(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 519 626 A3

# (12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
**01.02.2006 Bulletin 2006/05**

(43) Date of publication A2:
**30.03.2005 Bulletin 2005/13**

(21) Application number: **04405754.5**

(22) Date of filing: **07.12.2004**

(51) Int Cl.:
***H04R 25/00*** *(2006.01)*

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
**AL BA HR LV MK YU**

(71) Applicant: **PHONAK AG**
**8712 Stäfa (CH)**

(72) Inventor: **Luo, Henry**
**Waterloo N2L 5Y6 (CA)**

(74) Representative: **Frei Patent Attorneys**
**Frei Patentanwaltsbüro**
**Postfach 1771**
**8032 Zürich (CH)**

## (54) Method and device for processing an acoustic signal

(57) For reducing wind noise effects in a hearing instrument, a converted acoustic signal is processed in a number of frequency bands, a low frequency band of which is chosen to be a master band. A wind noise attenuation value is determined in each frequency band, based on a signal level in the frequency band concerned and on a signal level in the master band. A further wind noise reducing effect may be achieved in hearing instruments with at least two microphones where in the presence of wind noise the instrument may be switched from a direction al mode to a omnidirectional mode in which an average of the output signals of the two microphones is used as signal. In single microphone hearing instruments, the microphone signal and a delayed version of this signal are used to improve wind noise detection and reduction.

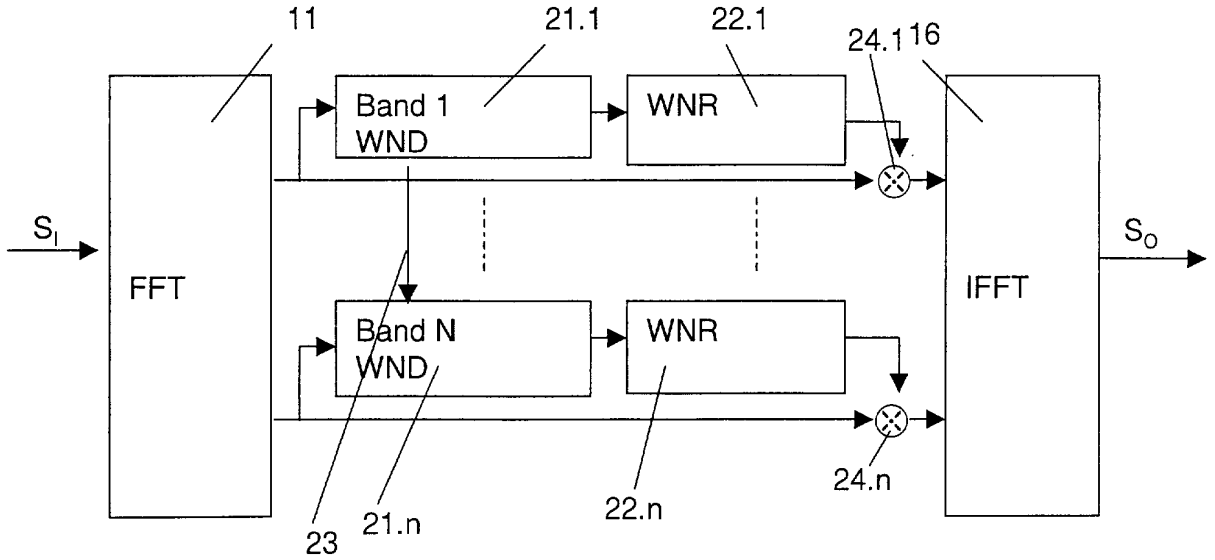


Fig. 4

EP 1 519 626 A3

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 04 40 5754

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| D,A | US 2002/191804 A1 (LUO HENRY ET AL) 19 December 2002 (2002-12-19) * paragraph [0019] - paragraph [0023] * * paragraph [0044] - paragraph [0050] * * paragraph [0062] - paragraph [0071]; figures 1-3 * | 1,11,15 | H04R25/00 |
| A | EP 1 450 354 A (HARMAN BECKER AUTOMOTIVE SYSTEMS-WAVEMAKERS, INC) 25 August 2004 (2004-08-25) * paragraph [0014] - paragraph [0037]; figure 2 * | 1,11,15 | |

TECHNICAL FIELDS SEARCHED (IPC)

H04R
G10L

~~The present search report has been drawn up for all claims~~

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 25 August 2005 | Nieuwenhuis, P |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 04 40 5754

## CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

## LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-15,20

European Patent Office

# LACK OF UNITY OF INVENTION SHEET B

Application Number
EP 04 40 5754

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-15,20

Independent claim 1 relates to a method for processing a time dependent electric signal being a converted acoustic signal into a processed electric signal, wherein
- - at least a section of the converted acoustic signal is split into frequency bands, to obtain a frequency band signal, choosing one said bands having a lower central frequency than a central frequency of a majority of the frequency bands as master band,
- based on pre-defined criteria, a frequency band indicator value is obtained in each frequency band including the masterband,
- a frequency band wind noise attenuation is obtained for each one of said frequency bands, by using its frequency band indicator value and using the master band indicator value, and wherein
- said frequency band wind noise attenuation is applied to the converted acoustic signal in each one of said group of frequency bands

Independent claims 11 relates to an acoustical device carrying out the method of claim 1 and claim 15 to a method of manufacturing such an acoustical device.

---

2. claims: 16-19,21-24

European Patent Office

## LACK OF UNITY OF INVENTION
## SHEET B

Application Number
EP 04 40 5754

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

Independent claim 16 relates to a method for processing a first and second time dependent electric signal each obtained from an acoustic signal wherein the average of said first and second electric signal is determined, which average is used as in input signal for further processing stage (according to claim 16 a wind noise detection stage).

Independent claims 21 relates to an acoustical device carrying out the method of claim 1 and claim 22 to a method of manufacturing such an acoustical device.
Independent claim 23 relates to an acoustical device comprising an input transducer for converting an acoustic input signal into a converted input signal, a signal processing unit, and an output transducer, wherein the input transducer is operationally connected to the output transducer via the signal processing unit, wherein
- the signal processing unit, comprises a delay stage operable to compute a delayed input signal from the converted input signal and a averaging stage operable to determine an average of the converted input signal and the delayed input signal.

Independent claim 24 relates to a method of manufacturing such an acoustical device.

---

3. claims: 25-31

Independent claim 25 relates to a method for processing a time dependent electric signal being a converted acoustic signal into a processed electric signal, wherein
- at least a section of the converted acoustic signal is split into frequency bands, to obtain a frequency band signal,
- in each one of said group of frequency bands, said frequency band signal is compared with a frequency band level threshold,
- based the comparison, a frequency band indicator value is obtained in each frequency band including the masterband,
- a frequency band wind noise attenuation is obtained for each one of said frequency bands, by using its frequency band indicator value, and wherein
- said frequency band wind noise attenuation is applied to the converted acoustic signal in each one of said group of frequency bands.

Independent claims 30 relates to an acoustical device carrying out the method of claim 1 and claim 31 to a method of manufacturing such an acoustical device.

---

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 40 5754

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-08-2005

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 2002191804 A1 | 19-12-2002 | NONE | |
| EP 1450354 A | 25-08-2004 | CA 2458427 A1 | 21-08-2004 |
| | | CN 1530928 A | 22-09-2004 |
| | | JP 2004254329 A | 09-09-2004 |
| | | US 2004165736 A1 | 26-08-2004 |
| | | US 2004167777 A1 | 26-08-2004 |

EPO FORM P0459

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