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**D E C I S I O N**  
**of 30 July 2001**

**Case Number:** T 0952/95 - 3.4.1

**Application Number:** 90312321.4

**Publication Number:** 0428356

**IPC:** G09G 1/14

**Language of the proceedings:** EN

**Title of invention:**

Pattern generation method and pattern generation apparatus

**Applicant:**

CANON KABUSHIKI KAISHA

**Opponent:**

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**Headword:**

-

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step (yes) - after amendment"

**Decisions cited:**

-

**Catchword:**

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Case Number: T 0952/95 - 3.4.1

**D E C I S I O N**  
**of the Technical Board of Appeal 3.4.1**  
**of 30 July 2001**

**Appellant:** Canon Kabushiki Kaisha  
30-2, 3-chome, Shimomaruko  
Ohta-ku  
Tokyo (JP)

**Representative:** Beresford, Keith Denis Lewis  
Beresford & Co.  
2-5 Warwick Court  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 13 July 1995  
refusing European patent application  
No. 90 312 321.4 pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** G. Davies  
**Members:** M. G. L. Rognoni  
U. G. O. Himmler

## Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal, received on 14 September 1995, against the decision of the Examining Division, dispatched on 13 July 1995, refusing the application No. 90 312 321.4 (publication No. 0 428 356). The fee for the appeal was paid on 18 September 1995 and the statement setting out the grounds of appeal was received on 17 November 1995.

II. In the decision under appeal, the Examining Division held, *inter alia*, that the subject-matter of claim 1 did not involve an inventive step within the meaning of Article 56 EPC, having regard to the following documents:

D1: EP-A-0 132 454

D3: EP-A-0 215 664

III. The applicant requested that the decision under appeal be set aside and a patent be granted on the basis of the following documents:

**Claims:** No. 1 to 8 (lines 1 to 12) as filed with a letter dated 28 December 2000;  
No. 8 (lines 13 to 21) to 12 as file with a letter dated 18 July 2001;

**Description:** pages 2, 2a and 3 as filed with the letter dated 28 December 2000  
pages 7 and 8 as filed with the letter dated 18 July 2001;  
pages 4 to 6 and 9 to 12 as originally

filed;

**Drawings:** 1/5 to 5/5 as originally filed.

IV. The wording of claim 1 reads as follows:

"1. A pattern generating apparatus comprising:  
converting means (2) for converting vector data  
representing an image into a binary bit map of the  
image;

means (4) for storing the binary bit image; and  
output means (8) having G grey scale levels and  
adapted to output the binary bit map data as grey scale  
data; and characterised in that the converting means  
generate the binary bit map with a resolution of m x n  
which is greater than the output resolution of the  
output means, where m and n are integers by means of  
which the output resolution of the output means in the  
respective x and y axes have been multiplied to  
generate the resolution of the binary bit map, where (  
 $m \times n$ ) + 1  $\geq$  G ;

and in that there is additionally provided  
dividing means (6) for dividing the binary bit map into  
areas corresponding to the output resolution of the  
output means; and density detector means (7) for  
detecting the densities in each of the areas generated  
by the dividing means to generate grey scale data in  
accordance with the detected densities but at the  
output resolution of the output means".

The wording of claim 8 reads as follows:

"8. A method of generating a pattern comprising:  
a step of converting (2) vector data representing  
an image into a binary bit map of the image;

a step of storing (4) the binary bit image; and utilising output means (8) having G grey scale levels and adapted to output the binary bit map data as grey scale data; and characterised in that the converting step generates the binary bit map with a resolution of m x n which is greater than the output resolution of the output means, where m and n are integers by means of which the output resolution of the output means in the respective x and y axes have been multiplied to generate the resolution of the binary bit map, where  $(m \times n) + 1 \geq G$  ;

and in that there is additionally provided a step of dividing (6) the binary bit map into areas corresponding to the output resolution of the output means; and a step of detecting the densities in each of the areas generated by the step of dividing the binary map to generate grey scale data in accordance with the detected densities but at the output resolution of the output means".

V. The appellant's arguments can be summarized as follows:

The present invention took as its starting point the generation of a bit map font for an output device, such as a printer or a monitor, from vector font data. The vector format had the known advantage that it was relatively easy to arbitrarily enlarge or decrease the final character size by manipulating a single set of vector data. However, problems could arise in expressing the data with grey scale values at different magnifications.

According to the present invention, the problem of providing the characters to the output device with satisfactory grey scale levels so as to increase their

intelligibility while maintaining the advantage of the vector format was solved by multiplying the resolution of the bit map generated from the vector data by a factor which was related to the output resolution of the output means and to the number of grey scales available.

D1 was not concerned with the conversion of vector data into bit map format since all characters were stored as bit map fonts at a substantially higher resolution than the eventual output resolution.

As claim 1 identified all the features which made the present invention both novel and inventive with regard to D1, a patent could be granted on the basis thereof.

### **Reasons for the Decision**

1. The appeal is admissible.
2. All amendments made to the claims and the description find support in the application documents as originally filed and, therefore, are admissible under Article 123(2) EPC.
- 3.1 The present invention relates to a pattern generating apparatus and method which can be applied to an output device (display or printer) capable of expressing **grey levels**.

As pointed out by the appellant, it is known in the art that some characters can be more clearly printed out or displayed on a monitor if grey levels are used for the

boundary of the character or for some of the thinner lines.

