AUSTRALIA
PATENTS ACT 1990

NOTICE OF ENTITLEMENT

We   Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.

of   Leonrodstraße 54
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Germany

being the applicant in respect of Application No 27599/92, state the following:-

1.   The persons nominated for the grant fo the patent have entitlement from the actual inventors by virtue of an Assignment therewith.

2.   The persons nominated for the grant of the patent are the applicants of the application listed in the Declaration under Article 8 of the PCT.

The basic application listed in the declaration made under Article 8 of the PCT is the first application made in a Convention country in respect of the invention.

DATED this 13th day of April, 1994

FRAUNHOFER-GESELLSCHAFT ZUR FÖRDERUNG
DER ANGEWANDTEN FORSCHUNG E.V.
By its Patent Attorney
KEN MADDERN

AU9227599

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(54) Title
PROCESS FOR REDUCING DATA IN THE TRANSMISSION AND/OR STORAGE OF DIGITAL SIGNALS FROM SEVERAL DEPENDENT CHANNELS

International Patent Classification(s)
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(56) Prior Art Documents
WO 90/16136

(57) Claim

1.   Method for reducing data during the transmission and/or storage of digital signals from N dependent channels, in which sampled signals from the time range are transformed blockwise into the frequency range into spectral components, which are encoded, transmitted and/or stored, decoded and transformed back into N channels in the time range, characterised in that from the values of the spectral components of corresponding blocks of the different channels is determined a quantity, which is a measure for the spectral distance between signals of the different channels, and is compared with a predetermined threshold and that on dropping below the threshold there is a common encoding of the signals from the different channels.

(51) Internationale Patentklassifikation [5] :		(11) Internationale Veröffentlichungsnummer: WO 93/09644
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P 41 36 825.8　　　　8. November 1991 (08.11.91)　DE

(71) Anmelder *(für alle Bestimmungsstaaten ausser US):* FRAUNHOFER-GESELLSCHAFT ZUR FÖRDE-RUNG DER ANGEWANDTEN FORSCHUNG E.V. [DE/DE]; Leonrodstraße 54, D-8000 München 19 (DE).

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(81) Bestimmungsstaaten: AU, CA. JP, KR, NO, RU, UA, US. europäisches Patent (AT, BE, CH, DE, DK, ES. FR, GB, GR, IE, IT, LU. MC, NL, SE).

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659228

(54) Title: PROCESS FOR REDUCING DATA IN THE TRANSMISSION AND/OR STORAGE OF DIGITAL SIGNALS FROM SEVERAL DEPENDENT CHANNELS

(54) Bezeichnung: VERFAHREN ZUR REDUZIERUNG VON DATEN BEI DER ÜBERTRAGUNG UND/ODER SPEI-CHERUNG DIGITALER SIGNALE MEHRERER ABHÄNGIGER KANÄLE

(57) Abstract

The description relates to a process for reducing data in the transmission and/or storage of digital signals from several dependent channels. The dependence of the signals in a channel. e.g. in a left and right-hand stereo channel, can be used for further data reduction. Prior art processes like central/side-band coding or the intensity stereo process result in detectable interference with an unfavourable signal composition. The process of the invention avoids such interference in that the channels are jointly coded only if the signals in both channels have similar enough spectra. In addition, it is possible with the process of the invention to attain further data reduction in that in frequency ranges in which the energy spectrum of a channel does not exceed a predeterminable fraction of the total energy spectrum, the relevant spectrum values are zeroed. As the process is independent of the specific inner structure of the coding process, it is highly versatile.
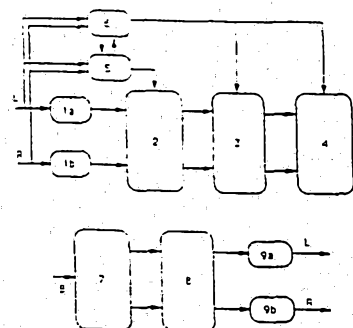
(57) Zusammenfassung

Beschrieben wird ein Verfahren zur Reduzierung von Daten bei der Übertragung und/oder Speicherung digitaler Signale mehrerer abhängiger Kanäle. Die Abhängigkeit der Signale in den Kanälen, beispielsweise in einem linken und einem rechten Stereokanal, kann zu einer zusätzlichen Datenreduzierung verwendet werden. Bekannte Verfahren wie die Mitte/Seite-Codierung oder das Intensity-Stereoverfahren führen bei ungünstiger Signalzusammensetzung zu wahrnehmbaren Störungen. Das erfin-dungsgemäße Verfahren vermeidet solche Störungen, indem eine gemeinsame Codierung der Kanäle nur erfolgt, wenn eine aus-reichende spektrale Ähnlichkeit der Signale in den beiden Kanälen vorliegt. Weiter kann die mit Hilfe eines erfindungsgemäßen Verfahrens zusätzliche Datenreduzierung dadurch erreicht werden, daß in solchen Frequenzbereichen, in denen die spektrale Energie eines Kanals einen vorgebbaren Bruchteil der gesamten spektralen Energie nicht übersteigt, die zugehörigen Spektralwer-te zu Null gesetzt werden. Da das Verfahren unabhängig vom spezifischen inneren Aufbau des Codierverfahrens ist, ist es vielsei-tig einsetzbar.

