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D E C I S I O N
of 6 July 2000

Case Number: T 0994/98 - 3.5.1

Application Number: 89902408.7

Publication Number: 0398973

IPC: H04B 1/66

Language of the proceedings: EN

Title of invention:
Method and apparatus for electrical signal coding

Patentee:
AUDIO PROCESSING TECHNOLOGY LIMITED

Opponent:
Koninklijke Philips Electronics N.V.

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0994/98 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 6 July 2000

Appellant: (Opponent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 19 August 1998 rejecting the opposition filed against European patent No. 0 398 973 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: P. K. J. van den Berg
Members: R. S. Wibergh
S. C. Perryman

Summary of Facts and Submissions

I. This is an appeal against the decision of the Opposition Division to reject the opposition against European Patent No. 0 398 973.

II. Claim 1 as granted reads as follows:

"A method of electrical signal coding comprising the steps of sampling the signal at repeated intervals, filtering each sample into at least two frequency sub-bands, coding the signal in each band by means of a linear prediction technique and quantizing each sub-band with a varying number of levels according to its signal variance, characterized in that the signal frequency range is 0-24 kHz and in that the energy in past inverse quantized samples is used to adjust the range for the next sample both at a receiver and a transmitter".

Independent claim 4 is directed to an apparatus for the coding of an electrical signal.

III. The opponent had opposed the patent on the grounds that the subject-matter of the patent extended beyond the content of the application as filed (Article 100(c) EPC) and that the invention was not new or did not involve an inventive step (Article 100(a) EPC). Among the documents cited were:

D1: Crochiere, "Sub-Band Coding", Bell System Technical Journal, Vol. 60, No. 7, September 1981, pages 1633 to 1653, and

D6: Jayant et al. "Digital coding of waveforms",

Prentice-Hall, New Jersey, 1984, pages 188 to 199.

IV. According to the decision under appeal all the subject-matter in the patent was disclosed in the original application and the invention was new and inventive when compared with the prior art known from D1 and the other documents cited by the appellant.

V. The opponent (appellant) lodged an appeal against this decision.

VI. On 18 April 2000 the Board summoned the parties to oral proceedings.

VII. With letter dated 23 June 2000 the respondent informed the Board that he would not be present at the oral proceedings. Referring to the independent claims he furthermore proposed to amend the upper limit of the claimed frequency range from 24 kHz to 22 kHz, a value mentioned in the description.

VIII. Oral proceedings before the Board were held on 6 July 2000. Only the appellant was represented. The appellant argued that the feature on which the Opposition Division had concentrated in its decision, viz. the use of the energy in past inverse quantized samples to adjust the range for the next sample, was disclosed in D6. The appellant furthermore maintained that the feature concerning the signal frequency range had no proper support in the application as filed.

IX. The appellant requested that the decision under appeal be set aside and that the patent be revoked.

X. The respondent had requested in writing that the appeal

be dismissed and the patent be maintained.

Reasons for the Decision

1. The invention according to claim 1 is a method of coding a signal. The signal is sampled and filtered into sub-bands. In each sub-band the signal is quantised. The quantisation range is determined using the energy in past inverse quantised samples. The purpose of the method is to transmit signals containing high frequencies, such as high quality music data, at low bit rates, for example over an ISDN channel.

2. The appellant has invoked the grounds for opposition mentioned in Article 100(a) and Article 100(c) EPC. As will be detailed further below, the Board has come to the conclusion that the invention as claimed does not involve an inventive step and that for this reason the patent has to be revoked. There is thus no need to examine whether any subject-matter of the patent extends beyond the content of the application as filed.

3. The parties do not agree how to interpret the feature in claim 1 which states that "the signal frequency range is 0-24 kHz". The respondent has declared that the examples described in the patent support the range claimed. These examples relate to signals limited to 16 kHz and to 22 kHz. This suggests that the respondent regards the range 0-24 kHz in claim 1 as an interval within which the signal range should lie, or in other words that the spectrum of the signal need not extend over the entire interval. With such an interpretation, however, the claim would also cover known, smaller ranges, such as 0-4 kHz.

For the sake of the present decision the feature in question will be understood in as limited a sense as possible, namely as relating to a signal whose spectrum covers the whole range 0-24 kHz. It will be held that even with this comparatively restricted interpretation of claim 1 the invention lacks an inventive step. Therefore the question whether the definition of the frequency range in claim 1 is in fact wider need not be resolved.

4. *The prior art*

4.1 D1

D1 relates to coding of speech or audio signals. Sub-band techniques are used. In each sub-band an adaptive step-size quantiser is used to adjust the range for a sample as a function of the previous code word output by the quantiser. The frequency range of the input signal typically corresponds to the telephone band 200-3200 Hz, but ranges up to 7 kHz are also mentioned.

