



(51) International Patent Classification:

H04R 1/04 (2006.01)

G01H 17/00 (2006.01)

H04R 9/02 (2006.01)

H04R 19/04 (2006.01)

(21) International Application Number:

PCT/CN2020/097890

(22) International Filing Date:

24 June 2020 (24.06.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/866,777

26 June 2019 (26.06.2019)

US

(71) Applicant: **GOERTEK INC.** [CN/CN]; No.268 Dongfang Road, Hi-Tech Industry District, Weifang City, Shandong 261031 (CN).

(72) Inventor: **LITTLE, Richard Warren**; No.268 Dongfang Road, Hi-Tech Industry District, Weifang City, Shandong 261031 (CN).

(74) Agent: **BEYOND TALENT PATENT AGENT FIRM**; Room 1201, Kuntai Building, #10 Chaoyangmenwai Str. Chaoyang District, Beijing 100020 (CN).

(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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,

HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, 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, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, 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, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

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

(54) Title: ACOUSTIC REFLECTOR AND ACOUSTIC ELECTRONICS DEVICE

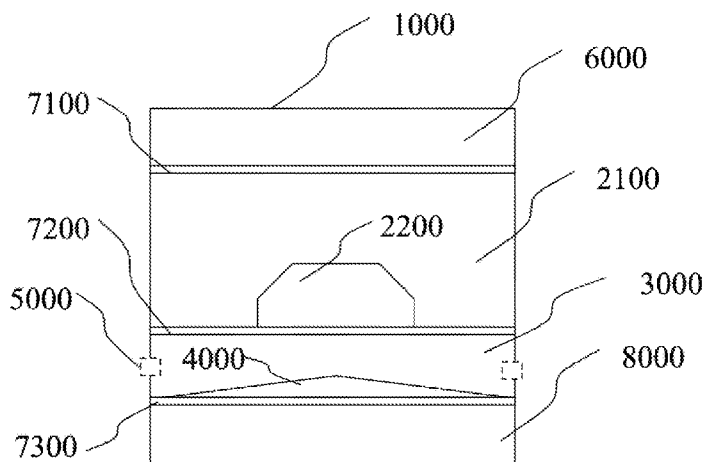


FIG. 4

(57) Abstract: An acoustic reflector (4000) and an acoustic electronics device are disclosed. The acoustic reflector (4000) is for being used inside an enclosure (1000) of an acoustic electronics device, which is made of thermal conductive material and functions as a heat sink. The acoustic electronics device comprises such an acoustic reflector (4000).



ACOUSTIC REFLECTOR AND ACOUSTIC ELECTRONICS DEVICE

FIELD OF THE INVENTION

The present invention relates to an acoustic device, and more specifically, to an acoustic
5 reflector and an acoustic electronics device.

BACKGROUND OF THE INVENTION

An acoustic transducer of an acoustic device consumes power and generates heat. The
acoustic transducer is, for example, a loudspeaker or a microphone.

In the prior art, some of the acoustic transducers are mounted inside enclosures of the
10 acoustic devices. For example, such acoustic devices include Apple Home pod, Amazon Mini Dot,
Google Home and so on.

In such acoustic devices, the heat generated therein will put an adverse impact on the
performance of the device.

SUMMARY OF THE INVENTION

15 One object of this invention is to provide a new technical solution for an acoustic reflector.

According to a first aspect of the present invention, there is provided an acoustic
reflector for being used inside an enclosure of an acoustic electronics device, which is made of
thermal conductive material and functions as a heat sink.

According to a second aspect of the present invention, there is provided an acoustic
20 electronics device, comprising: an enclosure; an acoustic transducer, mounted inside the
enclosure; a passage inside the enclosure; at least one sound port, wherein the passage connects the
acoustic transducer to the at least one sound port; and an acoustic reflector according to claim 1,
which is mounted in the passage and which reflects the sound wave from the acoustic transducer
to the at least one sound port or from the at least one sound port to the acoustic transducer.

25 According to an embodiment of this invention, the present invention can improve
thermal performance of an acoustic device without much change to its architecture design.

Further features of the present invention and advantages thereof will become apparent from the following detailed description of exemplary embodiments according to the present invention with reference to the attached drawings.

BRIEF DISCRIPTION OF THE DRAWINGS

5 The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description thereof, serve to explain the principles of the invention.

