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D E C I S I O N
of 11 April 1997

Case Number: T 0413/96 - 3.5.1

Application Number: 89309811.1

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Title of invention:
Image signal processor

Patentee:
MATSUSHITA GRAPHIC COMMUNICATION SYSTEMS, INC.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - no"

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Case Number: T 0413/96 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 11 April 1997

Appellant: MATSUSHITA GRAPHIC COMMUNICATION SYSTEMS, INC.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 9 November 1995 refusing European patent application No. 89 309 811.1 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. This appeal is against the decision of the examining division to refuse European patent application No. 89 309 811.1 on the ground that the subject-matter of the claims lacked an inventive step (Articles 52(1) and 56 EPC). The following documents were cited in the decision:

D1: IEEE Transactions on Communications, vol. 29, no. 12, December 1981, New York, US, pages 1898-1925; J.C. Stoffel et al.: "A survey of electronic techniques for pictorial image reproduction".

D2: JP-A-59 168 762

In both the present proceedings and those before the first instance, reference was made to an English-language abstract of D2 rather than the original:

Patent Abstracts of Japan, vol. 9, No. 23, (E-293). [1746], 30 January 1985

II. On 10 January 1996 the applicant (appellant) lodged an appeal against the decision and paid the prescribed fee. On 15 March 1996 a statement of grounds of appeal was filed, together with revised claims of a main request. An auxiliary request comprising a main claim based on claims 1 and 2 of the main request was also filed, together with a request for oral proceedings.

III. Following a communication from the Board, oral proceedings were held on 11 April 1997. At the oral proceedings the appellant requested that the decision under appeal be set aside and a patent granted on the basis of the following documents:

Main request:

Claims: 1 to 12, received with the grounds of appeal on 15 March 1996.

Description: pages 4 to 6, 9 to 27, 31, 33 to 35, 37 and 41, as originally filed;

page 1, received 5 December 1994;

page 2, received 22 June 1995;

pages 3, 28 to 30, 36 and 38 to 40, received with the grounds of appeal on 15 March 1996;

pages 7, 8 and 32, filed on 7 April 1997.

Drawings: sheets 1 to 24, as originally filed.

Auxiliary request:

As main request, but with claims 1 and 2 combined.

IV. Claim 1 of the main request, with the examining division's subdivision of the features, reads as follows:

"An image processing apparatus comprising:

(a) first process means for performing quasi-tone processing of an input image signal after smoothing with a low-pass filter;

(b) second process means for performing direct quasi-tone processing of an input image signal;

(c) detection means for detecting the power in the input signal;

(d) image signal identification means for outputting a kind-identification signal based on a signal from the detection means; and

(e) selection means for selecting an output of either one of said first and second process means based on the kind-identification signal;

characterised by:

(f) third process means for performing binary processing for obtaining an input image as a binary signal of either black or white;

(g) the detection means detecting power at a prescribed frequency in a main scanning direction where a read sensor for scanning image information of a document is arranged and a subscanning direction where the read sensor is moved relative to the document;

(h) the image signal identification means comparing said power in both scanning directions with a prescribed threshold value and outputting a kind-identification signal based on a pair of criterion value vectors based on the result of said comparison; and

(i) the selection means selecting an output of either one of said first process means, said second process means and said third process means based on the kind-identification signal."

V. Claim 1 of the auxiliary request adds to the above claim that the prescribed frequencies are one or more of the following:

"a frequency f1 in the main scanning direction of said input image signal which is a mesh point pitch frequency (a fundamental frequency) corresponding to a number of lines of a screen halftone;

said frequency f1 in the subscanning direction;

a frequency f2 in the main scanning direction which is a frequency lower than said frequency f1 and at which the power of a screen halftone becomes a minimum;

said frequency f2 in the subscanning direction;

a frequency f3 in the main scanning direction which is a maximum picture frequency decided by the reading resolution of said input image signal;

said frequency f3 in the subscanning direction".

VI. The appellant argued as follows:

The invention concerned an image processing apparatus with separate means for processing halftone image data, character data and continuous tone data (pictures). The system referred to in D1 as the "SHARE" system, primarily relied upon in the appealed decision, only had the first two of these processing means. It did not follow from D1 that the skilled person would provide a third processing means for continuous tone images.

