



- (51) **International Patent Classification:**
H04R 1/10 (2006.01) *H04R 1/28* (2006.01)
- (21) **International Application Number:**
PCT/SG2016/050246
- (22) **International Filing Date:**
24 May 2016 (24.05.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
10201504259V 29 May 2015 (29.05.2015) SG
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- (81) **Designated States** (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States** (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

[Continued on next page]

(54) **Title:** HEADPHONE

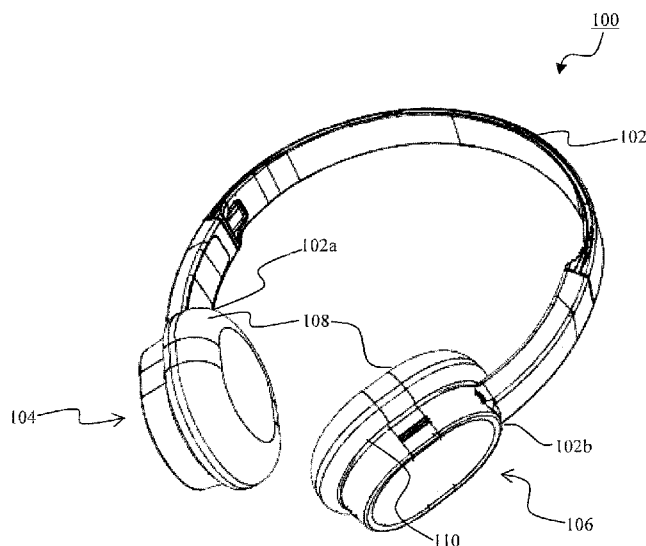


Fig.1

(57) **Abstract:** A headphone is provided. The headphone can include an enclosure having a surface. A continuous groove can be defined on the surface. The continuous groove can be shaped and dimensioned so that at least one perforation can be defined along the continuous groove. The continuous groove can be further shaped and dimensioned so as to be capable of carrying a detachable auxiliary portion. The at least one perforation can allow an air passage to be formed between the outside of the enclosure and a chamber defined within the enclosure. When the continuous groove carries the detachable auxiliary portion, air passage between the chamber and outside of the enclosure is blocked.



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, **Published:**
GW, KM, ML, MR, NE, SN, TD, TG).

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

HEADPHONE

Field Of Invention

The present disclosure generally relates a headphone which is capable of being tuned in a user friendly manner.

Background

Audible performance of a headphone can, for example, be associated with how well a listener is capable of perceiving low frequency signals being reproduced (i.e., bass performance).

When a headphone reaches a listener, the headphone would already have been tuned by its manufacturer. An example of tuning would be frequency tuning such as bass tuning.

In this regard, a listener would typically not have control over the tuning process.

It is therefore desirable to provide a solution to address the foregoing problem of a user not being able to tune a headphone in accordance with listener preference.

Summary of the Invention

In accordance with an aspect of the disclosure, a headphone is provided. The headphone can include an audio reproduction module. The headphone can further include a speaker driver and an ear pad.

The audio reproduction module can include an enclosure. A chamber can be defined within the enclosure. Additionally, the speaker driver can be carried within the enclosure. The enclosure can include a first face and a second face.

The first face can be capable of carrying the speaker driver within the enclosure. Additionally, the first face can be capable of carrying an ear pad outside of the enclosure.

The second face can be opposite of the first face. Additionally, the first and second faces can be spaced apart such that a surface can be defined between them.

The chamber can be defined within the enclosure nearer to the second face (i.e., relative to the first face).

A continuous groove can be defined on the surface. The continuous groove can be shaped and dimensioned so that at least one perforation can be defined along the continuous groove. The continuous groove can be further shaped and dimensioned so as to be capable of carrying a detachable auxiliary portion.

The at least one perforation can allow an air passage to be formed between the outside of the enclosure and the chamber. When the continuous groove carries the detachable auxiliary portion, air passage between the chamber and outside of the enclosure is blocked.