METHOD FOR REDUCING DATA IN THE TRANSMISSION AND/OR STORAGE OF DIGITAL SIGNALS OF SEVERAL DEPENDENT CHANNELS

DESCRIPTION

TECHNICAL FIELD

The invention relates to a method for reducing data in the transmission and/or storage of digital signals of several dependent channels according to the preambles of claims 1 or 8.

Methods in which e.g. audio signals are transmitted in frequency-coded manner, are e.g. known from PCT publications WO88/01811 and WO89/08357. Express reference is made to the latter documents for explaining terms which are not clarified here.

Many known methods for data-reduced coding of digital audio signals code the signals in the frequency range and use for the transformation ~~transmission~~ of the signals from the time range into the frequency range ~~(in spectral values)~~ (into spectral components) a suitable imaging procedure, e.g. a FFT, DCT, MDCT, polyphase filter bank or hybrid filter bank.

These methods lead to a high degree of utilization of signal redundancy and irrelevance with respect to the characteristics of the human ear. If during the transmission of signals of several channels the signals are not independent of one another, an additional reduction of the data quantity to be transmitted is possible. This requirement is e.g. fulfilled in the case of signals in the channels of a quadruphonic or stereophonic audio signal.

PRIOR ART

A method for the utilization of the redundancy/irrelevance between the two channels of a stereo audio signal is described in the publication by J.D. Johnston, "Perceptual Transform Coding of Wideband Stereo Signals", IEEE, 1989, pp.1993-1996. In this so-called MS coding (middle/side coding) instead of the left and right channel the sum (=centre) and the difference (=side) of the stereo signal is coded. This leads to a saving in the quantity of data to be transmitted.

The dependence of signals of two stereo channels is also utilised in the intensity stereo process known from "Subband Coding of Stereophonic Digital Audio Signals", IEEE 1991, pp.3601 to 3604. In this process the monosignal and an additional information concerning the left/right distribution of the signal are transmitted.

As a result of both these procedures in the case of an unfavourable signal composition high interference levels can occur. For example, a very differing signal composition in the left and right channels in MS coding leads to defects which are not concealed by the signal present in the channel. Therefore e.g. a loud saxophone signal, which is almost only contained in the right channel, leads to interference on the left channel, which is not concealed and which can therefore be clearly heard. When using the intensity stereo method the spatial sound impression is lost if the left and right channels have a widely differing spectral composition.

Thus, the known methods are only useable if no unfavourable signal composition is to be expected, or if interference can be accepted in favour of reducing the data quantity.

DESCRIPTION OF THE INVENTION

The problem of the invention is to provide a method for reducing data in the transmission and/or storage of digital signals of several dependent channels, in which the dependence of the signals in the different channels is utilised and which does not lead to a subjectively perceivable interference of the transmitted signals. Inventive solutions of this problem are given in claims 1 and 8.

According to the invention the signals of the different channels are firstly transformed into spectral ranges. Then, from the value of the spectral components, which belong to the corresponding blocks of the channels, a quantity is determined and this constitutes a measure for the spectral distance between the signals. The more similar the values of the spectral components of the corresponding blocks the smaller this quantity. If this quantity drops below a predetermined threshold, the encoding of the signals no longer takes

place separately in the individual channels and instead a common encoding takes place. The common encoding takes place according to known processes, which leads to a reduction of the quantity of data to be transmitted. On exceeding the predetermined threshold a common encoding of the signals of the different channels is no longer performed. Therefore, in favour of the quality of the transmitted data, temporarily there is no additional data reduction.

Further developments and variants of the invention are characterised in the subclaims.

According to claim 2 all of the values of the spectral components belonging to a block are not used for determining the spectral distance. Instead the spectral distance is determined from parts of the frequency range, so that several values of the spectral distance per block are determined. Therefore this method reacts more quickly to changes in the spectral distance.

According to claim 3 the method according to the invention can be used with particular advantage for signals from two acoustic stereo channels. For this case a preferred instruction for the determination of a quantity is given, which represents a measure for the spectral distance.

If the spectral spacing or distance SD/SE standardised for the spectral energy is below a threshold constant c, it is ensured that the spectral similarity is adequate for a common coding of the two channels. In this case, the masking thresholds for both channels determined according to psychoacoustics are also similar enough to ensure that defects occurring during common coding are effectively masked in both channels.

An alternative rule for determining the spectral distance is given in claim 4. The threshold constant c is to be determined empirically and is between 0.5 and 1 according to claim 5.

Particularly advantageous developments of the common coding or encoding are given in claims 6 and 7. According to claim 6 the common coding takes place by a per se known middle/side coding. This method is preferably used if

importance is attached to maximum quality for low bit rates. A simple method according to claim 7 uses intensity stereo coding.

The independent claim 8 characterises a further method solving the problem according to the invention.