Fig. 1 is a schematic diagram of an acoustic reflector according to a first embodiment of this disclosure.

10 Fig.2 is a schematic diagram of an acoustic reflector according to a second embodiment of this disclosure.

Fig.3 is a schematic diagram of an acoustic reflector according to a third embodiment of this disclosure.

15 Fig.4 is a schematic diagram of an acoustic electronics device according to a fourth embodiment of this disclosure.

Fig.5 is a schematic diagram of an acoustic electronics device according to a fifth embodiment of this disclosure.

Fig.6 is a schematic diagram of an acoustic electronics device according to a sixth embodiment of this disclosure.

20 Fig.7 is a schematic diagram of an acoustic electronics device according to a seventh embodiment of this disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Various exemplary embodiments of the present invention will now be described in detail with reference to the drawings. It should be noted that the relative arrangement of
25 the components and steps, the numerical expressions, and numerical values set forth in these embodiments do not limit the scope of the present invention unless it is specifically stated otherwise.

The following description of at least one exemplary embodiment is merely illustrative in nature and is in no way intended to limit the invention, its application, or uses.

Techniques, methods and device as known by one of ordinary skill in the relevant art may not be discussed in detail but are intended to be part of the specification where
5 appropriate.

In all of the examples illustrated and discussed herein, any specific values should be interpreted to be illustrative only and non-limiting. Thus, other examples of the exemplary embodiments could have different values.

Notice that similar reference numerals and letters refer to similar items in the
10 following figures, and thus once an item is defined in one figure, it is possible that it need not be further discussed for following figures.

In this disclosure, an acoustic reflector for being used inside an enclosure of an acoustic electronics device is provide. The acoustic reflector is made of thermal conductive material and functions as a heat sink.

15 For example, the thermal conductive material may include metal, such as copper and aluminium, and may further include aluminium nitride, and so on. Compared with adjacent component in the acoustic electronics device, the thermal conductive material has a better thermal conduction performance and can provide a thermal dispersion path to disperse the heat generated in the acoustic electronics device away.

20 An acoustic reflector can be used to adjust the frequencies and/or directions and/or volumes of sound generated by an acoustic electronics device in space so that the acoustic electronics device can provide a better acoustic performance. A conventional acoustic reflector did not take the thermal dispersion into consideration and compared with a heat sink, it did not use thermal conductive material and/or did not provide a thermal dispersion path.

25 Normally, in order to achieve an aesthetic feeling, an enclosure of an acoustic electronics device is designed to be an integrated shape. This will limited the thermal dispersion inside the acoustic electronics device. Further, a separate heat sink will require an extra room inside the disclosure and extra vents for thermal dispersion.

Here, an acoustic reflector is combined with a heat sink. This is advantageous for being used inside an enclosure of an acoustic electronics device. The acoustic reflector will improve the sound travelling performance from/to the acoustic transducer and the heat sink will improve the heat dispersion inside the enclosure.

5 This design will save room for placing an extra heat sink and will leave more freedom of design to a designer.

Besides, because the sound wave will travel passing the acoustic reflector, which will also bring an air flow through the acoustic reflector, it will improve the thermal dispersion and omit the requirement of a fan to blow air through a heat sink.

10 Figs. 1-3 shows three embodiments of an acoustic reflector according to this invention.

In Fig. 1, the acoustic reflector is designed into a comb shape in cross-section view. The acoustic performance of an acoustic transducer can be adjusted by adjusting the comb teeth of the comb. The comb teeth and/or the comb base where the comb teeth are placed can be made of thermal conductive material.

15 In Fig. 2, the acoustic reflector is designed into a solid block. Fig. 2 shows a triangle shape. However, according to the practice demand, it can be other shapes. The body of the solid block is made of thermal conductive material.

In Fig. 3, the acoustic reflector is hollow and has at least one thermal conductive beam inside. On one hand, this design can reduce the weight of the acoustic reflector; on the other hand,
20 this design gives a designer a design freedom to arrange the thermal paths in the heat sink / acoustic reflector.

Figs. 4-7 shows embodiments of acoustic electronics device which incorporate the acoustic reflector as any of the above.

The acoustic electronics device is, for example, an electronics device like Apple Home
25 pod, Amazon Mini Dot, Google Home and so on.

