Datasheet for the decision
of 7 February 2020

Case Number: T 1735/16 - 3.4.03
Application Number: 09730656.7
Publication Number: 2277162
IPC: G09G3/20, G09G5/10, G09G3/34
Language of the proceedings: EN

Title of invention:
METHODS FOR DRIVING ELECTRO-OPTIC DISPLAYS

Applicant:
E Ink Corporation

Headword:

Relevant legal provisions:
EPC Art. 123(2), 84, 54(1), 56

Keyword:
Added subject matter - no
Clarity - after amendment (yes)
Novelty and inventive step - after amendment (yes)

Decisions cited:
Catchword:
Case Number: T 1735/16 – 3.4.03

DECISION
of Technical Board of Appeal 3.4.03
of 7 February 2020

Appellant: E Ink Corporation
(Applicant)
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Decision under appeal: Decision of the Examining Division of the European Patent Office posted on 28 January 2016 refusing European patent application No. 09730656.7 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman G. Eliasson
Members: M. Papastefanou
T. Bokor
Summary of Facts and Submissions

I. The appeal is against the decision of the examining division refusing the European patent application No. 09 730 656.7 (published as WO 2009/126957 A1) on the grounds that claim 1 of the sole request then on file comprised added subject matter (Article 123(2) EPC), was not clear (Article 84 EPC), and was not new (Article 54(1) EPC).

II. At the end of the oral proceedings before the board, the appellant's (applicant's) requests were that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:
- Description: pages 1-7, 9-11, 15, 16 as published, pages 8, 12, 13, 17 filed during the oral proceedings before the board (page 14 as published to be deleted)
- Claims 1-10 as filed during the oral proceedings before the board
- Drawings: Sheets 1/2, 2/2 as published, as Main Request, or, alternatively, on the basis of one of the 1st to 4th Auxiliary Requests filed with letter dated 7 January 2020.

In the course of the appeal, the appellant withdrew its initial request for reimbursement of the appeal fee because of an alleged procedural violation committed by the examining division (Rule 103(1)(a) EPC).

III. Reference is made to the following document, cited in the decision under appeal:


D3 is the publication of the US patent application
corresponding to the US patent US 7,119,772 B2, which is referred to in the description of the application (see [Para 1] and [Para 20] of the published application, for example).

IV. Claim 1 of the Main request has the following wording:

A method of driving a bistable electro-optic display having a plurality of pixels and a storage means arranged to store data representing a plurality of drive schemes at least equal in number to the different drive schemes to be stored for the various pixels of the display, and a time value associated with each of the stored drive schemes, the method comprising: storing, for each pixel of the display, data representing an initial state of the pixel, data representing a desired final state of the pixel, and a drive scheme index number representing the drive scheme to be applied to the pixel; and generating, for each pixel of the display, output signals representing the impulse to be applied to each pixel to switch the pixel from the initial state to the desired final state, the output signals being generated, for each pixel, dependent upon the initial and desired final states of the pixel, the drive scheme index number, the time value associated with the drive scheme denoted by the drive scheme index number, and the stored data representing the drive scheme denoted by the drive scheme index number, the method being characterized in that at least two of the drive schemes begin at different times and run independently of one another, and the time value stored for each drive scheme represents the period since the commencement of the current update effected with the drive scheme.
V. The wording of the claims of the auxiliary requests is not relevant for the decision.

VI. The appellant argued mainly that the subject-matter of claim 1 was clear (Article 84 EPC), new (Article 54(1) EPC) and involved an inventive step (Article 56 EPC). In particular, D3 neither disclosed nor suggested a method of driving a bistable electro-optic display whereby at least two drive schemes began at different times and ran independently of one another.

Reasons for the Decision

1. The claimed invention

The claimed invention relates to a method for driving electro-optic displays which comprise a plurality of pixels, and such displays.

According to the claimed method, different drive schemes (series of waveforms consisting of impulses, which are applied to the pixel electrode) are used to drive different (groups of) pixels of the display. When an update of the displayed image is carried out, a final state (grey value) for each pixel is determined, and each pixel is driven with a drive scheme to change its colour (grey value) from an initial state (the actual grey value) to a final state (updated grey value). Pixels which are driven with a faster drive scheme will reach their final state before the pixels which are driven with a slower drive scheme. Normally, the update of the former pixels has to be delayed in order to allow the latter pixels to reach their final state before a new update can start. This results in some pixels being idle for a certain period of time.
("unresponsive period" in the application), during which other pixels complete their transition to their corresponding final state (updated grey value).