From the value of the spectral components of corresponding parts of the frequency range of the different channels, quantities are determined which represent a measure for the spectral energy of these parts of the frequency range. These spectral energies of the different channels are compared with the total spectral energy of all the channels.

In the channels in which in a part of the frequency range the spectral energy drops below a predetermined fraction of the total spectral energy of all the channels in this part, the value 0 is associated with the corresponding spectral components. This method is then particularly advantageous if the number of bits used for the transmission is adapted to the value of the spectral components to be transmitted. The desired data saving then occurs, because zeros can be transmitted with a particularly low number of bits.

According to claim 9 the method is used on individual spectral components. Thus, in individual channels, prior to transmission it is possible to remove selected individual spectal components from the overall spectrum, which would in any case not be perceived by the psychoacoustic effect of masking.

In the method characterised in claim 10 signals from two acoustic channels are transmitted, which are formed by forming a matrix from the stereo signals. This method is particularly effective if by the forming of a matrix according to claim 11 a middle/side encoding is brought about. Particularly in the case of stereo signals, which are characterised by a high spectral similarity of the two channels, with middle/side encoding different spectral energies occur in the middle anc .n the side channel. In this case small frequency coded values in the side channel can be replaced by zero without subjectively perceivable interference occurring. However, the method is also useable for the middle

channel, if the side channel has a sufficiently high spectral energy compared with the middle channel.

Advantageous rules for the selection of spectral values which are set at zero are given in claims 12 and 13. Whereas according to claim 12 in each case individual values of the spectral components are used for determining the spectral energies, the method according to claim 13 operates with pairs of spectral values. This method is advantageously used if, for transmission purposes, use is made of a two-dimensional coding, in which pairs of adjacent spectral values are jointly coded. Obviously the instruction given can also be extended to multidimensional coding methods.

The threshold factor k essential for the selection of spectral values set at zero, is a freely determinable factor, which is empirically optimised.
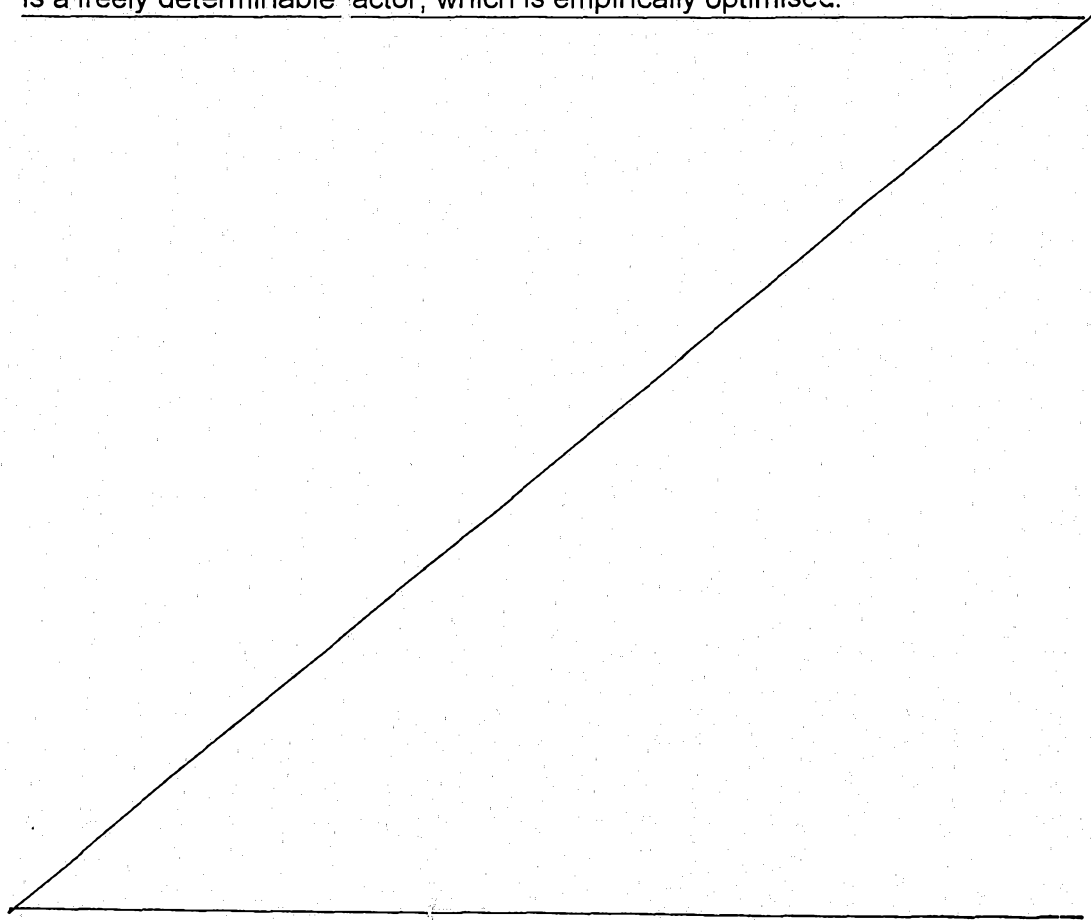
According to claim 14 different threshold factors are determined for different frequency ranges, so that better account is taken of the characteristics of the human ear.