As shown, in Figs. 4-7, the acoustic electronics device comprises an enclosure 1000; an acoustic transducer 2100, 2200, mounted inside the enclosure 1000; a passage 3000 inside the enclosure 1000; at least one sound port 5000, wherein the passage 3000 connects the acoustic

transducer 2100, 2200 to the at least one sound port 5000; and an acoustic reflector 4000 as described above.

The acoustic reflector 4000 is mounted in the passage and reflects the sound wave from the acoustic transducer to the at least one sound port or from the at least one sound port to the acoustic transducer. As the sound wave travels, the air also flows. When the air passes the acoustic reflector 4000, it functions as a heat sink and the heat will be dispersed out of the at least one sound port 5000. The at least one sound port 5000 also functions as a vent. As such, the acoustic reflector 4000 with heat sink function can be deemed as a heat pump which abstracts heat from the acoustic transducer and pump the heat out through the sound port during it reflects sound wave. This heat dispersion path may be combined with the sound path.

This will save the room in the enclosure for placing a separate heat sink. Furthermore, the sound wave will help to improve the thermal dispersion effect.

The acoustic transducer may be a loudspeaker.

The acoustic transducer includes a front cavity 2200 and a back cavity 2100. The front cavity 2200 is surrounded by the back cavity 2100 and the passage 3000.

As shown, in Figs. 4-7, the acoustic electronics device comprises a power unit 6000. The power unit 6000 provides power to the acoustic transducer. It may also include an amplification unit for the acoustic transducer.

As shown in Fig. 5, 6 and 7, the acoustic transducer 2100, 2200 is mounted on a first side (upper side) of the passage 3000, the power unit 6000 is mounted on a second side (lower side) of the passage 3000, and the acoustic reflector 4000, 4100, 4200 is between the acoustic transducer 2100, 2200 and the power unit 6000.

Generally, a power unit is a major source of heat generation. Placement of the power unit adjacent to the passage will facilitate the dispersion of heat from the power unit.

In Fig. 6, the acoustic reflectors 4100, 4200 are mounted on the inner surface of the upper side of the passage 3000, which are on the same side with the acoustic transducer 2100, 2200.

In Figs. 5 and 7, the power unit 6000 is mounted on an outer surface of the lower side of the passage 3000 and the acoustic reflector is mounted on an inner surface of the lower side of the passage.

Consequently, the heat sink is near the heat generation source and the thermal dispersion
5 is more efficient.

As shown in Fig. 5, the power unit 6000 and the acoustic reflector 4000 sandwich a sealing plate 7300 inside the enclosure.

As shown in Fig. 7, the power unit 6000 is in direct contact with the acoustic reflector 4000. On one hand, this will omit a sealing plate and further improve the thermal dispersion
10 performance; on the other hand, the power unit may be integrated with the acoustic reflector so as to simplify the assembly of the acoustic electronics device.

The acoustic electronics device may further comprise an operation unit 8000. The operation unit 8000 is used for operation of the acoustic electronics device and may include at least one of the following components: Bluetooth components, control button, WiFi components,
15 microphone and light.

As shown in Fig. 4, the acoustic transducer 2100, 2200 is mounted between the operation unit 8000 and the passage 3000.

Fig 4 shows a different embodiment, in which the power unit 6000 is mounted above the acoustic transducer 2100, 2200.

20 As shown in Figs. 4-7, the acoustic electronics device may further include sealing plates 7100, 7200 and 7300 for separating different components in the enclosure.

Although some specific embodiments of the present invention have been demonstrated in detail with examples, it should be understood by a person skilled in the art that the above examples are only intended to be illustrative but not to limit the scope of the
25 present invention.

CLAIMS

What is claimed is:

1. An acoustic reflector for being used inside an enclosure of an acoustic electronics device, which is made of thermal conductive material and functions as a heat sink.

5

2. The acoustic reflector according to claim 1, wherein the thermal conductive material is metal.

3. The acoustic reflector according to claim 1, wherein the metal is copper.

10

4. An acoustic electronics device, comprising:

an enclosure;

an acoustic transducer, mounted inside the enclosure;

a passage inside the enclosure;

15

at least one sound port, wherein the passage connects the acoustic transducer to the at least one sound port; and

an acoustic reflector according to claim 1, which is mounted in the passage and which reflects the sound wave from the acoustic transducer to the at least one sound port or from the at least one sound port to the acoustic transducer.