Brief Description of the Drawings

Embodiments of the disclosure are described hereinafter with reference to the following drawings, in which:

Fig. 1 shows a perspective view of a headphone which can include a headband, a first audio reproduction module and a second audio reproduction module, according to an embodiment of the disclosure;

Fig. 2 shows the first audio reproduction module of Fig. 1 in further detail, according to an embodiment of the disclosure; and

Fig. 3 shows a front view of the headphone of Fig. 1, according to an embodiment of the disclosure.

Detailed Description

Representative embodiments of the disclosure, for addressing the foregoing problem associated with the lack of user friendliness when tuning a headphone in accordance with user listening preference, are described hereinafter with reference to Fig. 1 to Fig. 3.

Referring to Fig. 1, a headphone 100 is shown in accordance with an embodiment of the disclosure. Specifically, Fig. 1 shows a perspective view of the headphone 100.

The headphone 100 can include a headband 102, a first audio reproduction module 104 and a second audio reproduction module 106. Each of the first and second audio reproduction modules 104/106 can be shaped and dimensioned to carry an ear pad 108 and a detachable auxiliary portion 110.

Moreover, as shown, the headband 102 can include a first end 102a and a second end 102b. The first audio reproduction module 104 can be coupled to the headband 102 at the first end 102a. The second audio reproduction module 106 can be coupled to the headband 102 at the second end 102b.

Fig. 2 shows the first audio reproduction module 104 in further detail, in accordance with an embodiment of the disclosure. Specifically, Fig. 2 shows a front view (with reference to the perspective view of Fig. 1) of the first audio reproduction module 104 with the ear pad 108 and the detachable auxiliary portion 110 removed.

For the sake of clarity, the removed ear pad 108 is represented by dotted line 202a in Fig. 2. Furthermore, although Fig. 2 is discussed with reference to the first audio reproduction module 104, it is appreciable that the discussion in relation to Fig. 2 can analogously apply to the second audio reproduction module 106 since the first and second audio reproduction modules 104/106 can be identical or substantially similar.

As shown, the first audio reproduction module 104 can include an enclosure 204. The enclosure 204 can, for example, be a casing. The enclosure 204 can include a first face 204a and a second face 204b. The first and second faces 204a/204b can be spaced apart so that a surface 204c can be defined. Specifically, the first face 204a can be opposite of the second face 204b. More specifically, the first and second faces 204a/204b can be on opposite sides of the surface 204c. In one embodiment, the surface 204c can be based on a basic curvilinear shape such as a cylinder.

The enclosure 204 can be shaped and dimensioned to carry a speaker driver (shown in dotted lines 202b) within. Additionally, a chamber 206 can be defined within the enclosure 204. Specifically, the speaker driver can be carried within the enclosure 204 at its first face 204a. The chamber 206 can be defined within the enclosure 204 nearer to the second face 204b.

The enclosure 204 can be shaped and dimensioned so that a groove 208 can be defined/formed. The groove 208 can be a continuous groove running along the surface 204c. Specifically, the groove 208 loops around the enclosure 204 along the surface 204c. More specifically, the groove 208 can be considered to encircle the enclosure 204 along the surface 204c. For example, where the surface 204c is based on a basic curvilinear shape, the groove 208 can be a continuous curvilinear groove adhering/following the curvilinear surface 204c (i.e., the groove 208 being in the form of a ring looping around the enclosure 204 along the surface 204c). In this regard, the groove 208 can be considered to be an unbroken/uninterrupted groove running along the surface 204c. Hence it is appreciable that the groove 208 can be considered to be a continuous groove. Therefore, it is further appreciable that a continuous groove 208 can be defined on the surface 204c.

One or more openings/perforations 210 can be formed/defined along the groove 208. Specifically, the groove 208 can be shaped and dimensioned so that at least one perforation/opening 210 can be defined along the groove 208. The opening(s)/perforation(s) 210 can allow an air passage to be formed between the environment (i.e., outside of the enclosure 204) of the headphone 100 and the chamber 206 defined within the enclosure 204. In this regard, the opening(s)/perforations 210 can facilitate equalizing of pressure.

