR G02B5/1809 OR G02B5/1842 OR G02B5/1847 OR G02B5/206 OR G02B5/23 OR G02B6/0026 OR G02B6/0045 OR G02B6/122 OR G02B6/1221 OR G02B6/42 OR G02B7/285).cpc.)					
L73	2195	L17 AND ((G02C11/10 OR G02C11/06 OR G02C7/04 OR G02C11/00 OR G02C5/14 OR G02C7/101 OR G02C5/143 OR G02C5/001 OR G02C3/003 OR G02C5/146 OR G02C2200/02 OR G02C5/22 OR G02C11/04 OR G02C5/16 OR G02C7/083 OR G02C2200/08 OR G02C5/12 OR G02C9/00 OR G02C5/02 OR G02C2200/10 OR G02C7/081 OR G02C7/086 OR G02C7/00 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/05 01:07 PM

		G02C7/02 OR G02C9/04 OR G02C7/16 OR G02C7/049 OR G02C1/00 OR G02C1/10 OR G02C7/06 OR G02C7/08 OR G02C1/06 OR G02C5/20 OR G02C7/021 OR G02C7/12 OR G02C2202/10 OR G02C7/085 OR G02C5/006 OR G02C9/02 OR G02C5/045 OR G02C7/10 OR G02C7/104).cpc.)					
L74	2462	L30 AND ((G02B27/017 OR G02B2027/0178 OR G02B27/0172 OR G02B2027/014 OR G02B2027/0138 OR G02B27/0093 OR G02B2027/0187 OR G02B27/0176 OR G02B2027/0127 OR G02B27/0101 OR G02B2027/0118 OR G02B2027/0134 OR G02B2027/0141 OR G02B27/0179 OR G02B2027/0156 OR G02B2027/0174 OR G02B2027/0132 OR G02B6/34 OR G02B2027/0123 OR G02B2027/0185 OR G02B27/01 OR G02B2027/0147 OR G02B27/4205 OR G02B26/101 OR G02B27/4227 OR G02B6/10 OR G02B2027/0105 OR G02B27/42 OR G02B26/001 OR G02B27/0081 OR G02B2027/0112 OR G02B13/0045 OR G02B2027/0169 OR G02B6/0001 OR G02B27/0075 OR G02B2027/0125 OR G02B27/028 OR	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/02/05 01:07 PM