When transmitting digital audio signals generally a psychoacoustic model is used for calculating a masking threshold. As the masking threshold is a measure of which components of an acoustic signal can be perceived by the human ear, according to claim 15 the threshold factor is derived from the masking threshold. The masking threshold is a time-variable quantity, which is continuously adapted to the threshold factor. This method makes it possible to obtain an optimum data reduction with respect to the perceivability in the decoded signal. In the case of particularly critical frequency ranges with tonal components, there is a conservative treatment of the frequency-coded values, whereas selected individual spectral components lines are removed from the spectrum in non-critical areas.

The essential advantages of the invention are that without significantly increasing the complexity of the transmission process an additional data reduction is obtained. The method according to the invention is independent of the specific construction of the coding method used and can therefore be employed in a universal manner.

The method merely requires an additional signal processing in the encoder coder, whereof only small numbers are required, on the transmitter side, but not in the decoder, which is used in large numbers by the final consumer.

BRIEF DESCRIPTION OF THE DRAWINGS
An embodiment of a method according to the invention is described in greater detail hereinafter with reference to the drawings, wherein show:
Fig. 1   A block circuit diagram of a method according to the invention:
             a) encoding
             b) decoding.

MANNER OF PERFORMING THE INVENTION
The time signals of a left-hand stereo channel L and a right-hand stereo channel R are transformed transferred into the frequency range in analysis filter banks 1a, 1b and for this purpose several methods are available such as FFT, DCT, MDCT, polyphase filter bank, hybrid filter bank, etc.

A coding matrix (stage 2) is used on the signals transformed in the frequency range and this permits a common encoding of the two channels. In the present embodiment middle/side encoding is used.

In stage 3, data reduction takes place by eliminating certain frequency ranges. In the side channel or in the middle channel, in frequency ranges in which the signal has a comparatively low spectral energy, corresponding spectral components are set to zero. The signals are then encoded in a two-channel audio data encoder, stage 4, e.g. an entropy encoder and transformed with the aid of a multiplexer into a bit stream.

To control the middle/side encoding, the elimination of the frequency ranges and the audio data encoding, the input signals undergo a further analysis. With the aid of a psychoacoustic model in a stage 6 the masking threshold is calculated, this being decisive for the audio data encoding of stage 4. From the masking threshold is derived a threshold factor as a condition for which spectral components in which frequency ranges in stage 3 are set to zero.

By means of the spectral spacing of the signals in the two channels, determination takes place in stage 5 as to whether there is to be a middle/side encoding for a selected signal portion by using the coding matrix stage 2. If in the selected signal portion the spectral similarity of the data is too low, in stage 2 no middle/side encoding takes place and instead both channels are separately encoded. The bit stream formed in the encoder is transmitted to the decoder, whose construction is shown in Fig. 1b.

In the decoder and in stage 7 the bit stream is decoded and subsequently in stage 8 from the middle/side-encoded signals the signals of the left and right channels are formed, which in the synthesis filter banks 9a, 9b are transformed back from the frequency range into the time range.
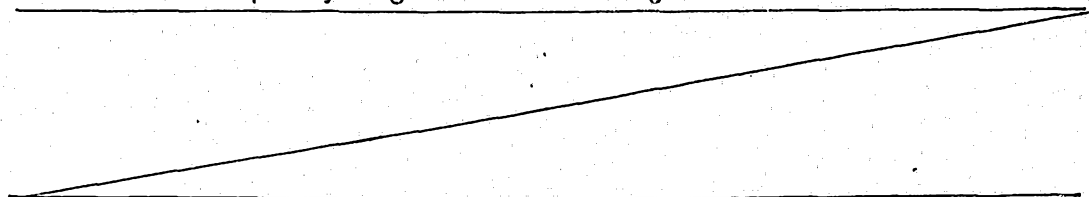
METHOD FOR REDUCING DATA IN THE TRANSMISSION AND/OR STORAGE OF DIGITAL SIGNALS OR SEVERAL DEPENDENT CHANNELS

C L A I M S

1.   Method for reducing data during the transmission and/or storage of digital signals from N dependent channels, in which sampled signals from the time range are transformed blockwise into the frequency range into spectral components, which are encoded, transmitted and/or stored, decoded and transformed back into N channels in the time range, characterised in that from the values of the spectral components of corresponding blocks of the different channels is determined a quantity, which is a measure for the spectral distance between signals of the different channels, and is compared with a predetermined threshold and that on dropping below the threshold there is a common encoding of the signals from the different channels.

2.   Method according to claim 1, characterised in that the spectral distance between the signals of different channels is determined from corresponding parts of the frequency range of the signals.