3.2 Characters can be stored in the form of **bit maps** or **vectors** . A **bit map** is a matrix of "black" and "white" cells, whereby black cells correspond to the dots to be printed or displayed and the white cells represent blank spaces. The combination of all white and black dots gives a "picture" of a character. In the **vector** representation, the lines of a character are expressed in mathematical form.

3.3 The vector representation has the advantage that the character can be scaled up or down very easily. However, before a character of a vector font can be displayed or printed out, the data have to be converted into a bit map which is used to drive the monitor or the printer. In other words, the lines of a character have to be "drawn" on the bit map and converted into a combination of black and white dots. As pointed out above, the character's boundary or thin lines are preferably printed or displayed using some grey scale level.

4.1 The present application seeks to combine the advantage of vector representation, as far as the possibility of scaling up and down the characters is concerned, with the advantage of the bit map representation which allows an easy definition of the grey levels for the points of a character.

4.2 The gist of the invention can be summed up as follows:

- characters are stored in a vector form;

- the vector which expresses a character is converted into a bit map which has a higher resolution than the bit map used to drive the printer or to be displayed on the monitor.

In other words, a character is represented as a bit map which is magnified by a certain factor "n" with respect to the actual bit map used to drive the printer, so that one cell of the bit map used to drive the printer corresponds to "n" cells of the bit map used for the conversion.

5.1 D1, which the Examining Division considered to represent the closest prior art, teaches to store a character in the form of a bit map which has a higher resolution than the bit map used to drive a printer or monitor. Each element of the lower resolution map corresponds to n elements of the higher resolution map. The n elements of the higher resolution map are used to define the grey level of the corresponding "dot" on the lower resolution bit map.

5.2 As pointed out by the appellant, a fundamental difference between the present invention and document D1 lies in the fact that the characters in document D1 are already stored in the form of bit maps and that there is a bit map for **each character** and for **each size** (cf. page 8, lines 17 to 23). Furthermore, though in D1 all characters are stored as bit maps at a higher resolution than the eventual output resolution, there is no indication in D1 that a high resolution bit map might be obtained from vector data. In fact, this document is not concerned with the conversion of vector data into a bit map which can be used to drive a printer or a monitor.



6.1 In the opinion of the Board, document D3, which addresses, *inter alia*, the problem of converting vector data into a bit map, represents the closest prior art.

As shown in Figures 10 a and 10 b, vector data are used to "draw" the lines of the character on a grid, whereby there is a direct correspondence between the elements of the grid and the elements of the bit map into which the vector data are to be converted. The elements of the grid contained within the boundaries of the character represent elements of the bit map with the maximum grey level (a black point on the print out). The elements of the grid crossed by the boundary of the character (see Figure 10 b) are elements of the bit map with a certain grey level proportional to the area of the element occupied by the solid part of the character.

6.2 The essential difference between the present invention and document D3 consists in the way in which the grey scale level is determined from the vector data. In document D3 the part of the curve which crosses an element of the grid and thereby defines part of the boundary of a character is assimilated to a straight segment which crosses two sides of the grid at predetermined points (35 and 40 in Figure 10 b). The surface (60 or 50) occupied by a solid part of the character is calculated by approximating a curved line with a straight line and by determining the coordinates of the crossing points on the grid. From this value it is then possible to derive a parameter (i.e. the fraction of the area of the grid element covered by the character) representing a level on the grey scale.

6.3 As in document D3, the present invention starts also

from characters expressed as vector data but converts them into a bit map with more elements than the points to be printed or to be displayed on a monitor. In fact, this is equivalent to drawing the lines which define the boundaries of the character on a grid with more elements. This grid is then divided up into a number of "squares" corresponding to the number of points to be printed, so that each point comprises the same number of elements (e.g. 4) of the grid on to which the lines of the vector data are "drawn". A grey level for the point to be printed is determined on the basis of the number of elements within the corresponding "square" which are taken up by the character.

6.4 The present invention may be regarded as a simplification of the solution known from document D3 which is based on the calculation of the crossing points between the grid elements and the lines defining the boundary of the character. The conversion between vector data and bit map carried out in the present application does not involve the definition of crossing points between the boundary lines of the character and the grid lines: it is simply based on the identification of the elements of the bit map which are within the boundaries of the character.

7. Summarizing, D1 teaches to associate a point to be printed out or displayed with a number of elements (i.e. 4) of a bit map, whereby the grey level used to print out this point is a function of the number of "black" elements of the bit map corresponding to this particular point. D3 teaches how to derive grey level values while converting a vector into bit map, whereby the element of the bit map on the boundary of the character is printed out or displayed using some grey

level. However, there is no hint in any of the cited prior art documents to derive a grey level for a boundary point of a character by first transforming the vector data of a character into a high resolution bit map, i.e. into a bit map having a number of elements which is a function not only of the point to be displayed or printed out but also of the number of levels on the grey scale used to print or display that point.

8. For these reasons, the Board finds that it was not obvious to arrive at an apparatus falling within the terms of claim 1 by combining the teachings of D1 and D3, and, therefore, the subject-matter of this claim involves an inventive step within the meaning of Article 56 EPC.
9. The method claim 8 is based essentially on the same features of claim 1 expressed in terms of method steps. Hence, the subject-matter of this claim complies with the requirements of Article 56 EPC.
8. Claims 2 to 7 and 9 to 12 are dependent, and, therefore, their subject-matters also involve an inventive step.
10. In summary, the Board finds that the appellant's request is allowable and that a patent can be granted on the basis thereof.

**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 the first instance with the order to grant a patent on the basis of the appellant's request (cf. point III).

The Registrar:

The Chairman:

R. Schumacher

G. Davies