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D E C I S I O N
of 9 May 2003

Case Number: T 0050/01 - 3.5.1

Application Number: 96200452.9

Publication Number: 0717550

IPC: H04N 1/40

Language of the proceedings: EN

Title of invention:
Image processing apparatus

Applicant:
CANON KABUSHIKI KAISHA

Opponent:
-

Headword:
Image Processing/CANON

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (main and auxiliary requests, no)"

Decisions cited:
-

Catchword:
-



Case Number: T 0050/01 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 9 May 2003

Appellant:

CANON KABUSHIKI KAISHA
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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 29 June 2000
refusing European application No. 96200452.9
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: S. V. Steinbrener
Members: A. S. Clelland
E. Lachacinski

Summary of Facts and Submissions

I. This is an appeal against the decision of the examining division to refuse European patent application No. 96 200 452.9 on the ground that the subject-matter of each of independent claims 1 and 5 lacked an inventive step. *Inter alia* the following documents were cited:

D1: Proceedings of the SID, Vol. 22, No. 3, 1981, Los Angeles, USA, pages 185-190, Netravali et al: "Display of dithered images".

D3: IBM Technical Disclosure Bulletin, Vol. 27, No. 7B, Dec. 1984, pages 4279-4282, Fox et al: "High frequency information detector/discriminator".

II. The applicant (appellant) requested that the examining division's decision be set aside and the application granted. Together with the statement of grounds of appeal a revised set of claims was filed to replace those previously on file. An auxiliary request was made for oral proceedings.

III. In an annex to summons to oral proceedings the Board summarized its understanding of the invention and took the preliminary view that D1 was the correct starting-point for a consideration of inventive step. Reference was made to D3, which was said to describe a method of discriminating between halftone and bilevel data so as to permit the appropriate form of processing for each. It was noted that "high frequency operators" shown in Figure 2 of D3 performed essentially the same function

as the matrices shown in the application. The question was then raised as to whether it would be obvious for the skilled person that in the apparatus of Figure 3 of D1 the printing of bi-level pixels could be improved by implementing the discriminating circuit of D3 and processing such pixels separately.

IV. In a fax dated 17 April 2003 the appellant submitted claims of a revised main request and of a new auxiliary request. It was argued that the claims of each of these requests were novel and inventive having regard to the disclosure of D1 and D3. The appellant requested that the case be allowed to proceed on the basis of the main request or, failing that, the auxiliary request. It was also asked that the Board make its decision "on the basis of the state of the file"; this statement was understood as indicating that the appellant would not be attending the oral proceedings.

V. Claim 1 of the main request reads as follows:

"A digital processor for generating multi-level data for printing by a multi-level printer, the processor comprising:

input means (301) for inputting bi-level pixel data (1, 0) representing an image to be printed; and
printer data generating means (302, 303) for generating print data, and characterised in that said printer data generating means comprise in parallel a multi-level converter (302) for converting input pixel data into multi-level print data and a level shifter (303) for shifting the level of a pixel of interest to either the maximum or the minimum density level of said printer in accordance with whether the pixel of

interest is a 1 or a 0, and discrimination means (307) for detecting whether an input bi-level pixel data represents part of a halftone image or part of a line or character image, said discrimination means comprising differential filter means for filtering pixels, the differential filter means comprising dither matrices of thresholding values arrayed in vertical and horizontal direction with respect to a pixel of interest so as to generate an absolute value indicating whether the pixel of interest is part of a halftone image or part of a character or line image, and selection means for selecting the output of the multi-level converter when it has been determined that a pixel of interest belongs to a halftone image portion or the output of the level shifter when it has been determined that the pixel is part of a character or line portion of an image."