3.   Method according to claim 1 or 2, characterised in that signals from two acoustic stereo channels are transmitted and that the condition for the common encoding of the signals is described by the following rule

$$SD/SE < c,$$

in which SD is a measure for the spectral distance between the signals from the right and left stereo channels and is formed according to the following instruction:

$$SD = \sum_{i=f1}^{f2-1} \left| |L_i/LR\_RATIO|^n - |R_i|^n \right|$$

in which L_i or R_i are the coefficients of the left or right stereo channel frequency-encoded with the block length IBLEN, n is a freely selectable integer number and f1 and f2
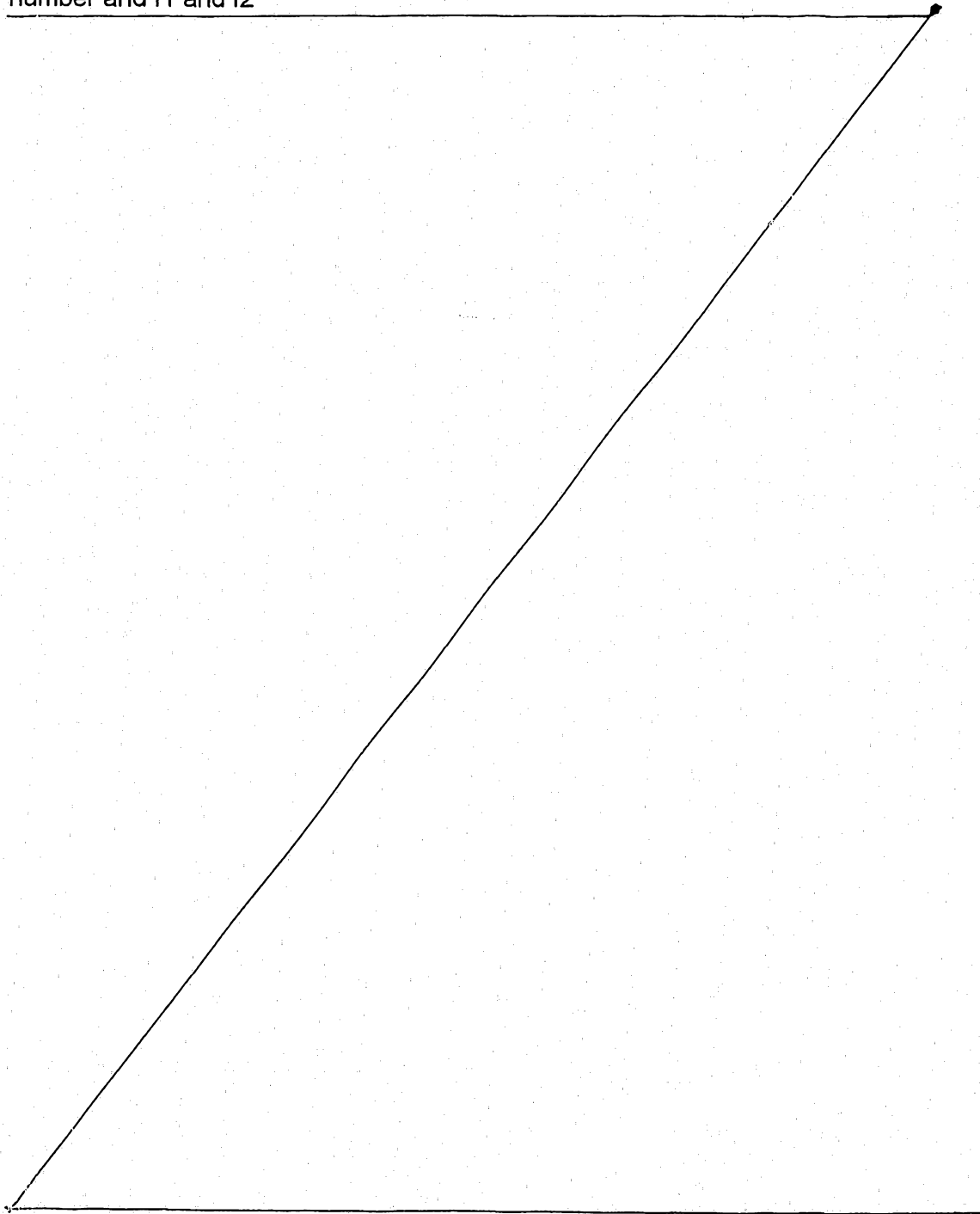
are the index limits of the considered frequency interval, the quantity LR_RATIO is the ratio of the signal quantities of the left to the right channel and SE the spectral energy of the stereo signal and which is formed according to the following instruction:

$$SE = \sum_{i=f1}^{f2-1} \left| |L_i|^n + |R_i|^n \right|$$

and c is a predeterminable threshold constant with $0 < c < 1$.

4.   Method according to claim 3, characterized in that the measure for the spectral distance SD is formed according to the following instruction:

$$SD = \sum_{i=f1}^{f2-1} \left| \left(|L_i / LR\_RATIO| - |R_i| \right) \right|^n$$

5.   Method according one of the claims 3 or 4, characterized in that the threshold constant c is chosen between 0.5 and 1.

6.   Method according to any one of the claims 3 to 5, characterized in that the common encoding takes place by a middle/side encoding and the quantity LR_RATIO is set at 1.

