Datasheet for the decision of 30 August 2007

Case Number: T 0853/05 - 3.4.03
Application Number: 96305740.1
Publication Number: 0822536
IPC: G09G 3/28
Language of the proceedings: EN
Title of invention: Method of and apparatus for displaying halftone images
Opponent: -

Headword:

Relevant legal provisions:
EPC Art. 56, 123(2)

Keyword:
"Inventive step (second auxiliary request) - yes"

Decisions cited:
- 

Catchword:
-
Case Number: T 0853/05 - 3.4.03

DECISION
of the Technical Board of Appeal 3.4.03
of 30 August 2007

2-1, Otemachi 2-chome
Chiyoda-ku
Tokyo (JP)

Representative: Williams, Michael Ian
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Decision under appeal: Decision of the Examining Division of the European Patent Office posted 14 March 2005 refusing European application No. 96305740.1 pursuant to Article 97(1) EPC.

Composition of the Board:
Chairman: R. G. O'Connell
Members: G. Eliasson
T. Bokor
Summary of Facts and Submissions

I. This is an appeal against the refusal of application 96 305 740 for lack of novelty and added subject matter.

II. The following prior art was cited in the decision under appeal:
    D1: JP 08 123 355 with corresponding Patent Abstracts of Japan; and
    D1*: Translation of document D1.

III. The appellant applicant filed new claim requests.

IV. At oral proceedings before the board the appellant applicant filed further new claims and amended description pages and requested that the decision under appeal be set aside and a patent granted on the basis of

    Claims 1 to 17 filed as main request by letter dated 29 June 2005, or

    Claims 1 to 12 filed as first auxiliary request dated 30 July 2007, or

    Claims 1 and 2 filed during oral proceedings as second auxiliary request, or

    Claims 1 to 17 filed as second auxiliary request and re-designated third auxiliary request dated 29 June 2005, or

    Claims 1 to 11 filed as fourth auxiliary request dated 29 June 2005.
Independent claims 1 and 16 of the main request read as follows:

"1. A method of displaying a halftone image on a display unit by using a frame division technique that divides each frame of the halftone image into more than two subframes (SFn) each having a specific sustain discharge period to provide a specific intensity level, characterised by:

changing a displayed position of the halftone image on said display unit from subframe to subframe in each frame, the displayed position in each subframe being successively advanced between a first position determined by display data provided for a first frame and a second position determined by display data provided for a second frame next to said first frame, and the displayed position in each subframe being determined according to a motion vector (A) set between the first position and the second position."

"16. An apparatus for displaying a halftone image on a display unit by using a frame division technique that divides each frame of the halftone image into more than two subframes each having a specific sustain discharge period to provide a specific intensity level, comprising:

a motion vector detection unit (6) for detecting a motion vector that indicates a moving direction of the halftone image, by comparing display data for a first frame of the halftone image with display
data for a second frame next to the first frame; and

a differing unit (10) for changing the display position of the halftone image from subframe to subframe in the first frame according to the motion vector, the displayed position in each subframe being successively advanced between a first position determined by display data provided for the first frame and a second position determined by display data provided for the second frame next to said first frame."
determined from a motion vector (A) set between the first position and the second position;

displaying the halftone image of the highest intensity level subframe or one of the subframes having a highest intensity level at an origin of individual motion vectors; and

displaying the halftone image of the other subframes at said displayed position, wherein said individual motion vectors are determined by a delay or advance time between the highest intensity subframe or one of the subframes having a highest intensity level respectively and each of the other subframes."

"11. An apparatus for displaying a halftone image on a display unit by using a frame division technique that divides each frame of the halftone image into subframes each having a specific sustain discharge period to provide a specific intensity level, comprising:

a motion vector detection unit (6) for detecting a motion vector that indicates a moving direction of the halftone image, by comparing display data for a first frame of the halftone image with display data for a second frame next to the first frame;

a differing unit (10) for changing the display position of the halftone image from subframe to subframe in the first frame according to the motion vector, the displayed position in each subframe being successively advanced between a
first position determined by display data provided for the first frame and a second position determined by display data provided for the second frame next to said first frame; and the displayed position in each subframe being determined according to an individual motion vector determined from a motion vector (A) set between the first position and the second position; and

displaying means for displaying the halftone image of the highest intensity level subframe or one of the subframes having a highest intensity level at an origin of individual motion vectors; and

displaying the halftone image of the other subframes at said displayed position,

wherein said individual motion vectors are determined by a delay or advance time between the highest intensity subframe or one of the subframes having a highest intensity level respectively and each of the other subframes."

