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**BOARDS OF APPEAL OF  
THE EUROPEAN PATENT  
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**D E C I S I O N  
of 29 June 1995**

**Case Number:** T 0521/93 - 3.5.1

**Application Number:** 86902906.6

**Publication Number:** 0222918

**IPC:** H04N 13/00

**Language of the proceedings:** EN

**Title of invention:**

System for transferring three-dimensional TV images

**Applicant:**

NIPPON HOSO KYOKAI

**Opponent:**

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**Headword:**

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**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step (no) "

**Decisions cited:**

T 0170/87

**Catchword:**

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Case Number: T 0521/93 - 3.5.1

**D E C I S I O N**  
**of the Technical Board of Appeal 3.5.1**  
**of 29 June 1995**

**Appellant:** NIPPON HOSO KYOKAI  
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**Decision under appeal:** Decision of the Examining Division of the European  
Patent Office dated 13 January 1993 refusing  
European patent application No. 86902906.6  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** P. K. J. van den Berg  
**Members:** A. S. Clelland  
C. Holtz

### Summary of Facts and Submissions

- I. The Appellant contests the decision of the Examining Division dated 13 January 1993 refusing European patent No. 86 902 906.6.
- II. The reason given for the refusal was that the subject-matter of Claims 1, 6, 7 and 11 lacked an inventive step having regard to the prior art known from the following documents:

D1: NHK Laboratories Note serial No. 304, September 1984, Ninomiya et al, "A SINGLE CHANNEL HDTV BROADCAST SYSTEM - THE MUSE",

D2: US-A-3 674 921.

On 10 March 1993 the Appellant filed a Notice of Appeal and paid the appeal fee. Cancellation of the entire decision was requested. A statement setting out the grounds of appeal was subsequently filed on 20 May 1993, the Appellant also filing sets of claims of new main and auxiliary requests. Oral proceedings were requested in the event that the Board were unable to allow either request.

- III. In a communication dated 5 October 1994 the Rapporteur, on behalf of the Board, made observations on the clarity of the claims of both requests and took the preliminary view that the subject-matter of Claim 1 of both requests lacked an inventive step having regard to the prior art cited by the Examining Division. In response to this communication the Appellant on 6 February 1995 filed a new, sole, request with revised claims and argued that these claims were clear and that their subject-matter involved an inventive step. In a further communication

on behalf of the Board dated 28 April 1995 the Rapporteur again raised questions of clarity and inventiveness. Oral proceedings were appointed and held on 29 June 1995. Prior to these proceedings, on 24 May 1995, the Appellant filed a new, sole, request with revised claims and argued that these claims were clear.

IV. The application consists of the following documents:

Claims: 1 to 6 as received on 24 May 1995.

Description: pages 2, 3, 7, 23 and 27 as filed 24 May 1995,  
page 5 as filed 22 May 1992,  
pages 1, 4, 6, 8, 16, 17, 20 to 22, 26 as filed 21 November 1991,  
pages 9 to 15, 18, 19, 24, 25, 28, 29 as filed 10 June 1991,

Drawings: sheets 1/17 to 10/17 and 12/17 to 17/17 as published.  
sheet 11/17 as filed 24 May 1995

V. Claim 1 reads as follows:

"1. A stereoscopic television picture transmission system having: on a transmitting side,

means (14, 16) for obtaining a picture signal with respect to one of right and left pictures in stereoscopic television;

means (22) for obtaining a difference signal between a right picture signal for the right picture and a left picture signal for the left picture; and

means (42) for combining said one picture signal with said difference signal to form a combined signal and for transmitting said combined signal; and

on a receiving side,

means (50) for separating said one picture signal and said difference signal from the combined signal thus transmitted; and

means (66) for combining said separated one picture signal with said interframe interpolated difference signal, to obtain the other picture signal of said right and left picture signals;

said system being characterised by comprising:

on said transmitting side,

means (28, 30) for performing sub-Nyquist sampling of said difference signal once every predetermined number of television frames where said predetermined number of television frames is greater than two and is determined as a value equal to or less than a result obtained by dividing the frame frequency by a critical modulation frequency for stereoscopic visual perception of a movement in a direction of depth, at which critical modulation frequency a depth perception sensitivity drops by more than 30dB, to obtain a sampled difference signal; and

on said receiving side,

means (60) for judging motion between frames of said one picture signal thus separated; and

means (62) responsive to a result of judgement of a motion by said judging means for performing interframe interpolation of a difference signal which has been sub-Nyquist sampled by said means for performing sub-Nyquist sampling and separated by said means for separating."

Claim 6 is a further independent claim directed to stereoscopic television picture transmission apparatus having in essence the features of the transmitting apparatus included in Claim 1.