7.   Method according to any one of the claims 3 to 5, characterized in that the common encoding takes place by a intensity stereo encoding and for the quantity LR_RATIO the following applies:

$$LR\_RATIO = \sqrt[n]{\frac{\sum_{i=f1}^{f2-1} |L_i|^n}{\sum_{i=f1}^{f2-1} |R_i|^n}}$$

8.   Method according to the preamble of claim 1, characterised in that from the value of the spectral components of corresponding parts of the frequency range of the different channels, quantities are determined which represent a measure for the spectral energy of these parts of the frequency range, that these quantities for the different channels are compared with the spectral energy of all the channels in these parts of the frequency range and that in parts of the frequency range in which the spectral energy in individual channels drops below a predeterminable fraction of the total energy of all the channels, the corresponding value of the spectral components of the part of the frequency range are set at zero.

9.   Method according to claim 8, characterised in that individual values of the spectral components from the different channels are used for determining the spectral energy.

10.   Method according to claim 8, characterised in that signals from two acoustic channels are transmitted which are formed by forming a matrix of the signals of a left and a right channel of a stereo signal.

11.   Method according to claim 10, characterised in that the forming of a matrix is a middle/side encoding.

12.   Method according to claim 11, characterised in that spectral values S_i in the difference channel ($S_i = L_i - R_i$) or in the sum channel ($S_i = L_i + R_i$) are replaced by the value zero in accordance with the following instruction:

if $|S_i|^n < k^*(|L_i|^n + |R_i|^n)$,

then $S_i := 0$

in which L_i or R_i are the coefficients of the left or right stereo channel frequency encoded with the block length IBLEN, n is a freely selectable integer number and k is an appropriately chosen threshold factor, i running from 0 to the block length IBLEN (exclusively).

13. Method according to any one of the claims 8 to 11, characterised in that for determining the spectral energy use is made of corresponding pairs of sampled data from the time domain signal and the spectral values S_{2i} and S_{2i+1} in the difference channel or in the sum channel are set to the value zero according to the following instruction:

if $\quad |S_{2i}^{n} + S_{2i+1}^{n}| < k*(\ |L_{2i}|^{n} + |R_{2i}|^{n} + |L_{2i+1}|^{n} + |R_{2i+1}|^{n}),$

then $\quad S_{2i} = 0$ and $S_{2i+1} := 0,$
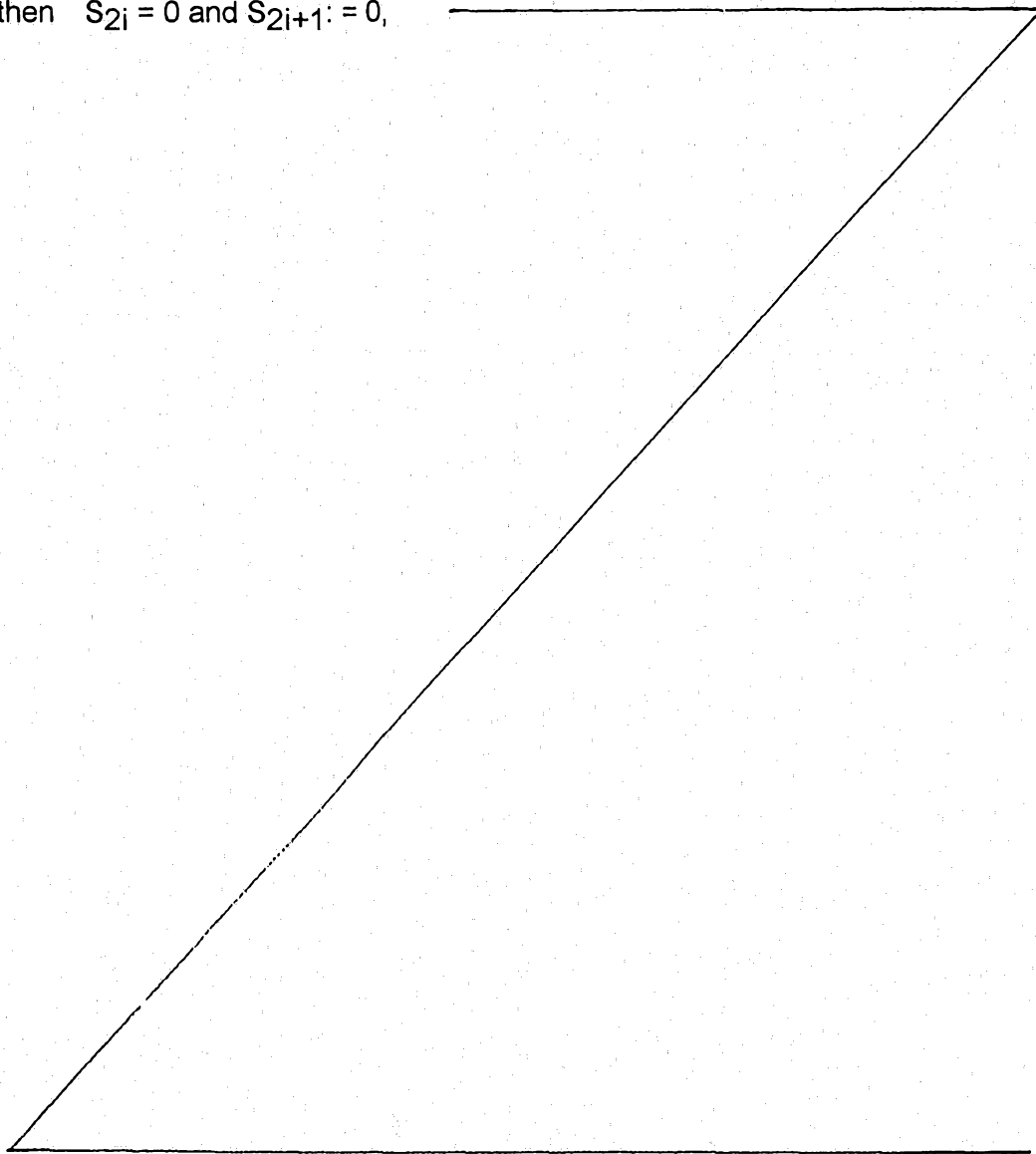
in which the index i runs from zero to half the block length IBLEN (exclusively).

