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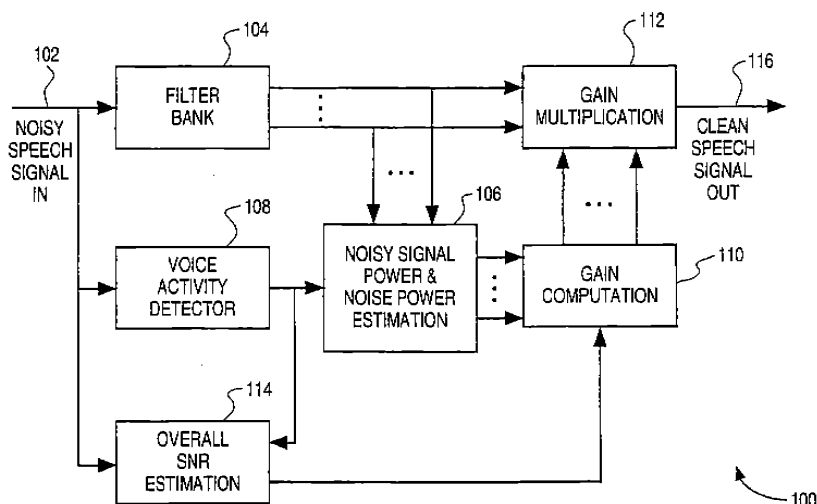
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(54) **Method and apparatus for adaptively suppressing noise**

(57) An apparatus and method for suppressing noise is presented. The apparatus may utilize a filter bank of bandpass filters to split the input noisy speech-containing signal into separate frequency bands. The overall average noise-to-signal ration (NSR) of the input signal is estimated in the overall NSR estimator, which estimates the average noisy signal power in the input signal during speech activity and the average noise power during si-

lence. Two indirect power measures are performed for each band, measuring a short-term power and a long-term power. The power estimation processes are adapted based on the signal activity indicated by the JVADAD. An NSR adapter adapts the NSR for each frequency band based on the long-term and short-term power measures, the overall NSR and the signal activity indicated by the JVADAD. The gain computer utilizes these NSR values to determine the gain factors for each frequency band.

**FIG. 1**





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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 630 305 A (BORTH DAVID E ET AL) 16 December 1986 (1986-12-16)  * column 3, line 36 - line 53 * * column 5, line 12 - line 46 * * column 5, line 62 - column 6, line 8 * * column 6, line 32 - line 46 * * column 7, line 60 - column 8, line 23 * * column 8, line 37 - line 46 * * column 9, line 61 - column 10, line 9 * * column 10, line 20 - line 35 * * column 12, line 44 - line 65 *	1-6,12, 15-21, 30-32	INV. G10L21/02
Y	-----	7-11,13, 14, 22-29, 33,34	
Y	WO 96/24128 A (ERICSSON TELEFON AB L M ;HAENDEL PETER (SE)) 8 August 1996 (1996-08-08)  * page 3, paragraph 2 *	7-11,13, 14, 22-29, 33,34	TECHNICAL FIELDS SEARCHED (IPC)
A	US 5 706 395 A (VISWANATHAN VISHU R ET AL) 6 January 1998 (1998-01-06) * abstract * * column 11, line 65 - column 12, line 4 *	1-35	G10L
X	WO 89/03141 A (MOTOROLA INC) 6 April 1989 (1989-04-06) * abstract * * page 9, line 24 - page 10, line 12 * * page 10, line 34 - page 11, line 14 * ----- -/--	35	
The present search report has been drawn up for all claims			
Place of search <b>Munich</b>		Date of completion of the search <b>12 January 2007</b>	Examiner <b>RAMOS SANCHEZ, U</b>
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			

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Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 06 02 0682

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GAGNON L ET AL: "SPEECH ENHANCEMENT USING RESONATOR FILTERBANKS" PROC. IEEE INTERNATIONAL CONFERENCE ON ACOUSTICS, SPEECH & SIGNAL PROCESSING (ICASSP '91), 14 May 1991 (1991-05-14), - 17 May 1991 (1991-05-17) pages 981-984, XP000222243 IEEE, NEW YORK, USA ISBN: 0-7803-0003-3 * the whole document *	1-35	TECHNICAL FIELDS SEARCHED (IPC)
A	US 5 632 003 A (DAVIDSON GRANT A ET AL) 20 May 1997 (1997-05-20) * column 2, line 20 - line 29 * * column 5, line 12 - line 20 * * column 3, line 57 - line 62 *	1-35	
A	EP 0 856 833 A (NIPPON ELECTRIC CO) 5 August 1998 (1998-08-05) * page 4, line 16 - line 19 *	1-35	
D,A	US 5 012 519 A (ADLERSBERG SHABTAI ET AL) 30 April 1991 (1991-04-30) * column 9, line 7 - line 20 *	1-35	
D,A	US 4 630 304 A (BORTH DAVID E ET AL) 16 December 1986 (1986-12-16) * abstract *	1-35	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 January 2007	Examiner RAMOS SANCHEZ, U
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			

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EPO FORM 1503 03.02 (P04C01)

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

EP 06 02 0682

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The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-01-2007

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4630305	A	16-12-1986	NONE	
-----				
WO 9624128	A	08-08-1996	AU 696152 B2	03-09-1998
			AU 4636996 A	21-08-1996
			BR 9606860 A	25-11-1997
			CA 2210490 A1	08-08-1996
			CN 1169788 A	07-01-1998
			DE 69606978 D1	13-04-2000
			DE 69606978 T2	20-07-2000
			EP 0807305 A1	19-11-1997
			ES 2145429 T3	01-07-2000
			FI 973142 A	30-09-1997
			JP 10513273 T	15-12-1998
			RU 2145737 C1	20-02-2000
			SE 505156 C2	07-07-1997
			SE 9500321 A	31-07-1996
			US 5943429 A	24-08-1999
-----				
US 5706395	A	06-01-1998	NONE	
-----				
WO 8903141	A	06-04-1989	DE 3856280 D1	21-01-1999
			DE 3856280 T2	12-08-1999
			EP 0380563 A1	08-08-1990
			JP 2995737 B2	27-12-1999
			JP 3500347 T	24-01-1991
			US 4811404 A	07-03-1989
-----				
US 5632003	A	20-05-1997	AT 147908 T	15-02-1997
			AU 677856 B2	08-05-1997
			AU 7362194 A	13-02-1995
			CA 2164964 A1	26-01-1995
			DE 69401512 D1	27-02-1997
			DE 69401512 T2	12-06-1997
			DK 709004 T3	10-03-1997
			EP 0709004 A1	01-05-1996
			ES 2097057 T3	16-03-1997
			JP 3804968 B2	02-08-2006
			JP 9500772 T	21-01-1997
			SG 47116 A1	20-03-1998
			SG 54317 A1	16-11-1998
			WO 9502928 A1	26-01-1995
-----				
EP 0856833	A	05-08-1998	AU 736904 B2	02-08-2001
			AU 5278698 A	06-08-1998
			CA 2228097 A1	29-07-1998
			JP 2874679 B2	24-03-1999

EPO FORM P0459

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

EP 06 02 0682

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.

12-01-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0856833	A	JP 10215193 A	11-08-1998
		US 6266422 B1	24-07-2001
-----			
US 5012519	A	30-04-1991	NONE
-----			
US 4630304	A	16-12-1986	JP 2714656 B2
		JP 63500543 T	16-02-1998
			25-02-1988
-----			

EPO FORM P0459

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