20

5. The acoustic electronics device according to claim 4, wherein the acoustic transducer is a loudspeaker.

6. The acoustic electronics device according to claim 4, further comprising: a power unit,

25

which provides power to the acoustic transducer,

wherein the acoustic transducer is mounted on a first side of the passage, the power unit is mounted on a second side of the passage, and the acoustic reflector is between the acoustic transducer and the power unit.

7. The acoustic electronics device according to claim 6, wherein the power unit is mounted on an outer surface of the second side of the passage and the acoustic reflector is mounted on an inner surface of the second side of the passage.

5

8. The acoustic electronics device according to claim 6, wherein the power unit is in contact with the acoustic reflector.

9. The acoustic electronics device according to claim 6, wherein the power unit and the acoustic reflector sandwich a sealing plate inside the enclosure.

10

10. The acoustic electronics device according to claim 4, further comprising: an operation unit, which includes at least one of the following components: Bluetooth components, control button, WiFi components, microphone and light,

15

wherein the acoustic transducer is mounted between the operation unit and the passage.

11. The acoustic electronics device according to claim 4, wherein the acoustic transducer includes a front cavity and a back cavity, and the front cavity is surrounded by the back cavity and the passage.

1/3

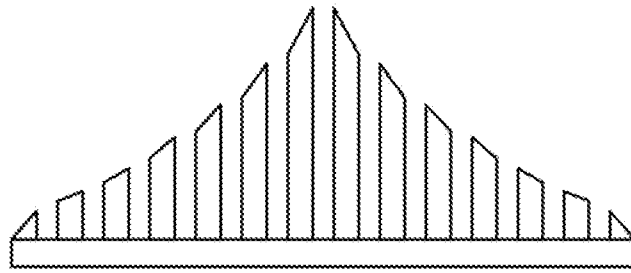


FIG. 1



FIG. 2