14.　　　　Method according to one of the claims 12 or 13, characterized in that the threshold factor k is chosen differently in different frequency ranges.

15.　　　　Method according to any one of the claims 12 to 14, characterized in that in encoding the spectral $\wedge$ ~~values~~ *components*, use is made of a psychoacoustic model for the calculation of a masking threshold and the threshold factor k is derived $\wedge$ ~~in~~ *an* adaptive manner from this masking threshold.

METHOD FOR REDUCING DATA IN THE TRANSMISSION AND/OR STORAGE OF DIGITAL SIGNALS OF SEVERAL DEPENDENT CHANNELS

A B S T R A C T

A method for reducing data during the transmission and/or storage of the digital signals of several dependent channels is described.

The dependence of the signals in the channels, e.g. in a left and a right stereo channel, can be used for an additional data reduction. Known methods such as middle/side encoding or the intensity stereo process lead to perceptible interference in the case of an unfavourable signal composition.

The method according to the invention avoids such interference, in that a common encoding of the channels only takes place if there is an adequate spectral similarity of the signals in the two channels.

With the aid of the method according to the invention an additional data reduction can be achieved in that in those frequency ranges where the spectral energy of a channel does not exceed a predeterminable fraction of the total spectral energy, the associated spectral components are set to zero.

As the method is independent of the specific internal form of the encoding method, it is universally usable.
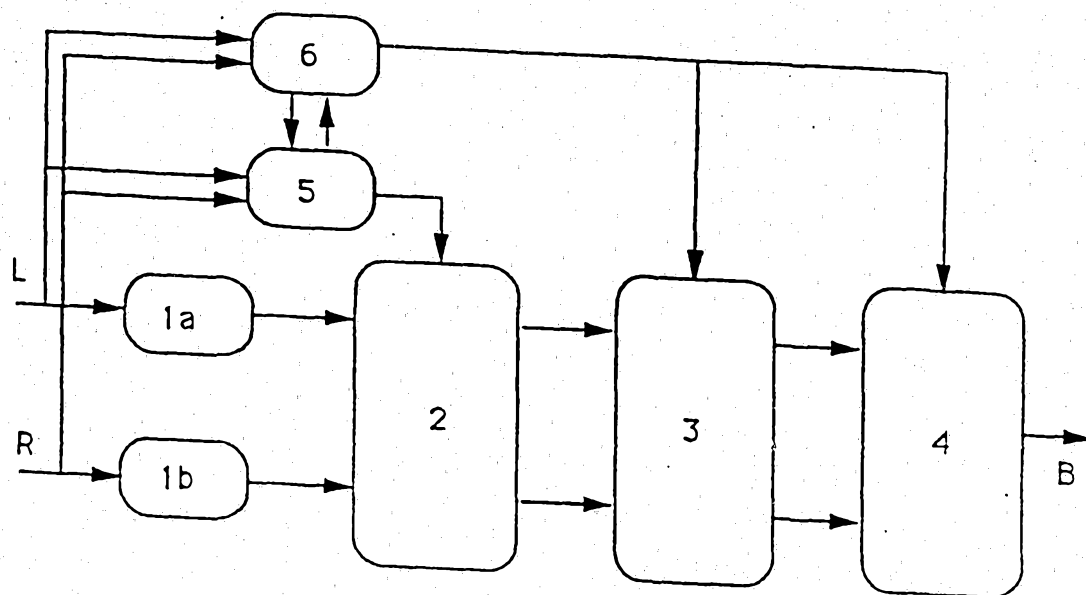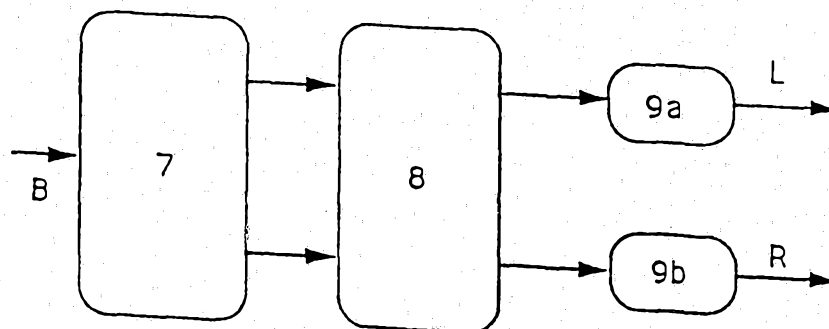
27599/92

