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(54) Title: SIDE-PORTED MEMS MICROPHONE ASSEMBLY

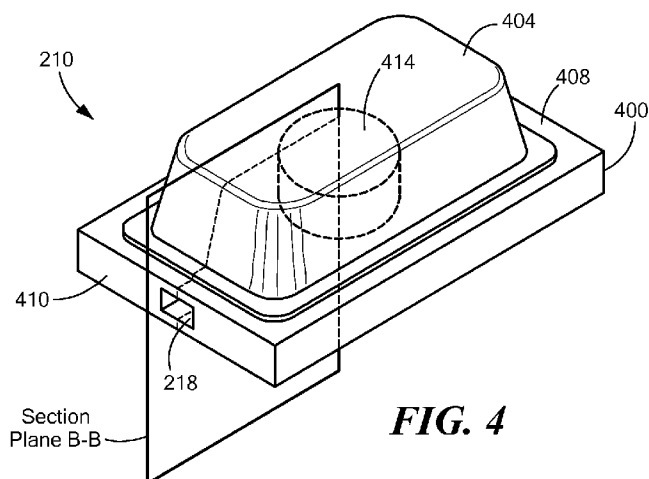


FIG. 4

(57) Abstract: A side-ported MEMS microphone package (210, 2700) defines an acoustic path (528) from a side of the package substrate (400) to a microphone die (414) disposed within a chamber (514) defined by the substrate (400) and a lid (404) attached to the substrate (400). Optionally or alternatively, a circuit board (1500, 1800, 2200), to which the microphone package (210, 2700) is mounted, may define an acoustic path (528) from an edge of the circuit board (1500, 1800, 2200) to a location under the microphone package (210, 2700), adjacent a bottom port on the microphone package (210, 2700). In either case, the acoustic path (528) may be a hollow passage through at least a portion of the substrate (400) or the circuit board (1500, 1800, 2200). The passage may be defined by holes (600, 1404, 2720), channels (1000, 1400, 1804, 2500, 2716), notches (700, 2204), etc. defined in each of several layers of a laminated substrate (400) or circuit board (1500, 1800, 2200), or the passage may be defined by holes (1100, 1108) drilled, molded or otherwise formed in a solid or laminated substrate (400) or circuit board (1500, 1800, 2200).



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**INTERNATIONAL SEARCH REPORT**

International application No  
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. H04R19/00 H04R31/00 ADD. H04R19/04		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> 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 practical, search terms used) EPO-Internal		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/237806 A1 (MARTIN JOHN R [US] ET AL) 26 October 2006 (2006-10-26)	1-4, 6, 9-17, 20, 21, 28, 29, 31
Y	paragraphs [0093], [0079]; figures 3, 9b	23-26, 30
A		5, 7, 8, 18, 19, 32-34
X,P	----- US 2009/180655 A1 (TIEN JIUNG-YUE [TW] ET AL) 16 July 2009 (2009-07-16) paragraphs [0005], [0013] - [0018]; figure 2 ----- -/--	1-5, 9, 12-14, 17, 20, 21, 28, 30, 32
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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 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 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		
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/205492 A1 (WANG ZHE [SG] ZHE WANG [SG]) 6 September 2007 (2007-09-06)	23
A	figures 5,8	6
Y	US 2005/095813 A1 (ZHU XU [US] ET AL) 5 May 2005 (2005-05-05) paragraph [0004]	30,37
Y	EP 1 992 589 A2 (IND TECH RES INST [TW]) 19 November 2008 (2008-11-19)	24,25
A	paragraphs [0016] - [0020]; figure 2	12,13
Y	JP 4 076795 U (-) 3 July 1992 (1992-07-03)	23,26
A	figures 1,4,7	8,19,34
X,P	WO 2009/034786 A1 (HOSIDEN CORP [JP]; NAKANISHI KENSUKE [JP]; AWAMURA RYUJI [JP]) 19 March 2009 (2009-03-19)	22
A,P	* abstract; figure 5	23-27
E	& EP 2 190 215 A1 (HOSIDEN CORP [JP]) 26 May 2010 (2010-05-26) paragraphs [0030] - [0032]; figure 5	22
X	EP 0 711 095 A2 (AT & T CORP [US]) 8 May 1996 (1996-05-08)	22,27
Y	page 4, line 46 - page 5, line 50; figures 2,3,6	23-26
X	WO 2008/109399 A1 (KNOWLES ELECTRONICS LLC [US]; MINERVINI ANTHONY D [US]; MASSINGILL GWE) 12 September 2008 (2008-09-12)	35,36
Y	paragraphs [0078] - [0080]; figures 2,	37
A	51,52	38

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2009/065041

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

## 1. claims: 1-21, 28-34

A side-ported microphone package, comprising:  
a substrate;  
a lid attached to a first surface of the substrate to define a chamber therebetween; and  
a microphone die disposed within the chamber;  
wherein the substrate at least partially defines an acoustic path from outside the chamber to the microphone die, such that at least a portion of the acoustic path defined by the substrate is oriented other than perpendicular to the first surface of the substrate, wherein:  
the substrate comprises a second surface on substantially an opposite side of the substrate from the first surface; and  
at least a portion of the passage is open at the second surface.

Independent claim 18 corresponds to the combination of features of claims 1, 6, and 7. Independent claims 20 and 21 are a mere rewording of claim 1. Independent claim 28 is linked to a method of producing a side-ported microphone package according to claim 3, wherein claim 31 dependent on claim 28 corresponds to a combination of claims 4 and 6.

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## 2. claims: 22-27

A kit of parts for assembling a side-ported microphone package, the kit comprising:  
a first layer defining a hollow channel or notch in a surface of the first layer, the channel or notch extending from an edge of the first layer and terminating at a location away from any edge of the first layer;  
a second layer defining a bore, such that when the first and second layers are assembled in registration with each other, the bore is in communication with the channel or notch;  
at least one wall configured such that when the at least one wall is attached to the second layer in registration therewith, the bore is in communication with a volume defined by the at least one wall; and  
a lid.

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## 3. claims: 35-38

A method for producing a side-ported microphone assembly, the method comprising:  
attaching a bottom side of a bottom-ported microphone package to a surface of a circuit board;  
defining an opening in the surface of the circuit board adjacent a present or expected future location of the bottom port of the microphone package; and  
defining a hollow acoustic path from a side of the circuit

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

board, through at least a portion of the circuit board, to the opening.

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/065041

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