Specifically, pressure associated with the chamber 206 can be equalized with respect to the environment (i.e., outside of the enclosure 204). This is made possible by the opening(s)/perforation(s) 210. Audio output performance (of the speaker driver), especially audio output performance at low frequency range (i.e., bass audio range), can be affected by virtue of the aforementioned pressure equalizing. Specifically, the chamber 206 and perforation(s)/opening(s) 210 can function as some form of bass tuning to tune audio output performance of low frequency range audio signals output from the speaker driver.

Earlier mentioned, the first audio reproduction module 104 can be shaped and dimensioned to carry a detachable auxiliary portion 110 (not shown in Fig. 2).

Specifically, the detachable auxiliary portion 110 can be carried along the surface 204c. More specifically, the detachable auxiliary portion 110 can be carried by the groove 208. Yet more specifically, the detachable auxiliary portion 110 can be worn onto the first audio reproduction module 104 along the surface 204c in a manner such that the detachable auxiliary portion 110 is

accommodated within the groove 208. In this regard, the groove 208 can be shaped and dimensioned so as to be capable of carrying the detachable auxiliary portion 110.

Preferably, when worn onto the first audio reproduction module 104, the detachable auxiliary portion 110 can fit into the groove 208 and cover the groove 208 so that the groove 208 is hidden from view (e.g., as shown in Fig. 1 where the groove 208 is not visible/blocked from view). In this regard, the detachable auxiliary portion 110 can be shaped and dimensioned according to the shape and dimension associated with the groove 208.

In one example, where the groove 208 is a continuous curvilinear groove adhering/following the curvilinear surface 204c, the detachable auxiliary portion 110 can be a curvilinear shaped structure following the shape of the groove 208.

In a more specific example, where the groove 208 is in the form of a ring looping around the enclosure 204 along the surface 204c, the detachable auxiliary portion 110 can be a structure shaped in the form of a ring which can fit into, and cover, the groove 208.

In general, the detachable auxiliary portion 110 should be shaped and dimensioned so that when worn onto the first audio reproduction module 104, the detachable auxiliary portion 110 can fit snugly to the groove 208, covering the groove 208. Preferably, the detachable auxiliary portion 110 can be constructed based on a material which is elastic/stretchable so that it can be stretched over the first face 204a, positioned over the groove 208 and fit snugly to the groove 208 when released after being stretched.

For example, the (continuous) groove 208 can be associated with a diameter/circumference. The detachable auxiliary portion 110 can be a ring shaped structure of a suitably smaller diameter/circumference compared to the diameter/circumference associated with the groove 208 (i.e., diameter of the groove 208 measured across the first face 204a or the second face 204b/circumference of the groove 208 measured around the surface 204c). In this manner, when accommodated within the groove 208, the detachable auxiliary portion 110 can fit snugly to the groove 208.

Appreciably, since the chamber 206 and perforation(s)/opening(s) 210, as mentioned earlier, can function as some form of bass tuning to tune audio output performance of low frequency range

audio signals (i.e., bass performance) output from the speaker driver, and the perforation(s)/opening(s) 210 can be covered/blocked by the detachable auxiliary structure 110 when the detachable auxiliary portion 110 is carried by the groove 208, bass performance of the headphone 100 can be varied depending on whether the detachable auxiliary structure 110 is attached (i.e., to the headphone 100) or not (i.e., detached). This will be discussed in earlier detail with reference to Fig. 3 hereinafter.

Referring to Fig. 3, a front view (with reference to Fig. 1) of the headphone 100 is shown in accordance with an embodiment of the disclosure. For the sake of contrast and clarity, the headphone 100 is shown without the ear pad 108 and the detachable auxiliary portion 110 being carried by the first audio reproduction module 104 whereas the second audio reproduction module 106 is shown carrying the ear pad 108 and the detachable auxiliary portion 110.