VI. The Appellants' arguments in support of patentability can be summarised as follows:

The correct starting point for the invention is D2, which discloses a stereoscopic television picture transmission system having the features acknowledged in the preamble of Claim 1. D1, on the other hand, is not concerned with stereoscopic television picture transmission but with the MUSE television system for bandwidth reduction. The invention and MUSE rely on differing physiological properties of the human visual system. MUSE is concerned with perceived visual resolution whereas the invention is concerned with visual perception in the depth direction. In MUSE, a trade-off is made between spatial and temporal resolution; sub-Nyquist sampling, so-called sub-sampling, is used to reduce the data rate. In still images the sub-sampling can be used to give a high definition by building up each image over a number of frames, but as during picture motion perceived visual resolution drops whilst a high refresh rate is needed, the images are sub-sampled frame by frame, giving a lower resolution without substantially degrading perceived image quality; the invention on the other hand concerns a stereoscopic system and the sub-sampling is based on the visual depth perception properties of the human eye. The curves in Figure 8 of the application show that depth perception sensitivity drops substantially if the spatial frequency is above a predetermined frequency, 3 Hz for square waves and 5 Hz for sinusoidal waves. The reduction in visual depth perception is in fact more significant than the reduction in visual resolution in two-dimensional moving scenes. A skilled person considering the subsampling principles known from MUSE would not have expected that a signal containing depth information could be

subsampling since, in a stereoscopic system, movement in the depth direction causes only a comparatively small movement in the two-dimensional image.

### **Reasons for the Decision**

#### **1. Amendments to the claims**

1.1 Claims 1 and 6 contain features relating to the sub-Nyquist sampling period. The present claims state that sampling is done "once every predetermined number of television frames where said predetermined number of television frames is greater than two and is determined as a value equal to or less than a result obtained by dividing the frame frequency by a critical modulation frequency for stereoscopic visual perception of a movement in a direction of depth, at which critical modulation frequency a depth perception sensitivity drops by more than 30dB".

1.2 The Board has some difficulty in determining the limits of the range of the "predetermined number"; the value used in the first embodiment of the invention, namely two, has been disclaimed. Since the range has in effect been limited at its lower end, no objection arises under Article 123(2) EPC. It is clear from the description that although two was preferred it is not the only possible predetermined number; values of 4 or 6 (page 18, line 16: "8 fields or 12 fields") are also mentioned. A lower limit of three, although not explicitly supported, would thus appear implicit. The derivation of the maximum value of the "predetermined number" is defined with respect to the physiological properties of the human eye as exemplified by the empirical curves shown in Figure 8 and depends on the

nature of the image being viewed, i.e. whether it contains gradual or sudden spatial transitions ("sine wave" and "square wave" respectively). In the NTSC system, which has a frame rate of 30 Hz, the maximum predetermined number is apparently 6 for gradual transitions and 10 for sudden transitions. It thus appears that the upper limit depends to some extent on the image content.

- 1.3 Be that as it may, even though the upper limit is in the Board's view unclear it has not proved necessary to pursue this since for the reasons given below it would have been obvious for the skilled person to try at least some of the values of predetermined number which clearly do fall within the scope of Claims 1 and 6.

2. *Inventive step*

- 2.1 The present invention is concerned with a stereoscopic television system, i.e. a system which permits depth information to be transmitted and retrieved in addition to the normal two-dimensional picture information. This requires imaging by means of two cameras together with a receiver which permits the information to be transmitted to each eye separately, e.g. by means of colour filters in a monochrome system or polarizing filters in a colour system. Unless some form of bandwidth reduction is used, double the bandwidth of a normal television signal must be transmitted.

It is common ground that before the priority date of the application it was known from D2 to reduce bandwidth by transmitting, instead of the two television signals, a single television signal accompanied by a difference signal.



2.2 The question which would then present itself to the skilled person is whether any further bandwidth compression might be applied to such a composite signal. The minimization of bandwidth is a well-known aim in the telecommunications industry.

2.3 D1 shows an example of a bandwidth compression system, the Japanese MUSE system, which system is described in the application as being "widely used" (original page 29, last paragraph); the Board sees no reason to disagree with this opinion. The MUSE system makes what is in effect a trade-off between spatial and temporal resolution, see point VI above; in a standard television system transmitting a still image the data is sent at a constant rate, even though there is no change in image content from frame to frame. By making use of the properties of the raster scanning of a television signal it is possible to build up an image over, e.g. two frames, by thinning out the number of pixels transmitted in each field to one quarter of their normal number, a different pixel position being transmitted for each field so that over the four fields, or two frames, a pixel is transmitted for each position. This is known as sub-Nyquist sampling. Such a system is however unsatisfactory for moving images, which will exhibit jerky movement, so that it is necessary to transmit an entire image each frame in order to avoid this. Since, however, the bandwidth has been reduced the result is an image of reduced spatial resolution which, as pointed out by the Appellant, is acceptable because of the physiological properties of the human eye. In order for this to be successful some form of motion detection must be incorporated into both the transmitting and receiving equipment.