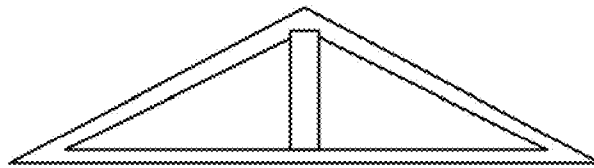


FIG. 3

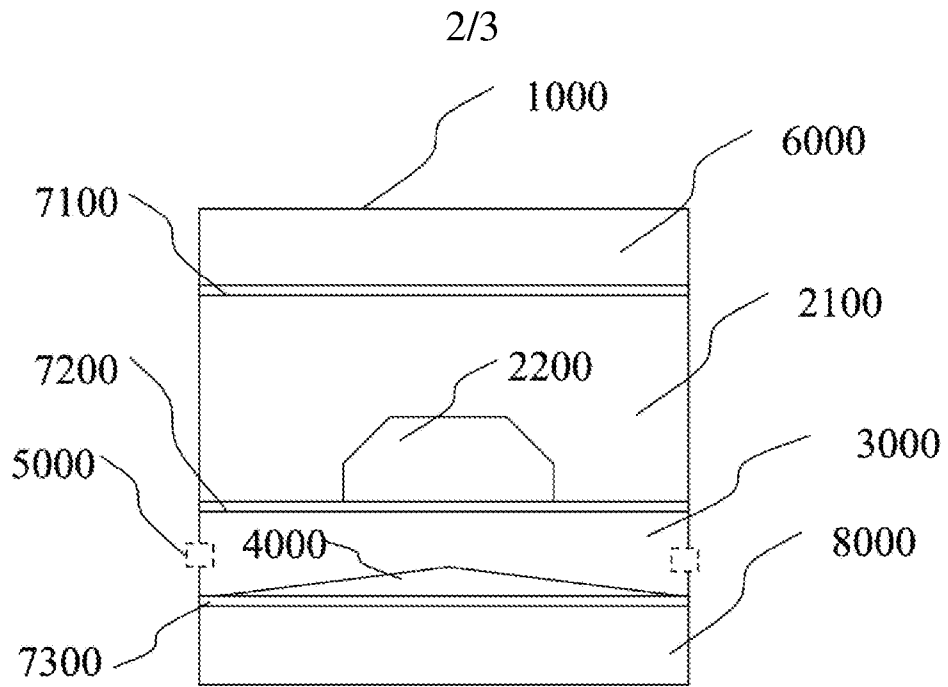


FIG.4

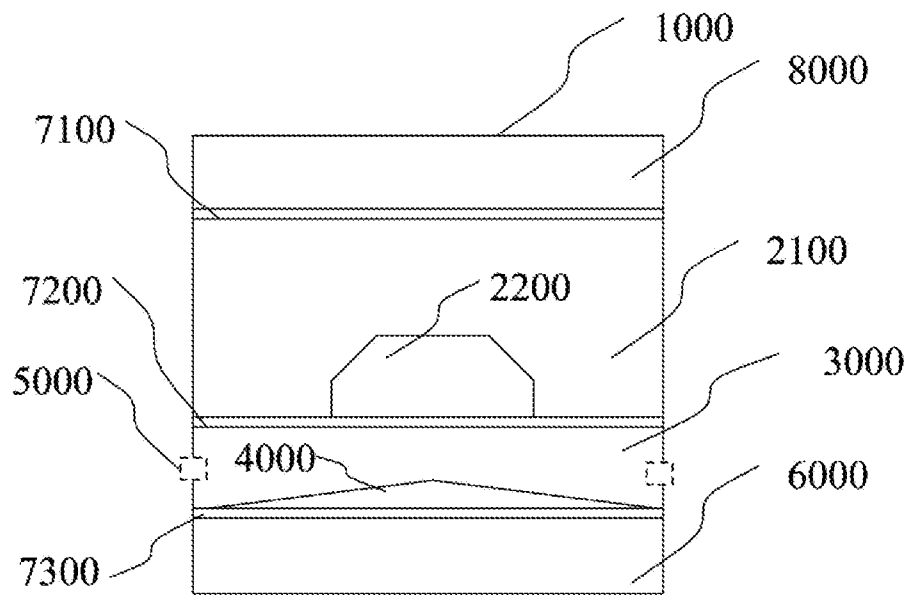


FIG.5

3/3

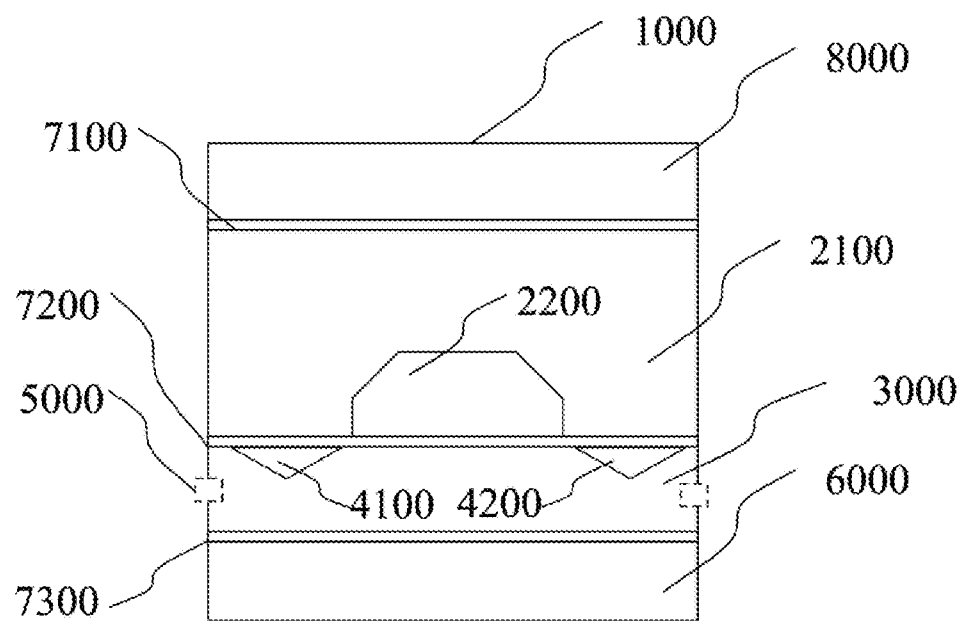


FIG. 6

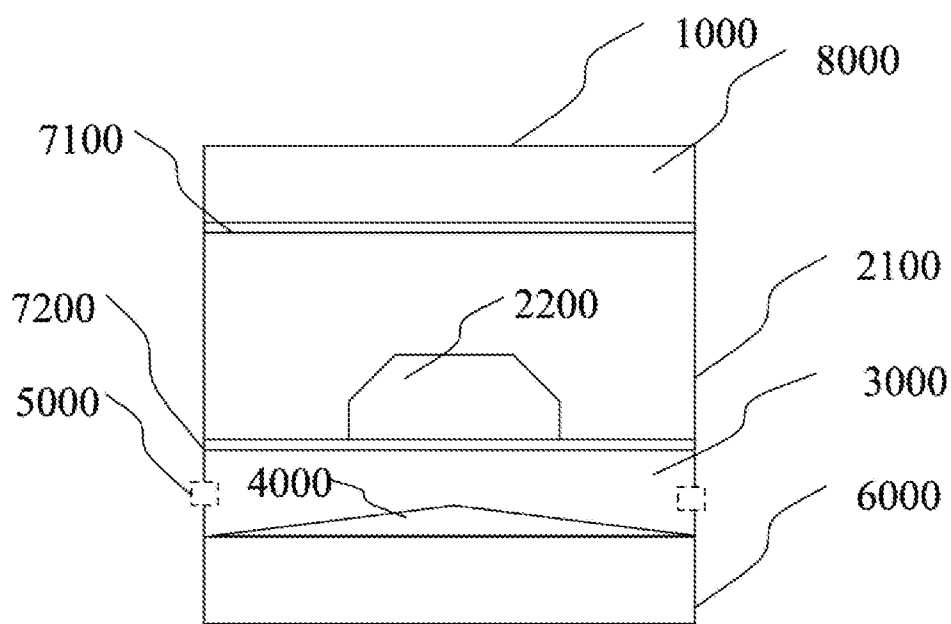


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/097890

A. CLASSIFICATION OF SUBJECT MATTER

H04R 1/04(2006.01)i; H04R 9/02(2006.01)i; G01H 17/00(2006.01)i; H04R 19/04(2006.01)i

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;G01H17

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)

CNPAT, CNKI, WPI, EPODOC: acoustic, sound, audio, loudspeaker, speaker, reflector, reflect, transducer, thermal, conductive, heat, metal, copper, passage, port, power, inner, inside, sandwich, sealing, cavity.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 207340158 U (XI'AN TCL SOFTWARE DEVELOPMENT CO., LTD.) 08 May 2018 (2018-05-08) paragraphs [0016]-[0031] in the description	1-11
X	CN 102685651 A (SONY CORP.) 19 September 2012 (2012-09-19) paragraphs [0056]-[0146] in the description	1-11
A	WO 2010071102 A1 (TOA CORP.) 24 June 2010 (2010-06-24) the whole document	1-11
A	CN 107421635 A (INFINEON TECHNOLOGIES A.G.) 01 December 2017 (2017-12-01) the whole document	1-11
A	CN 208675540 U (GOERTEK TECHNOLOGY CO., LTD.) 29 March 2019 (2019-03-29) the whole document	1-11

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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

“E” earlier application or patent but published on or after the international filing date

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