The invention distinguished between the different image types by determining the power amplitude at a certain prescribed frequency or frequencies. None of the prior art documents suggested this feature. Even if the

skilled person were to consider using the frequency spectra of the different images as a basis for discriminating them, this would not lead to the invention. Rather, the skilled person would look for peaks in a frequency spectrum produced, for example, by a Fourier transform. This would involve comparing amplitudes at all frequencies, and not merely the claimed prescribed frequency or frequencies.

Because the invention only detected the power amplitude at a prescribed frequency or frequencies, it was not necessary to use a full Fourier transform. The discrimination of differing signals could by means of the invention be implemented using a digital filter or a partial transform which would not require as much processing power.

Reasons for the Decision

1. The appeal complies with Article 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. The only issue to be decided is that of inventive step.

3. *Inventive Step (Main Request)*

3.1 The application is concerned with a problem which arises in the field of image processing, namely the need to process differing kinds of image data in dependence on their nature. Thus continuous tone image data, such as produced by a photographic image, requires processing which preserves the unquantized grey levels it contains, whereas halftone image data, in which an image is built up using a matrix of black

dots of predetermined pitch (referred to in the application as the "mesh point pitch"), requires processing which avoids sampling artifacts such as moiré patterns. Line copy, i.e. alphanumeric data, also requires separate processing.

3.2 It is common ground that D1 is the single most relevant prior art document. From section I on page 1898 and Figure 1 it can be seen that it deals with the general problem of faithfully representing an input image, whatever its nature, on a binary output array. In section II on page 1899 it describes the three above-mentioned categories of input image. In sections V and VI, starting at page 1901, the various techniques mentioned in the application for processing these image categories are discussed, including binarisation, dither processing, error diffusion and halftone processing. D1 is a review article and the Board considers that the image processing concepts discussed represent common general knowledge in this field.

3.3 At page 1917, second paragraph, D1 describes a specific processing algorithm called the "SHARE" algorithm, which is designed to discriminate between the three image types discussed above. Figure 35 shows a functional block diagram of a processor using this algorithm for the case where only halftone images and line copy images are processed. The halftone image data is processed by a low-pass filter referred to as a "screen removal filter" (page 1917, left hand column, lines 10 to 13; right hand column, lines 13 to 30), and the resulting continuous tone data is subjected to "electronic screening" (left hand column, lines 15 and 16), which is described in detail at section V of D1. The line copy image data is subjected to an "adaptive thresholding (line copy) process" (page 1917, left hand column, lines 13 to 15). This is a

binarisation process and is also described in section V (in particular at page 1902, left hand column, line 19 to right hand column, line 12). For a review of many of the algorithms used reference is directed to citation [26] at page 1924, the title of which is "Binarization using associative addressing" (Board's underlining).

3.4 The Board accepts the argument advanced by the appellant at the oral proceedings that the specific "SHARE" system discussed in D1 only discloses processing means for two types of image signal, on the one hand "high frequency halftone" (halftone), and on the other "line copy" (alphanumeric) and "low frequency halftone" (continuous tone or "quasi-tone processing" in the terminology of the application). A pixel classifier determines the type of image using the autocorrelation properties of the halftone image. It is stated that this is equivalent to a power spectral discrimination (page 1917, left hand column, lines 25 to 29), for which other techniques (including Fourier transforms - see the title of citation [56], page 1924) may be incorporated. Subsequently the "line copy" and "low frequency halftone" are discriminated and processed separately (page 1917, left hand column, lines 13 to 16).

3.5 D1 thus discloses an image processing apparatus comprising features (a), (c), (d) and (e) of the pre-characterising part and feature (f) of the characterising part of claim 1. Indeed, this is now common ground. The subject-matter of claim 1 differs from the "SHARE" system as shown in Figure 35 of D1 in that direct "quasi-tone" processing of the input signal and its selection, features (b) and (i) respectively, are provided, and in that discrimination amongst the various input image types is provided by detecting power at a prescribed frequency, features (g) and (h). In other words, in addition to discriminating and

processing halftone images in one path and all others in the other path, claim 1 specifies that there are three paths, alphanumeric and continuous tone data also being discriminated directly, see Figure 1 of the application.

3.6 Although D1 does not explicitly disclose processing means for continuous tone data in the "SHARE" system, it states at page 1917, left hand column, lines 7 to 10 that the "SHARE" algorithm was originally a "tricategory processor" designed also to discriminate "low frequency halftones", i.e. continuous tone images, and that Figure 35 shows a "simplified version" (page 1917, left hand column, lines 1 to 6 and 16 to 19) in which "only halftone pictorial input is assumed" (caption under Figure 35). The processing of a continuous tone image signal is well known and several examples are given in section V of D1.

