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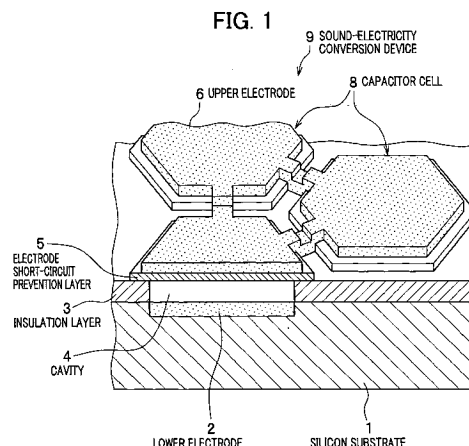
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(54) **Sound-electricity conversion device, array-type ultrasonic transducer, and ultrasonic diagnostic apparatus**

(57) The present invention aims to stabilize sound-electricity conversion characteristics of a diaphragm-type sound-electricity conversion device as well as to decrease the noise level of an ultrasonic diagnostic apparatus using the sound-electricity conversion device. The sound-electricity conversion device is configured by a capacitor cell including a lower electrode formed on a silicon substrate and an upper electrode over the lower electrode, the lower and upper electrodes sandwiching a cavity. An electrode short-circuit prevention film is formed on the upper electrode on the cavity side. The electrode short-circuit prevention film is formed of a material with an electrical time constant shorter than 1 second and longer than 10 microseconds, such as silicon nitride containing a stoichiometrically excessive amount of silicon. As a result, the electrode short-circuit prevention film has small electric conductivity, and thus it is made possible to prevent the film from being charged with electric charge and to avoid the drift of the electric

charge. Consequently, the sound-electricity conversion characteristics of the sound-electricity conversion device stabilize, and further the sound noise level of the ultrasonic diagnostic apparatus decreases.





## EUROPEAN SEARCH REPORT

Application Number  
EP 06 00 1863

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                              |                                         |
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| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                                                                                                                                                                                      | Relevant to claim                                                                                                                                                                                                                                                            | CLASSIFICATION OF THE APPLICATION (IPC) |
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| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                              |                                         |
| Place of search<br>The Hague                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                    | Date of completion of the search<br>19 July 2012                                                                                                                                                                                                                             | Examiner<br>Scappazzoni, E              |
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EPO FORM 1503 03.82 (P04C01)



## EUROPEAN SEARCH REPORT

Application Number  
EP 06 00 1863

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                          |                                  |                                         |
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| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                                                                                                                                                                                                                                            | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                          |                                  |                                         |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                          |                                  |                                         |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                          | Date of completion of the search | Examiner                                |
| The Hague                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                          | 19 July 2012                     | Scappazzoni, E                          |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                                                                                                                                                                                                                                                          |                                  |                                         |

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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19-07-2012

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|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------------|
| 专利名称(译)        | 声电转换装置，阵列型超声波换能器和超声波诊断装置                                                                                                                                                                       |         |            |
| 公开(公告)号        | <a href="#">EP1736247A3</a>                                                                                                                                                                    | 公开(公告)日 | 2012-08-22 |
| 申请号            | EP2006001863                                                                                                                                                                                   | 申请日     | 2006-01-30 |
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| IPC分类号         | B06B1/02 A61B8/00 H04R19/00                                                                                                                                                                    |         |            |
| CPC分类号         | B06B1/0292                                                                                                                                                                                     |         |            |
| 优先权            | 2005179959 2005-06-20 JP                                                                                                                                                                       |         |            |
| 其他公开文献         | EP1736247B1<br>EP1736247A2                                                                                                                                                                     |         |            |
| 外部链接           | <a href="#">Espacenet</a>                                                                                                                                                                      |         |            |

# 摘要(译)

本发明的目的在于稳定隔膜式声电转换装置的声电转换特性，并降低使用该声电转换装置的超声波诊断装置的噪声水平。声电转换装置由电容器单元构成，该电容器单元包括形成在硅基板上的下电极和下电极上的上电极，下电极和上电极夹着空腔。在腔侧的上电极上形成电极短路防止膜。电极短路防止膜由电时间常数小于1秒且长于10微秒的材料形成，例如含有化学计量过量的硅的氮化硅。结果，电极短路防止膜具有小的导电性，因此可以防止膜带电荷并避免电荷漂移。因此，声电转换装置的声电转换特性稳定，并且超声波诊断装置的声音噪声水平进一步降低。

