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D E C I S I O N
of 6 February 1995

Case Number: T 0953/93 - 3.5.2

Application Number: 89300189.1

Publication Number: 0324584

IPC: H03M 3/04

Language of the proceedings: EN

Title of invention:
Predictive coding device

Applicant:
CANON KABUSHIKI KAISHA

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - yes, after amendment"

Decisions cited:
-

Catchword:
-

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Case Number: T 0953/93 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 6 February 1995

Appellant: CANON KABUSHIKI KAISHA
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Tokyo (JP)

Representative: Beresford, Keith Denis Lewis
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 27 May 1993 refusing European patent application No. 89 300 189.1 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: R. E. Persson
Members: W. J. L. Wheeler
A. G. Hagenbucher

Summary of Facts and Submissions

I. The Appellant contests the decision of the Examining Division to refuse European patent application No. 89 300 189.1. The reason given for the refusal was that the subject-matter of the claims then on file did not involve an inventive step, having regard to the following prior art:

D2: EP-A-117 525

D3: T.J. Stonham, "Digital Logic Techniques", Tutorial Guides in Electronic Engineering, Part 6, pages 103 to 108, 1984, Van Nostrand Reinhold (UK)

D4: U. Tietze, Ch. Schenk, "Halbleiter-Schaltungstechnik", pages 486 to 493 and 517 to 525, 1980, Springer Verlag.

II. On 6 January 1995, the Appellant submitted new claims and adapted pages of the description to replace those previously on file and requested deletion of Figure 6 of the drawings.

III. Claim 1 is now worded as follows:

"1. A high-definition television image data processing apparatus having at least one device for coding said image data, which device comprises:

(i) predictive coding means for providing:

(a) a coded value (Yi) representing the result of quantising the difference between an input value (Xi) and a predicted value ($\hat{X}i$); and

(b) a local decoded value ($\bar{X}i$) corresponding to the input value (Xi), representing the result of adding the predicted value ($\hat{X}i$) and a decoded difference corresponding to the coded value (Yi); and

(ii) predictor means (7, 16, 37) for receiving the local decoded value ($\bar{X}i$) and outputting the predicted value ($\hat{X}i$),

characterised in that

the predictive coding means (9) comprises memory means (12, 39) receiving the input value (Xi) and the predicted value ($\hat{X}i$) as address inputs and acting as a look-up table to provide the coded value (Yi) and the local decoded value ($\bar{X}i$) as outputs from a common memory."

Claims 2 to 6 are dependent on Claim 1.

IV. The Appellant argued essentially that, as explained on pages 2 and 3 of the present application as filed, it had previously been necessary to use a large number of processing circuits operating in parallel in order to cope with the high sample rates in high-definition television (HDTV) signals. As explained on page 8 of the application as filed, the apparatus as set out in Claim 1 required fewer parallel processing paths. The pixels for one processing path were closer together, and their values more closely correlated, allowing more accurate prediction and more efficient coding.

V. The Appellant requests that the decision under appeal be set aside and a patent granted on the basis of the application in its present form, namely:

Claims 1 to 6, filed 6 January 1995;

Description: pages 2, 3, 7 to 14 and 17, originally filed; pages 4 and 5A, filed with letter of 23 November 1992, received 25 November 1992; and pages 1, 5, 6, 15 and 16, filed 6 January 1995; with the amendments to pages 3, 8, 11 to 14 and page 15, line 2, requested in the letter of 23 November 1992;

Drawings: Figures 1 to 3 as originally filed; and Figures 4 and 5, filed with the letter of 23 November 1992.

Reasons for the Decision

1. The appeal is admissible.

2. In the appeal proceedings, the claims have been restricted to a high-definition television image data processing apparatus having at least one device for coding image data. The features recited in the claims were all disclosed in combination in the application documents as originally filed. In the opinion of the Board, the present form of the application does not infringe Article 123 (2) EPC.

3. None of the cited prior art documents discloses a high-definition television image data processing apparatus comprising all the features recited in Claim 1. Thus, the subject-matter of the independent claim is novel within the meaning of Article 54 EPC.

4.1 The present application relates to a data processing apparatus for coding high-definition television (HDTV) image data using a predictive coding method, such as differential pulse-code modulation (DPCM), in which

advantage is taken of correlations between adjacent sampled values to reduce the number of bits in the coded signal.

4.2 The preamble of Claim 1 is based on conventional prior art as acknowledged in the description with reference to Figure 1 of the patent application. Document D2 shows, inter alia, a coding device for DPCM (fig. 1) which comprises predictive coding means and predictor means as specified under (i) and (ii) in the preamble of Claim 1 and discloses that the quantiser in the predictive coding means is implemented as a ROM. However, this document does not mention any application in a HDTV image data processing apparatus.