a

b

Fig. 1

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl.⁵ H04S1/00; H04H1/00; H04B1/66; G11B20/00
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)
Int.Cl.⁵ H04S; H04H; H04B; G11B
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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	ICASSP 91 Toronto, Ont., Canada, 14 May 1991 vol. 5, pages 3601-3604, R.G. VAN DER WAAL et al. : "Subband Coding of Stereophonic Digital Audio Signals" cited in the application see the whole document	1

A	ICASSP 89 ; Glasgow , Scotland 23 May 1989 ; vol. 3, pages 1993 -1996 J.D. JOHNSTON : " Perceptual Transform Coding of Wideband Stereo Signals " cited in the application see the whole document	1

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

* Special categories of cited documents:	"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
"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	"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
"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)	"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
"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	"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 February 1993 (02.02.93)	16 February 1993 (16.02.93)

Name and mailing address of the ISA/	Authorized officer
European Patent Office	
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	ICASSP 89 ; Glasgow , Scotland 23 May 1989 ; vol. 3 , pages 2009 - 2012 R.N.J. VELDHUIS et al.: " Subband Coding of Digital Audio Signals Without Loss of Quality " see chapter 3 and chapter 4 ---	1
A	WO,A,9 016 136 (BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY) 27 December 1990 see claims -----	1

DE 9200869
SA   65644

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international 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.   02/02/93

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-9016136	27-12-90	AU-A-	5837990	08-01-91
		EP-A-	0478615	08-04-92
		JP-T-	4506141	22-10-92

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

I. KLASSIFIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)[6]

Nach der International.:len Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

Int.Kl. 5 H04S1/00;   H04H1/00;   H04B1/66;   G11B20/00

II. RECHERCHIERTE SACHGEBIETE

Recherchierter Mindestprüfstoff [7]	
Klassifikationssytem	Klassifikationssymbole
Int.Kl. 5	H04S ; H04H ; H04B ; G11B

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese
unter die recherchierten Sachgebiete fallen [8]

III. EINSCHLAGIGE VEROFFENTLICHUNGEN [9]

Art.°	Kennzeichnung der Veröffentlichung [11], soweit erforderlich unter Angabe der maßgeblichen Teile [12]	Betr. Anspruch Nr. [13]
A	ICASSP 91 Toronto, Ont., Canada, 14. Mai 1991, Band 5, Seiten 3601-3604, R.G. VAN DER WAAL et al. : "Subband Coding of Stereophonic Digital Audio Signals " in der Anmeldung erwähnt siehe das ganze Dokument ---	1
A	ICASSP 89 ; Glasgow , Schottland 23. Mai 1989 ; Band 3 , Seiten 1993 – 1996 J. D. JOHNSTON : " Perceptual Transform Coding of Wideband Stereo Signals " in der Anmeldung erwähnt siehe das ganze Dokument --- -/--	1

° Besondere Kategorien von angegebenen Veröffentlichungen [10] :

"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist

"E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist

"L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt)

"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht

"P" Veröffentlichung, die vor dem internationalen Anmeldedatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist

"T" Spätere Veröffentlichung, die nach dem internationalen Anmeldedatum oder dem Prioritätsdatum veröffentlicht worden ist und mit der Anmeldung nicht kollidiert, sondern nur zum Verständnis des der Erfindung zugrundeliegenden Prinzips oder der ihr zugrundeliegenden Theorie angegeben ist

"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden

"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist

"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
02.FEBRUAR 1993	1 6. 02. 93
Internationale Recherchenbehörde	Unterschrift des bevollmächtigten Bediensteten
EUROPAISCHES PATENTAMT	Gastaldi G. L.

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III. EINSCHLAGIGE VEROFFENTLICHUNGEN (Fortsetzung von Blatt 2)		
Art °	Kennzeichnung der Veröffentlichung, soweit erforderlich unter Angabe der maßgeblichen Teile	Betr. Anspruch Nr.
A	ICASSP 89 ; Glasgow , Schottland 23. Mai 1989 ; Band 3 , Seiten 2009 - 2012 R. N. J. VELDHUIS et al. : " Subband Coding of Digital Audio Signals Without Loss of Quality " siehe Kapitel 3 und Kapitel 4 ---	1
A	WO,A,9 016 136 (BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY) 27. Dezember 1990 siehe Ansprüche -----	1

ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT
ÜBER DIE INTERNATIONALE PATENTANMELDUNG NR.

DE 9200869
SA 65644

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

02/02/93

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
WO-A-9016136	27-12-90	AU-A-	5837990	08-01-91
		EP-A-	0478615	08-04-92
		JP-T-	4506141	22-10-92

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