VII. Independent claims 1 and 2 of the second auxiliary request read as follows (board's emphasis marking differences with respect to the main request):

"1. A method of displaying a halftone image on a display unit by using a frame division technique that divides each frame of the halftone image into more than two subframes (SFn) each having a specific sustain discharge period to provide a specific intensity level, comprising the step of:
changing a displayed position of the halftone image on said display unit from subframe to subframe in each frame, the displayed position in each subframe being successively advanced between a first position determined by display data provided for a first frame and a second position determined by display data provided for a second frame next to said first frame, and the displayed position in each subframe being determined according to a motion vector (A) set between the first position and the second position wherein when the number of subframes to be turned ON in the frame is smaller than the total number of subframes, said method comprises the steps of forming plural subframe groups, the number of groups being equal to the number of subframes to be enabled;

selecting one of the subframe groups as a vector origin;

displaying the halftone image in the selected subframe group;

finding a delay or advance time between the intensity level center of the selected subframe group and the intensity level center of each of the other subframe groups; and
calculating positions according to the subframe group vectors determined by the delay or advance time and vector origin; and

displaying the halftone image in the corresponding subframe groups at the calculated positions."

"2. An apparatus for displaying a halftone image on a display unit by using a frame division technique that divides each frame of the halftone image into more than two subframes each having a specific sustain discharge period to provide a specific intensity level, comprising:

a motion vector detection unit (6) for detecting a motion vector that indicates a moving direction of the halftone image, by comparing display data for a first frame of the halftone image with display data for a second frame next to the first frame;

a differing unit (10) for changing the display position of the halftone image from subframe to subframe in the first frame according to the motion vector, the displayed position in each subframe being successively advanced between a first position determined by display data provided for the first frame and a second position determined by display data provided for the second frame next to said first frame

wherein said apparatus further comprises means for when the number of subframes to be turned ON in the frame is smaller than the total number of subframes:
forming plural subframe groups, the number of subframe groups being equal to the number of subframes to be enabled;

selecting one of the subframe groups as a vector origin;

displaying the halftone image in the selected subframe group;

finding a delay or advance time between the intensity level center of the selected subframe group and the intensity level center of each of the other subframe groups;

calculating positions according to the subframe group vectors determined by the delay or advance time and vector origin; and

displaying the halftone image at the calculated positions in the corresponding subframe groups."

VIII. The appellant applicant's arguments can be summarised as follows:

(a) Document D1 could not be considered an enabling disclosure due to its many self-contradictory statements. Even if claim 1 of document D1 arguably could be interpreted to define motion correction for each subframe, this was contradicted by the examples illustrated in Figures 7 and 8 which each showed three frames having only one frame corrected. In particular in
the example of Figure 7 showing three subframes, only one subframe SF3 was corrected.

It was also not clear from document D1 how correction of the subframes should be carried out; in the example of Figure 3 the reader was left in doubt after reading paragraphs 0019 and 0020 as to which subframe the correction Xs should be applied.

The statement of grounds of appeal illustrated two possible interpretations as to how the teaching of document D1 could be implemented in a frame composed of four subframes. The two alternatives gave completely different results, thereby showing the lack of any clear teaching derivable from document D1.

(b) The method of claim 1 of the main request differed from that of document D1 in that it specified more than two subframes where the displaced position in each subframe was successively advanced between a first and a second position. In the example of document D1 involving more than two subframes (three), two subframes appeared to be grouped together and displaced by the same amount (see figure 7). Therefore, the example of Figure 7 did not disclose successive advancement of each subframe.

(c) Regarding the first auxiliary request, document D1 did not teach displaying the highest intensity level subframe or one of the subframes having a highest intensity level at a vector origin, the other subframes being displayed at displayed
positions, each determined by its respective motion vector. The claimed method had the advantage that in case the calculation of the displayed position might fail causing the other subframes to be displayed at wrong positions, the degree of distortion of the displayed image was limited as the highest intensity level would in any case be displayed at the origin.