3.7 Thus the skilled person is faced with the problem of how in practice to discriminate continuous tone data in the D1 system. Although D1 implies that a two-step process was envisaged, with the continuous tone data being separated from alphanumeric data in a second step, the Board considers that it would have been obvious to the skilled person that all three types of data could be discriminated by a single "pixel classifier", in the terminology of D1.

3.8 The solution to the discrimination of continuous tone data is known per se from D2. The English-language abstract of this document discloses that in order to discriminate between character and image data the image signal is subjected to a Fourier transform in the longitudinal and lateral directions. By examining the frequency characteristics of these signals in the two dimensions, image data and line copy data can be distinguished. It is clear that the image date is

continuous tone since it is said to be "without regularity", i.e. with no strong frequency characteristic. Were the transform of a half-tone image to be examined it is clear from D1 that a very strong frequency characteristic corresponding to the "mesh point pitch" would be found.

3.9 Thus, once the skilled person has the general idea from D2 of distinguishing signals using their frequency characteristics, it would be obvious to apply this to the "pixel classifier" in the D1 system to discriminate, inter alia, continuous tone images. As noted above, for halftone images a high amplitude will exist at the frequency f1 corresponding to the mesh point pitch in both directions; similarly, the amplitude of this frequency will be low in the case of continuous tone images. Armed with this knowledge the skilled person could be expected to undertake a systematic investigation and to discover that images can be classified in terms of the amplitudes at various frequencies, as in the tables in the application. An obvious choice would be a simple classification which uses only one frequency in each direction (cf fifth embodiment of originally filed application). Thus the skilled person would without the exercise of invention arrive at detection means which detects power at a prescribed frequency in the main and sub-scanning directions, according to feature (g) of claim 1.

3.10 The appellant argued that because the "SHARE" system is a two-stage process with continuous tone images recognised at a second stage, the skilled person could be expected to keep to this scheme. The Board, however, considers that, given the disclosure of D2, it is an obvious alternative to distinguish the three kinds of data in a single stage.

3.11 The appellant also argued that even if the skilled person were to consider discrimination using the frequency characteristics of images, the obvious manner of implementation would be to search for peaks in the frequency spectrum produced by a Fourier transform. This would involve considerable processing power and would require a comparison of spectra. In contrast, the detection means of the invention determined the power only at a prescribed frequency or frequencies and could be implemented cheaply. The Board notes however that the "pixel classifier" of D1 does in fact disclose detecting the power at a prescribed frequency, namely by autocorrelation of the halftone signal to detect the halftone spatial (mesh point pitch) frequency, see page 1917, left hand column, lines 25 to 40. There is no suggestion of comparing the power at this prescribed frequency with the power at another frequency. Moreover, given that the skilled person would detect the power at the frequencies found from the above mentioned investigation of the spectra, even if a full Fourier transform were used, the step would still fall under the definition of detecting power at prescribed frequencies according to feature (g). Although it was argued that in the application the detection could be done using a horizontal and vertical filter without the need for a full Fourier transform, thus providing a simpler system, claim 1 does not exclude the use of a full Fourier transform. Indeed, the application nowhere discloses how power is detected at the prescribed frequency or frequencies.

3.12 As regards the remaining feature, feature (h), the appellant reiterated the above argument that the skilled person would not compare the power at the

prescribed frequency with a threshold value, but with the values at all other frequencies to determine if the power was a maximum peak. The Board, however, considers that, given a prescribed frequency to identify, a thresholding operation is an obvious way of identifying its presence.

3.13 The subject-matter of claim 1 of the main request accordingly lacks an inventive step.

4. *Inventive step (auxiliary request)*

4.1 Claim 1 of the auxiliary request adds to claim 1 of the main request that the "prescribed frequency" is "one or more frequencies" selected from six particular frequencies. Thus the claim contains a number of alternatives, one of which is the case discussed at point 3.9 above, namely the mesh point pitch frequency f1. As described above, D1 discloses the use of this frequency to distinguish halftone images and line copy. The selection of f1 for both prescribed frequencies is therefore obvious. It follows in any case from the preceding arguments that the skilled person could be expected to discover any characteristic frequencies, so that none of the remaining alternatives involves an inventive step either.

4.2 The subject-matter of claim 1 of the auxiliary request accordingly lacks an inventive step.

5. There being no other requests, it follows that the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

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