- 2.4 Turning now to the invention as claimed, the characterising part of Claim 1 is directed to transmitting and receiving apparatus, the transmitting apparatus including means for performing sub-Nyquist sampling at a rate falling within a certain range (see point 1.2 above) and the receiving apparatus including means for judging motion and means for performing "interframe interpolation" of a sub-sampled difference signal, i.e. a reconstruction of the image making use of successive frames. These features are analogous to the sub-Nyquist sampling of the MUSE system.
- 2.5 The Board accordingly considers that the skilled person, faced with the problem of reducing the bandwidth of the D2 system yet further, would find it obvious to try sub-Nyquist sampling as in the MUSE system and, having taken the decision to do so, to experiment with different compression rates in order to achieve optimum bandwidth compression. If he did so it is apparent that he would arrive at values within the claimed range.
- 2.6 The Appellant argues however that at the claimed priority date it would not have been obvious for the skilled person to apply the teaching of the MUSE system as exemplified by D1 to the stereoscopic system using a difference signal known from D2. The reason given is that the claimed range of values for the "predetermined number" is dependent on the properties of the human visual system and is specific to stereoscopic vision, the maximum bandwidth reduction being limited by a critical modulation frequency for stereoscopic visual perception of movement in a depth direction. MUSE, however, does not concern stereoscopic vision and would therefore not be pertinent.

2.7 The Board cannot accept this argument. Although the Appellant has sought to present the invention as arising from the properties of the human visual system, it is clear from the description as a whole that the objective problem to be solved is that of bandwidth reduction. The paragraph bridging pages 2 and 3 of the application as originally filed gives as the primary object of the invention the compression of stereoscopic picture signals onto a conventional TV channel without loss of quality. The skilled person, desiring to reduce the bandwidth of the difference signal in D2 would therefore consider all known forms of bandwidth reduction, including the one employed in the MUSE system. No technical prejudice has been put forward by the Appellant which would speak against the skilled person trying any particular system.

2.8 Having taken the initial step of testing the MUSE bandwidth reduction system, the skilled person would have to determine how much compression could be effected without degrading the perceived image. The Examining Division was of the opinion that suitable compression values could be found by trial and error. The Board shares this view; it appears unrealistic to assume that a key parameter of a new TV system would be selected without carrying out practical tests. The "predetermined number" in Claim 1, which corresponds to the level of compression of the signal, clearly is a key parameter. It would be obvious for the skilled person to try out various levels of compression for screens with different picture content. In the case of three-dimensional TV it appears inevitable that the visual impression of movements in the depth direction would be investigated. By assessing the effect on subjects, the maximal acceptable compression could be determined.

2.9 It is further argued that if the skilled person adapted MUSE to a stereoscopic TV system he would necessarily make use of a "predetermined number" of two, the value used in MUSE. This value is excluded from the claims. However, even if the Appellant now seeks to disclaim this value, it is clear from the description of the application that this was in fact the applicant's own preferred value and was excluded, not because it did not meet the acceptability criteria, but purely in order to render the claims inventive. As however pointed out in Decision T 170/86, OJ EPO 1989, 441, a disclaimer cannot make an obvious teaching inventive. In any case, as noted at point 2.8 above, the skilled person could be expected to try out different levels of bandwidth compression in order to find the optimum level.

2.10 Finally, the Appellant has argued that the degree of movement in the depth direction subtends a considerably smaller angle at the human eye than movement across the screen; for such a limited two-dimensional motion the reduction in visual resolution is insignificant and the skilled person would have assumed that no reduction in bandwidth was possible for the difference signal. He would therefore not have considered adding the teaching of D1 to that of D2. The Board, while willing to accept that the skilled person would have been aware of the considerations suggested by the Appellant, cannot agree that the skilled person would therefore have been led to dismiss the MUSE system as unsuitable. The need to minimise bandwidth so as preferably to fit the complete stereoscopic signal into a conventional TV channel would, in the Board's opinion, at the very least make it obvious for the skilled person to try the MUSE bandwidth compression.

2.11 The subject-matter of Claim 1 accordingly does not involve an inventive step. Since independent Claim 6 is directed to transmission apparatus having substantially the features of the corresponding apparatus in Claim 1 it follows that this claim is open to the same objection.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

M. Beer

P. K. J. van den Berg