Earlier mentioned, bass performance of the headphone 100 can be varied depending on whether the detachable auxiliary structure 110 is attached (i.e., per the second audio reproduction module 106 as shown in Fig. 3) or not (i.e., per the first audio reproduction module 104 as shown in Fig. 3).

Some users may prefer a more emphasized bass output from the headphone 100 whereas some users may not.

For a more emphasized bass output, there may be a need to equalize pressure associated with the chamber 206 with respect to the environment (i.e., outside of the enclosure 204). In this regard, the detachable auxiliary portion 110 may, for example, be removed. Specifically, the detachable auxiliary portion 110 can be unattached to the headphone 100 (e.g., per the first audio reproduction module 104 as shown in Fig. 3).

Conversely, if a less emphasized bass output is desired, pressure associated with the chamber 206 need not be equalized with respect to the environment (i.e., outside of the enclosure 204). In this regard, the detachable auxiliary portion 110 may, for example, be attached to block the air passage between the environment (i.e., outside the enclosure 204) and the chamber 206. Specifically, the detachable auxiliary portion 110 can be attached to the headphone 100 (e.g., per the second audio reproduction module 106 as shown in Fig. 3). In one example, the detachable auxiliary portion 110 can be constructed based on a non-porous material such as rubber or plastic to form a substantially airtight blockage.

In the manner discussed above, a user can be capable of performing bass tuning to tune audio output performance of low frequency range audio signals output from the speaker driver in a considerably user friendly manner (i.e., by simply removing the detachable auxiliary portion 110 or positioning the detachable auxiliary portion 110 over the groove 208).

It is appreciable that other ways, other than simply detaching or attaching the detachable auxiliary portion 110, of performing bass tuning may be possible.

In one example, the detachable auxiliary portion 110 can be constructed based on a porous material such as a sponge based material or a cloth based material. In this regard, air passage between the chamber 206 and the environment (i.e., outside of the enclosure 204) need not necessarily be completely sealed off when the detachable auxiliary portion 110 is carried by the groove 208 and the detachable auxiliary portion 110 covers the perforation(s)/opening(s) 210. Therefore, the detachable auxiliary portion 110 can be constructed based on a porous material so that it can provide some form of a non-airtight blockage to the perforation(s)/opening(s) although the perforation(s)/opening(s) can be blocked from view when the detachable auxiliary portion 110 is carried by the groove 208. In this regard, variance in terms of bass tuning may be possible depending on how porous a material is used for constructing the detachable auxiliary portion 110.

In another example, one or more holes (not shown) can be defined along the detachable auxiliary portion 110. Preferably, when worn onto the first audio reproduction module 104 and/or the second audio reproduction module 106, the detachable auxiliary portion 110 can fit snugly to the groove 208, covering the groove 208, yet remain movable. Specifically, when carried by the groove 208, the detachable auxiliary portion 110 can be moved by, for example, manner of rotation so that the hole(s) defined along the detachable auxiliary portion 110 can coincide with the opening(s)/perforation(s) 210, not coincide with the opening(s)/perforation(s) 210 or partially coincide with the opening(s)/perforation(s) 210. Thus position of the hole(s) relative to the opening(s)/perforation(s) can be adjusted by moving the detachable auxiliary portion 110. When the hole(s) coincide with the opening(s)/perforation(s), it is appreciable that the air passage between the environment (i.e., outside of the enclosure 204) and the chamber 206 will be substantially unblocked, hence allowing equalizing of pressure as discussed earlier. When the hole(s) do not coincide with the opening(s)/perforation(s) 210, it is appreciable that the air passage between the environment (i.e., outside of the enclosure 204) and the chamber 206 will be

substantially blocked, hence impeding equalizing of pressure as discussed earlier. When the hole(s) and the perforation(s)/opening(s) 210 partially coincide, the air passage between the environment (i.e., outside of the enclosure 204) and the chamber 206 will be partially blocked. In this regard, depending extent of blockage of the air passage, variance to pressure equalization, and consequently variance in terms of bass tuning, can be possible.