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

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

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

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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

“&” document member of the same patent family

Date of the actual completion of the international search

31 August 2020

Date of mailing of the international search report

30 September 2020

Name and mailing address of the ISA/CN

National Intellectual Property Administration, PRC
6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing
100088
China

Facsimile No. (86-10)62019451

Authorized officer

WANG, Yue

Telephone No. 86- (10) - 53962545

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/097890

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)		Publication date (day/month/year)
CN	207340158	U	08 May 2018	None		
CN	102685651	A	19 September 2012	JP	5644593 B2	24 December 2014
				EP	2498512 A2	12 September 2012
				US	8995702 B2	31 March 2015
				CA	2766660 A1	07 September 2012
				JP	2012186700 A	27 September 2012
				AU	2012200533 A1	27 September 2012
				US	2012230499 A1	13 September 2012
				EP	2498512 B1	20 September 2017
WO	2010071102	A1	24 June 2010	JP	WO2010071102 A1	31 May 2012
				JP	5450447 B2	26 March 2014
CN	107421635	A	01 December 2017	US	2019132661 A1	02 May 2019
				US	10194226 B2	29 January 2019
				US	2017325013 A1	09 November 2017
				DE	102017109821 B4	04 June 2020
				US	2017325012 A1	09 November 2017
				DE	102017109821 A1	09 November 2017
CN	208675540	U	29 March 2019	None		