VI. Claim 1 of the auxiliary request reads as follows:

"A digital processor for generating multi-level data for printing by a multi-level printer, the processor comprising:

input means (301) for inputting bi-level pixel data (1, 0) representing an image to be printed; and printer data generating means (302, 303) for generating print data, and characterised in that said printer data generating means comprise in parallel a multi-level converter (302) for converting input pixel data into multi-level print data and a level shifter (303) for shifting the level of a pixel of interest to either the maximum or the minimum density level of said printer in accordance with whether the pixel of interest is a 1 or a 0, and discrimination means (307) for detecting

whether an input bi-level pixel data represents part of a halftone image or part of a line or character image by generating an absolute value indicating whether the pixel of interest is part of a halftone image or part of a character or line image, and selection means for selecting the output of the multi-level converter when it has been determined that a pixel of interest belongs to a halftone image portion or the output of the level shifter when it has been determined that the pixel is part of a character or line portion of an image, and wherein said filter means comprise dither matrices (A,B,C,D) the [sic] surrounding the pixel of interest, two matrices (A,B) being located in either side of the pixel of interest in the horizontal direction and two matrices (C,D) being located in either side of the pixel of interest in the vertical direction, each matrix extending on either side of a line leading through the pixel of interest in the respective horizontal and vertical directions."

Oral proceedings were held on 9 May 2003 in the absence of the appellant. At the end of these proceedings the chairman closed the debate and announced the Board's decision, which was communicated to the appellant by way of the minutes of the oral proceedings.

Reasons for the Decision

1. The appeal complies with the requirements mentioned in Rule 65(1) EPC and is admissible.

2. Background to the invention

2.1 In the reproduction of images the problem arises that many printing systems are designed to cope with two levels only, for example black and white, referred to in the application (and hereinafter) as bilevel printing. Grey level images are reproduced in such systems by means of halftone printing, in which a grey level area is represented by patterns of black and white pixels, the pixel distribution and area being designed to emulate a grey level when seen by the eye. Such halftone printing is in everyday use and considerable thought and ingenuity has gone into the design of the pixel pattern in order to avoid artefacts and produce as natural an image as possible. A common method of mapping grey level to pixel pattern is dithering, in which a threshold mask is used in the form of a matrix which determines the threshold for different halftone values, each value being assigned a specific pattern to minimise artefacts. Dithering is used in the present application.

2.2 Because halftone imaging is done over an area, artefacts may particularly arise when genuinely black and white items are to be reproduced, for example lines or font characters; such data is referred to hereinafter as line data. In a system where bilevel data is supplied to a bilevel printer this may not matter, but if instead of a bilevel printer a multi-level or grey level printer is used, as in the application, then the line data may during processing be confused with dithered data and in consequence may exhibit artefacts. The object of the claimed invention is accordingly to discriminate between line data and

halftone data to enable each to be correctly processed for supply to a multi-level printer (see page 10, lines 23 to 26 of the A-publication).

3. Inventive step (main request)

3.1 The primary issue to be addressed in the present appeal is that of inventive step.

3.2 It was common ground in the course of the proceedings that the single most relevant document is D1. D1 discloses a digital processor similar to the prior art acknowledged in Figure 1 of the application and in which, see Figure 3 of D1, multi-level data is generated for printing by a multi-level printer; although Figure 3 refers to a "multi-level display" the introduction to D1 refers at page 185, left-hand column to "ink on paper", and therefore includes printing as a form of display. The processor receives bilevel pixel data representing an image to be printed and includes a look-up table which serves as a multi-level converter for converting bilevel pixel data into grey level print data.

3.3 Figure 3 also shows a switch which enables the multi-level converter to be bypassed; bilevel data can therefore be transferred directly to the printer. The document makes no reference as to how and when the switching is carried out, nor whether any processing is performed on the directly received bilevel data, but it appears to the Board to be implicit in any such arrangement that the level of the data must be rendered compatible with the characteristics of the printer to be used, i.e. a level shifter must be provided to shift

the level of each pixel to either the maximum or the minimum density level accepted by the printer in dependence on whether the pixel is a "1" or a "0".