In yet another example, the detachable auxiliary portion 110 can be constructed based on a porous material with one or more holes defined along the detachable auxiliary portion 110. In this regard, the foregoing discussion in relation to the examples concerning the porous material and the hole(s) apply analogously. Moreover, via the combination of the porous material and the hole(s), added variance (i.e., variance afforded by virtue of the porous material in combination with variance afforded by virtue of adjusting position of the hole(s) relative to the opening(s)/perforation(s) 210) in terms of bass tuning can be afforded to a user.

In yet a further example, when one or more holes are defined along the detachable auxiliary portion 110, the hole(s) can, in turn, be covered with a porous material. In this regard, the foregoing discussion in relation to the examples concerning the porous material and the hole(s) apply analogously.

Moreover, the detachable auxiliary portion 110 can be associated with at least one color. In one example, the detachable auxiliary portion 110 can be orange in color. In another example, the detachable auxiliary portion 110 can be multi-colored (e.g., yellow colored base with orange strips).

To put the forgoing discussion in perspective, an exemplary application will now be discussed.

In one exemplary scenario, the headphone 100 can be packaged together with a plurality of detachable auxiliary portions 110 as a packaged item for sale.

The plurality of detachable auxiliary portions 110 can include:

- 1) a first pair of detachable auxiliary portions 110 which are each an elastic rubber based ringed structure and yellow in color;
- 2) a second pair of detachable auxiliary portions 110 which are each an elastic rubber based ringed structure and green in color; and

3) a third pair detachable auxiliary portions 110 which are each a stretchable cloth based ringed structure and blue in color.

The plurality of detachable auxiliary portions 110 can further include a fourth and fifth detachable auxiliary portions 110 which are both gray colored elastic plastic based ringed structures.

The fourth and fifth detachable auxiliary portions 110 can be attached to the headphone 100 by default (i.e., as packaged for sale). For example, the fourth detachable auxiliary portion 110 can be carried by the groove 208 defined on the first audio reproduction module 104 and the fifth detachable auxiliary portion 110 can be carried by the groove 208 defined on the second audio reproduction module 106.

A consumer who purchases the packaged item may be afforded at least the possibilities of:

A) removing the fourth and fifth detachable auxiliary portions 110 if a more emphasized bass performance is desired.

B) replacing the fourth and the fifth detachable auxiliary portions 110 with any of the first to third pairs of detachable auxiliary portions 110.

Therefore, it is appreciable that not only is the consumer able to perform bass tuning on the headphone 100 in a user friendly manner (e.g., by removing the fourth and fifth detachable auxiliary portions 110 or replacing the fourth and fifth detachable auxiliary portions 110 with the third pair detachable auxiliary portions 110), the consumer is also able to change the appearance (i.e., change of a pair of grey colored detachable auxiliary portions 110 to, for example, a pair of yellow colored detachable auxiliary portions 110) of the headphone 100 according to preference.

In the foregoing manner, various embodiments of the disclosure are described for addressing at least one of the foregoing disadvantages. Such embodiments are intended to be encompassed by the following claims, and are not to be limited to specific forms or arrangements of parts so described and it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modification can be made, which are also intended to be encompassed by the following claims.

Claims

1. An audio reproduction module of a headphone, the audio reproduction module having an enclosure comprising:

a first face capable of carrying a speaker driver within the enclosure and an ear pad outside of the enclosure;

a second face which is opposite of the first face, the first and second faces being spaced apart such that a surface is defined between them;

a chamber defined within the enclosure near the second face;

a continuous groove defined on the surface, the continuous groove being shaped and dimensioned so that at least one perforation is defined therealong, the continuous groove being further shaped and dimensioned so as to be capable of carrying a detachable auxiliary portion,

wherein the at least one perforation allows an air passage to be formed between outside of the enclosure and the chamber, and

wherein when the continuous groove carries the detachable auxiliary portion, air passage between the chamber and the outside of the enclosure is blocked.