4.2 D6

D6 is an extract from a textbook concerning coding of speech and video signals. The cited chapter describes adaptive quantisation. In the introductory part (page 190) it is said that the quantiser step size - which determines the range for the samples - should in principle be adapted to changing input variance but that corresponding estimates can often be derived "from observation on the quantiser output y(n)" (page 191). According to equation 4.179b on page 196 the step size is a function of the squares of previous values y(n)

referred to as "samples of the quantizer output" (page 191, bottom) or just "quantizer output". According to Figure 4.41, y(n) is equal to the output of the decoder in the receiver, ie the final output of a transmission system consisting of a transmitter (encoder), a channel and a receiver (decoder). This figure also shows "level estimators", one in the transmitter and one in the receiver, for setting the quantiser step size. The inputs of the level estimators are illustrated as being directly connected to the channel.

5. *Novelty*

It is not disputed that the invention is new.

6. *Inventive step*

6.1 According to the decision under appeal, point 3.2, the respondent has agreed that the preamble of claim 1 is known from D1. In the appeal proceedings the respondent has not challenged this statement, and in fact all the arguments put forward by the respondent relate to the characterising features of the claim. The Board therefore assumes that the preamble of claim 1 corresponds to prior art.

6.2 Claim 1 requires that "the energy in past inverse quantized samples is used to adjust the range for the next sample both at a receiver and a transmitter". According to the appellant this feature is known from D6. The respondent denies that this is the case.

The Board agrees with the appellant on this point. It is clear from D6 that the variance (energy) of the

input samples should be used to set the step size, and that instead of the input samples one may use the output samples y(n) from the quantiser. This means that the energy of the output samples are approximately equal to the energy of the input samples, ie that y(n) denotes the quantised signal representing the input signal and not the binary words transmitted over the channel. These words contain no information about the quantisation step and therefore could not serve to represent the amplitude or the energy of the input samples. In order to convert a word to the corresponding sample value it is necessary to take the step size into account. It is this operation which is referred to as "inverse quantisation" in the patent-in-suit.

The conclusion that the series y(n) represents output **samples** (amplitude values) rather than output **words** (numbers) is consistent with Figure 4.41 in that y(n) is illustrated as being the output of the receiver, which signal should naturally correspond to the signal entering the transmitter.

The respondent, however, has pointed out that this same figure shows no inverse quantiser in the branch going from the channel to the level estimator (in the transmitter and in the receiver). The respondent concludes from this fact that in D6 the range is set using words which have **not** been subjected to inverse quantisation.

The Board finds that the respondent's objection relies too heavily on a (schematic) drawing and does not take the given (exact) equations sufficiently into account. As already mentioned, equation 4.179b indicates that

the quantised samples are used for setting the step size. It follows that inverse quantisation must be assumed to take place within the "level estimators" shown in Figure 4.41. This appears to be the only interpretation which makes technical sense, and therefore it is the one the skilled man would choose.

For these reasons D6 is regarded as disclosing the feature that the energy in past inverse quantized samples is used to adjust the range for the next sample both at a receiver and the transmitter. D6 being a standard text-book on coding, this kind of range adjustment was an obvious alternative to the one disclosed in D1.

6.3 Claim 1 further provides that "the signal frequency range is 0-24 kHz". As indicated above, for the purpose of the present decision this feature will be regarded as limiting the claimed method to the application to signals having frequency components up to 24 kHz.

The description mentions the advantages of a method permitting a high-quality audio signal to be coded and transmitted at a low bit rate. It is stated that "surprisingly high quality digital audio can be represented by split band ADPCM words approaching one quarter that of linear PCM, and still remain essentially indistinguishable". The respondent has moreover submitted that the invention has now been successfully exploited for many years.

The Board, however, cannot accept that it was inventive to propose to use a method which was as such obvious (see the preceding paragraph) with signals having this relatively large frequency range. It is true that D1

deals with signals having a bandwidth not exceeding 7 kHz. Still, the mere **wish** to be able to transmit (any) signal with acceptable quality using the lowest possible bit rate must be regarded as always obvious since all communication channels have limited capacity. The fact that the authors of D1 have concentrated on speech signals does not mean that they would not have considered signals of a higher frequency. It is said in D1, page 1633, that "in the past many of these techniques /ie digital encoding of speech and audio/ have only been implemented by non-real-time computer simulations or with the aid of highly specialized digital hardware". These constraints are of a practical rather than fundamental nature and would disappear in the course of time. It seems that once data processing at higher rates became available the most natural way to deal with high-frequency signals was to try the methods which had already proved to work at lower frequencies.

Also the addition of this feature was therefore obvious.

6.4 It follows that the subject-matter of claim 1 does not involve an inventive step.

7. The respondent has proposed, without making a formal request, to change the value of 24 kHz in claim 1 to 22 kHz. It should however be clear from the foregoing that such an amendment would be of no importance for the Board's assessment of the inventive activity.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

M. Kiehl P. K. J. van den Berg