3.4 As noted above, D1 does not disclose any criterion for switching between bilevel and multi-level data. The subject-matter of claim 1 of the main request is accordingly novel with respect to the disclosure of D1. The skilled person, seeking to implement the teaching of D1, is however faced with the problem discussed in the application, namely discriminating between halftone data, which requires processing in the look-up table, and line data, which merely requires level shifting. This problem is solved by D3, which describes a device and method for detecting and discriminating between halftone and "high frequency line copy" information. The "high frequency" information is defined as "very small or very thin lettering or graphics" (page 4280, last four lines) which "requires a thresholder adopted to line copy and designed to enhance its black-white-black transitions" (sentence bridging pages 4280 & 4281). A problem in detecting such data is said to be that "this high frequency line copy information appears to the system as almost identical to the high frequency pattern of many halftone line screens" (page 4281, first paragraph). D3 is thus concerned with the problem to be solved in D1. The solution to this problem is said to be the provision of a "symmetrical high frequency operator" (page 4281, last paragraph), shown in Figures 1 and 2 to relate to a matrix, the size of which (referred to in the text as the "radius") is said to determine the frequency information detected. Figure 2 shows four different operators, namely horizontal and vertical operators HF(X) and HF(Y)

respectively and two diagonal operators, used to compute a high frequency gradient for each high frequency pixel in order to determine the nature of the high frequency information, ie halftone or line copy.

3.5 In the Board's view the high frequency operators disclosed in D3 serve as discrimination means comprising differential filter means for filtering pixels, the differential filter means comprising matrices of thresholding values arrayed in vertical and horizontal direction with respect to a pixel of interest so as to generate an absolute value indicating whether the pixel of interest is part of a halftone or a line image. The wording of claim 1 additionally requires that the matrices be "dither matrices", which the Board understands in the context to mean that each matrix is made up of an array of pixels, as in D3. The only remaining feature in claim 1 of the main request is the provision of selection means for selecting the output of either the multi-level converter or the level shifter in dependence on whether a pixel belongs to a halftone or a line image. Were the skilled person to incorporate discrimination means in accordance with D3 in the processor of Figure 3 of D1 it would follow as a matter of course that the existing switch would serve to switch between the two kinds of data.

3.6 The subject-matter of claim 1 of the main request accordingly does not involve an inventive step, Articles 52(1) and 56 EPC.

4. Inventive step (auxiliary request)
 - 4.1 Claim 1 of the auxiliary request, although worded somewhat differently to claim 1 of the main request, in essence differs from the latter in specifying that the dither matrices forming part of the discrimination means surround the pixel of interest, two matrices being located on either side of the pixel of interest in the horizontal direction and two matrices being located on either side of the pixel of interest in the vertical direction, each matrix extending on either side of a line leading through the pixel of interest in the respective horizontal and vertical directions. This amounts to the arrangement of Figures 1 and 2 of D3. Claim 1 of the auxiliary request is accordingly open to the same objection of lack of inventive step as claim 1 of the main request.

5. In a submission in response to the invitation to oral proceedings the appellant accepted that document D1 provided confirmation of the prior art acknowledged in the application and that the concept of using dither matrices to provide a binary output was well known. D1 also provided a means of by-passing the dither processing by means of a switch. There was however no discussion in D1 as to how such a switch could be operated except by an operator with prior knowledge of the nature of the image to be displayed. This analysis is fully consistent with the Board's analysis above, the question to be answered being how the skilled person would seek to discriminate automatically between the two kinds of data. In the Board's view D3 gives the answer to this question. The appellant argued that the arrangement of D3, whilst permitting identification of

whether a pixel is part of a line image or part of a halftone image, did so by means which appeared to be relatively complex and gave no indication whatsoever as to how the information was to be actually utilised; the Board however considers that the system of D3 is in essence that of the invention as claimed, albeit expressed in different language. Its use in the context of D1 would be obvious to a skilled person in view of the problem posed.

6. 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

S. V. Steinbrener