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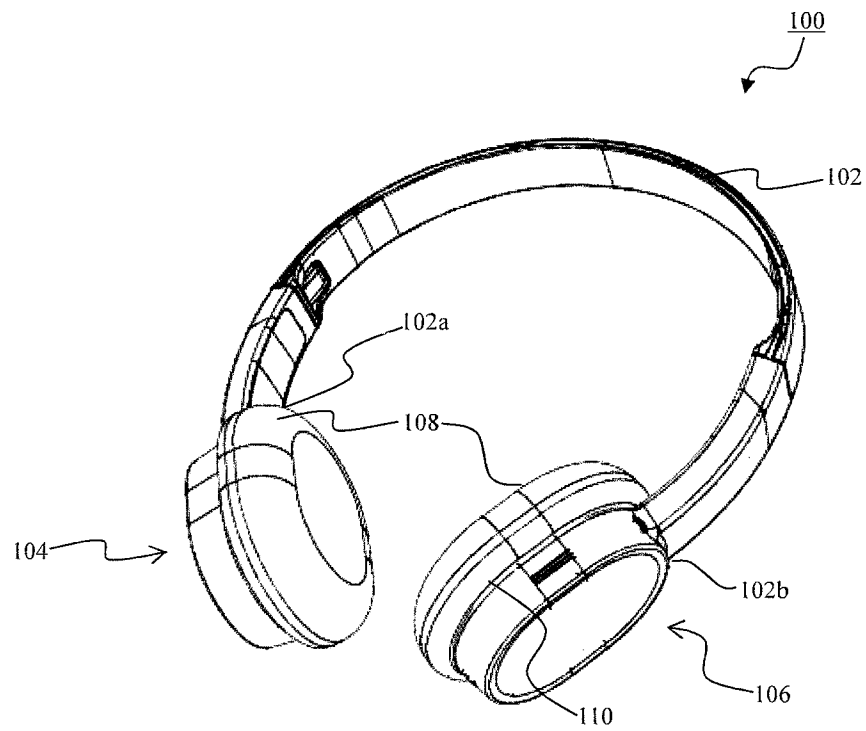


Fig.1

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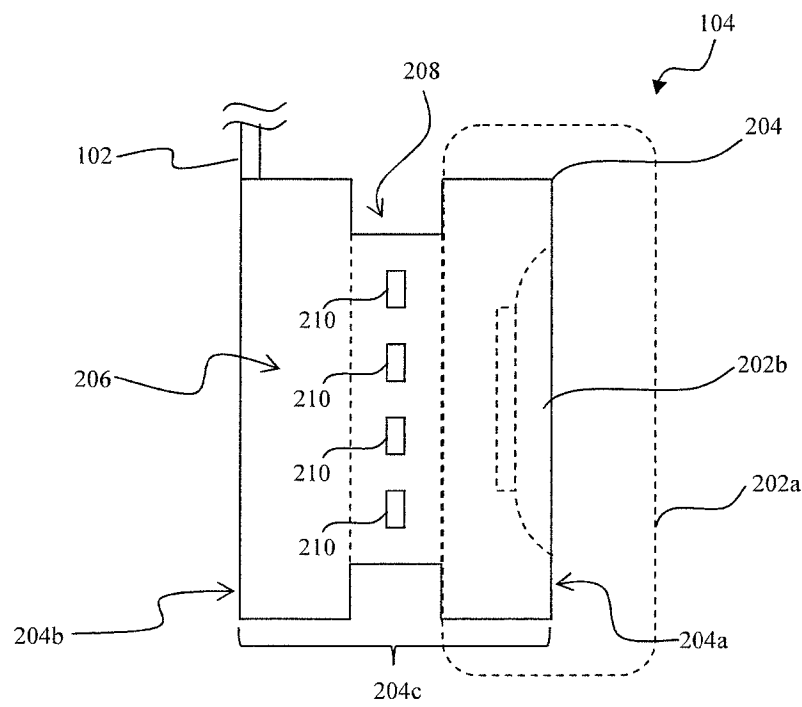


