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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

Patentee:
Hitachi Plasma Patent Licensing Co., Ltd., et al

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

D E C I S I O N
of the Technical Board of Appeal 3.4.03
of 30 August 2007

Appellant:	Hitachi Plasma Patent Licensing Co., Ltd. 2-1, Otemachi 2-chome Chiyoda-ku Tokyo (JP)
Representative:	Williams, Michael Ian Haseltine Lake Lincoln House 300 High Holborn London WC1V 7JH (GB)
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.

V.   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."

VI.   Independent claims 1 and 11 of the first 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, 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 an **individual** motion vector

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 Dl
       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 $X_s = X_f \times T_s/T_f$ (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 $X_s = X_f \times T_s/T_f$ 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

involve 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

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