(d) As to the second auxiliary request, the invention as claimed had the advantage of reducing flicker when less than the total number of subframes was to be enabled. None of the available prior art documents taught forming subframe groups with the number of subframe groups equal to the number of enabled subframes. Although the subframes SF1 and SF2 in Figure 7 of document D1 arguably could be regarded as forming a subframe group, all the subframes SF1 to SF3 in the frame in this example were enabled (turned ON). Therefore, document D1 did not provide any teaching applicable to the case where some subframes were disabled (turned OFF).

**Reasons for the Decision**

1. The appeal is admissible.

2. **Novelty and inventive step - Main request**

2.1 Document D1 discloses a method and an apparatus for displaying moving images on a display, such as a plasma displays. Grey-tones are conventionally displayed on
such displays by time-dividing each frame into subframes where each subframe illuminates the enabled pixels at a specific intensity level. The complete image of the frame is produced by displaying the sequence of subframes within a single frame period.

The method of document D1 has the purpose of preventing image distortions of rapidly moving images, often referred to in the art as "false contours", caused by displaying an image frame in form of a sequence of subframes (see paragraph 0005). In this method, the amount of motion $X_f$ and its direction in one frame display period is detected on a "bit-by-bit" basis. A motion correction amount $X_s$ is calculated from detected values of the amount and a "dividing period ratio" of each subframe in the frame period. The image in the corresponding subframe is moved in the detected direction by an amount equal to the motion correction amount (see paragraphs 0007 and 0015).

In the example illustrated in Figures 2 and 3, a frame is composed of two subframes (SF1, SF2), where SF2 displays a bright object moving on a darker background displayed by subframe SF1, whereas the example of Figure 5 shows a darker object (SF1) moving on a bright background (SF2). Regions 36 and 40 in Figures 3 and 5, respectively, refer to a correction region in order to adjust the brightness of the moving object at the edge. The subframes are displayed in the order SF1, SF2 in the example of Figures 2 and 3, whereas in the example of Figure 5 the order of displaying the subframes is reversed. Assuming that the moving object moves the amount $X_f$ within one frame period $T_f$ and the time delay between subframes SF1 and SF2 is $T_s$, the motion
correction amount becomes \( X_s = X_f \times \frac{T_s}{T_f} \) (see equation (1) in paragraph 0020).

Figure 7 shows three subframes SF1, SF2, SF3 where a darker object (displayed in SF1 and SF2) is moving in a bright background (SF3). The subframes are displayed in the order SF2, SF3, SF1. The motion correction amount \( X_s = X_f \times \frac{T_s}{T_f} \) as above where the time delay \( T_s \) is the time between subframes SF3 and SF1. The object in subframe SF2 is given the same position as in SF1 and subframes SF1 and SF2 are moved by the same motion correction amount \( X_s \) (see paragraphs 0034 and 0035).

2.2 The appellant applicant argued that due to its many inconsistencies and contradictions, document D1 was not to be considered an enabling disclosure (VIII(a) above).

The board is not persuaded by the above argument. Although the example of Figure 7 discloses motion corrections of subframes SF1 and SF2 which are somewhat at variance with the general statements made in paragraphs 0007 and 0015, document D1 emphasises that the trailing edge of the object should move along the line L1 shown in Figures 2, 5 and 7 (see paragraphs 0019, 0027, and 0033). Therefore, the skilled person reading document D1 would as a matter of routine seek to apply a motion correction to each subframe (more than two) so that the trailing edge of the moving object lies on this line L1. Moreover, the skilled person would recognise from Figure 2 of document D2 that the position of the image 32 in the subframe SF2 is linearly interpolated between the positions of the image at the first and second frames.
2.3 According to the appellant applicant, the subject matter of claim 1 of the main request differed from the method of document D1 in that there were more than two subframes where each subframe was successively changed, whereas in the example disclosed in document D1 involving three subframes, two of the subframes appeared to have been grouped together and displaced by the same amount (VIII(b) above).

2.4 Although the board for the sake of the argument is prepared to accept the above submission that the subject matter of claim 1 of the main request is to be considered new over D1, it should nevertheless be kept in mind that the disclosure of document D1 is not confined to examples having only two or three subframes, but it also suggests using larger numbers of subframes. For example, Figure 9 referring to prior art illustrates a frame composed of eight subframes.

2.5 The skilled person faced with the problem of applying the teaching of document D1 to a method where more than two subframes are used would in the board's opinion start from the example shown in Figures 2 to 6 involving two subframes. According to document D1, the common edges of the moving images should move along the same line thus linearly interpolating the positions of the image between the first and second frames as shown in Figure 2 (see also paragraphs 0019 and 0020). The resulting method would thus have all the features of claim 1 of the main request.