Fig.2

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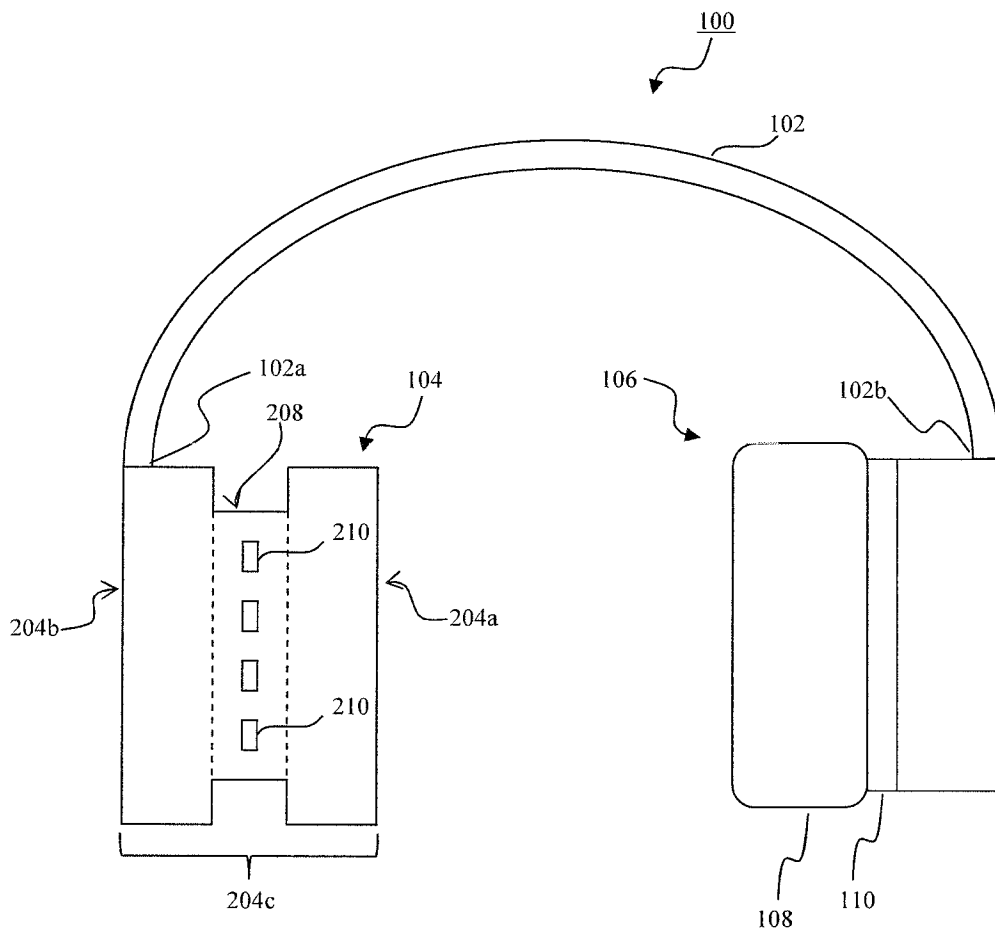


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/SG2016/050246

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04R1/10
ADD. H04R1/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/177165 A1 (OISHI TETSURO [US]) 11 July 2013 (2013-07-11) paragraphs [0069] - [0081]; figures 8-11 -----	1
X	US 2009/232340 A1 (YANG BILL [TW]) 17 September 2009 (2009-09-17) paragraphs [0029] - [0034]; figures 2A-2F -----	1
X	WO 2004/091253 A1 (MM GEAR CO LTD [KR]; KIM SUNG-IL [KR]) 21 October 2004 (2004-10-21) page 8, line 30 - page 9, line 10; figures 7,8 -----	1
A	US 5 555 554 A (HOFER ALAN [US] ET AL) 10 September 1996 (1996-09-10) the whole document -----	1



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

5 August 2016

Date of mailing of the international search report

17/08/2016

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/SG2016/050246

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