4.3 As explained in the description on page 3, when HDTV signals are coded, it is impossible to complete all the arithmetic operations required for predictive coding within a single processing loop in real time, so that the image data have to be processed by a number of parallel paths depending on the sampling frequency and the speed of the processing circuitry. Since the accuracy of the predictions, and therefore the efficiency of predictive coding, depends upon the correlation between successive pixel values which are processed in each path and this correlation decreases as the number of parallel paths increases, the efficiency and accuracy of a HDTV image data processing apparatus is limited by the number of parallel paths required. For the case of a HDTV sampling frequency of 48.6 MHz., an image data processing apparatus comprising DPCM devices implemented with state-of-the-art high-speed TTL-ICs and PROMs would require nine parallel processing paths (see description of the present application, page 3). Each path would therefore perform predictive coding for pixels separated in the television image by eight other pixels.

4.4 Starting from the acknowledged prior art, the problem addressed in the present application can be defined as to provide a processing apparatus for HDTV image data which has improved predictive coding and can be easily implemented. According to the present application, the above problem is solved by an apparatus as specified in Claim 1.

4.5 The gist of the invention consists in implementing all the logic and arithmetic operations required for predictive coding in a memory in the form of a look up table. Because of the increase in speed of a look up table compared with logic circuits, a processing apparatus for HDTV image data according to the present invention may comprise fewer parallel processing paths (four instead of nine, as explained on page 8 of the application). This results in a closer correlation between the pixels processed by each parallel path, yielding a more accurate prediction and a more efficient coding. Also the distributing and multiplexing circuitry required is simpler than in the conventional prior art devices.

4.6 None of the cited prior art documents deals specifically with the problem of increasing the efficiency of predictive coding in a HDTV image data processing apparatus. From D3 and D4 it is known that a memory circuit can be programmed to perform a sequential logical function, and that a RAM, a ROM or a PROM may be used for this purpose. However, D2 and D4 recommend avoiding excessive memory requirements by storing in the memory a table of values corresponding to only a part of the required logical function and deriving the values for the remaining parts of the function by simple arithmetic operations and therefore point away from the present invention.

4.7 Although it may be argued that, because of the rapid development in the memory art which took place in the period between the publication date of the cited prior art documents and the priority date claimed for the present application, the skilled person would probably not have considered the amount of memory required for a complete look up table as used according to the present invention as excessive, the cited prior art does not hint at any possible advantage which may be obtained by substituting a look up memory for all the circuitry otherwise required to implement a function for predictive coding involving logic operations and simple arithmetic operations, such as additions and subtractions (cf. adder 5 and subtractor 2 in the prior art circuit shown in Figure 1).

4.8 Moreover, in the opinion of the Board, the reduction in the number of parallel processing paths required to process HDTV image data which is made possible by the increased processing speed of the apparatus according to the present invention, and consequentially the closer correlation between the pixels processed by any one path, should not be regarded as a mere "bonus" resulting from an obvious replacement of logic circuits by an "equivalent" look up table stored in a memory. It represents an improvement over the prior art of considerable technical value, which the skilled person without inventive imagination would not have expected in the light of the cited prior art and the common general knowledge in the art (cf. Guidelines, part C, chapter IV, 9.9).

4.9 On balance, the Board considers that only with the benefit of hindsight would it seem to be obvious to the skilled person addressing the problem of improving the predictive coding of HDTV image data to use a look up memory to implement the logic function involved in the

predictive coding of HDTV image data and, thus, arrive at an apparatus falling within the terms of Claim 1. Hence, the subject-matter of Claim 1 involves an inventive step within the meaning of Article 56 EPC.

4.10 The subject-matter of Claims 2 to 6, which are dependent on Claim 1, also involves an inventive step.

5. In the opinion of the Board, the amended application documents meet the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent in the version requested by the Appellant (see paragraph V above), namely:

Claims 1 to 6, filed 6 January 1995;

Description: pages 2, 3, 7 to 14 and 17, as originally filed; pages 4 and 5A, filed with letter of 23 November 1992, received 25 November 1992; and pages 1, 5, 6, 15 and 16, filed 6 January 1995; with the amendments to pages 3, 8, 11 to 14 and page 15, line 2, requested in the letter of 23 November 1992;

Drawings: Figures 1 to 3 as originally filed; and Figures 4 and 5, filed with the letter of 23 November 1992.

The Registrar:

M. Kiehl

The Chairman:

E. Persson