2.6 For the above reasons, in the board's judgement, the subject matter of claim 1 of the main request does not
involves an inventive step within the meaning of Article 56 EPC.

3. **Inventive step - First auxiliary request**

3.1 With respect to the main request, the method of claim 1 of the first auxiliary request further specifies that the subframe displayed at an origin of individual motion vectors is chosen to be the subframe with the highest intensity level or one of the subframes having the highest intensity level. The subframe displayed at an origin of individual motion vectors is usually the first subframe displayed within a frame period (see Figure 12A of the application).

3.2 According to the appellant applicant, the above feature had the advantage that when the calculation of the displayed position might fail causing the other subframes to be displayed at wrong positions, since the highest intensity level was displayed at the origin, the distortion of the displayed image was limited (see item VIII(c) above).

3.3 As admitted by the appellant at the oral proceedings, it was known in the art to start the frame either with the subframe with the lowest intensity level, as indicated in Figure 1 of the application, or with the subframe having the highest intensity level. This is also indicated in document D1 where the examples of Figure 3 and 5 embody the two alternatives. Therefore, the feature of starting the frame with the subframe having the highest intensity level has to be considered as merely one of two straightforward alternatives from which the skilled person would select without the
exercise of inventive skills. Following the teaching of Figure 2 of document D1, the first subframe would be displayed without motion correction, or to use the terminology of claim 1, it would be displayed "at an origin of the individual motion vectors".

The advantageous effect of the claimed alternative referred to by the appellant applicant has to be regarded as a bonus effect, since as stated above, the alternative of starting the frame with the subframe having the highest intensity level is on its own to be regarded as obvious to the skilled person.

3.4 For the above reasons, in the board's judgement, the subject matter of claim 1 of the first auxiliary request does not involve an inventive step within the meaning of Article 56 EPC.

4. Second auxiliary request

4.1 Claim 1 of the second auxiliary request is based on claims 1 to 3 as filed with the feature on page 11, lines 4 to 11 and Figure 16 of the application as published. Independent claim 2 is based on claims 18 as filed with the addition of the features disclosed in the above-mentioned passage of the application as published.

The board is aware of the fact that the combination of claims 1, 2, 4, 8, and 11 as filed define a method of displaying a halftone image for the case when the number of subframes to be turned ON in the frame is smaller than the total number of subframes, and that this combination defines more features than what is the
case in claims 1 and 2 of the second auxiliary request. The omitted features are however in the board's judgement neither technically necessary for the operation of the invention nor would the skilled reader infer from the application as filed that they are presented as necessary (see Case Law of the Boards of Appeal of the EPO 5th Edition 2006, chapter III.A.2.2).

The board judges therefore that the requirements of Article 123(2) EPC are met.

4.2 The claimed method contributes to solving the problem of reducing flickering when the number of subframes to be turned ON (enabled) is smaller than the total number of subframes. This is done by forming subframe groups where the number of subframe groups is the equal to the number of subframes turned ON and by choosing the advance or delay times between the subframe groups by using the intensity level centre of each subframe group as reference.

4.3 Neither document D1 nor any other of the cited documents discloses the formation of subframe groups for the case where less than all subframes are turned on. Although the example of Figure 7 in document D1 arguably could be construed as disclosing a formation of two subframe groups, this is only shown in the context of correcting the positions of the subframes, without discussing the actual pixel (bit) values of a subframe, and is thus silent as to the case when less than all subframes are turned on. Furthermore, document D1 does not teach using the intensity level centre of the subframe groups as reference for determining the delay/advance times between the subframe groups. Hence
document D1 does not provide the skilled person with any hint that would point towards the method of claim 1 of the second auxiliary request.

4.4 In the board's judgement, the subject matter of claim 1 of the second auxiliary request involves an inventive step within the meaning of Article 56 EPC.

4.5 The apparatus of independent claim 2 involves an inventive step for the same reasons as for claim 1.
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 following version:

   Claims 1 and 2 as filed during oral proceedings

   Description pages 1, 2, 10, 11, 15 to 27, 52, 53 as filed during oral proceedings

   Figures 1 to 16 as originally filed.

Registrar

Chair

S. Sánchez Chiquero

R. G. O'Connell