The claimed method eliminates this unresponsive period by enabling drive schemes used for different (groups of) pixels to start at different times and run independently from one another. In this way, when pixels driven with a faster drive scheme reach their final state they do not need to "wait" until the remaining pixels of the display (driven with slower drive scheme(s)) reach their final state before they can start a new update but can start a new update towards a new final state right away (see [Para 21] to [Para 23] of the application as published).

2. Main Request

2.1 Amendments, added subject matter (Article 123(2) EPC)

2.1.1 Compared to the Main Request underlying the decision under appeal, the claims of the current Main Request have been amended as follows:

- The feature "the time value stored for each drive scheme represents the period since the commencement of the current update effected with the drive scheme" has been added in the end of claim 1. This feature finds basis in [Para 30] of the application as originally filed (published).

- Dependent claims 4, 6, 7, 8, 9 and 10 have been amended to define a bistable electro-optic display, in line with independent claim 2.

- Dependent claim 5 has been amended to refer to claim 2 instead of claim 1.
2.1.2 The description has been adapted to the claims of the Main Request.

2.1.3 In the decision under appeal, the examining division held that the feature of claim 1 "the method being characterised in that at least two of the drive schemes begin at different times and run independently of one another" had no basis in the originally filed application.

According to the examining division, there were certain limitations as to the time a drive scheme could begin, which related to the manner in which the electro-optic display was driven (see also [Para 38] of the published application). The feature in claim 1 implied that the drive scheme(s) could begin at any arbitrary time and this was beyond the originally filed content of the application (see point 1 of the reasons of the impugned decision).

The board does not share this opinion of the examining division. The identified feature of claim 1 defines only that the two drive schemes begin at different times, without any indication as to the actual time the drive schemes are supposed to begin. There may be limitations to take into account as to when a drive scheme can begin, but this is irrelevant for the question of the disclosure of the feature that the drive schemes begin at different times and run independently from one another. The claimed feature is described in [Para 37] of the application, which thus provides the necessary basis for the amendment.

2.1.4 The board is therefore satisfied that the application as amended meets the requirements of Article 123(2)
EPC.

2.2 Claims, Clarity (Article 84 EPC)

2.2.1 The amendments carried out in the claims overcome the objections for lack of clarity raised in the board's preliminary opinion regarding inconsistencies in the terminology used and the presence of multiple independent claims (see points 3.1.8 and 3.1.9 of the board's communication of 11 September 2019).

2.2.2 The examining division was of the opinion that the term "drive scheme" in claim 1 was too broad, rendering the claim unclear (see point 2.1 of the decision under appeal).

The board notes at first that a broad term in a claim is not necessarily unclear. Secondly, in the case at hand, the board is of the opinion that a skilled person would understand the meaning of "drive scheme" in the context of the application. In addition, the term is explained in the description (see [Para 9]). The explanations provided in this paragraph make it clear what a waveform is and what is meant by a drive scheme. In general it is acceptable to provide explanations in the description of the meaning of terms in the claims (see also Case Law of the Boards of Appeal of the EPO, 9th Edition, July 2019, Chapter II.A.6.3.3).

2.2.3 In the decision under appeal, the examining division held that the feature "the method being characterised in that at least two of the drive schemes begin at different times and run independently of one another" attempted to define the subject-matter for which protection was sought in terms of the result to be
achieved instead of defining clear method steps to be
carried out to achieve the claimed result (see point
2.2 of the impugned decision).

The board agrees with the examining division on this
point (see also points 3.1.3 and 3.1.4 of the board's
communication of 11 September 2019). However, with the
addition of the last feature in claim 1 of the current
Main Request (see point IV above), this objection has
been overcome.

As the appellant also explained (see statement of
grounds of appeal, paragraph bridging pages 4 and 5),
the claimed method generated the output signal
depending on the time value associated with the drive
scheme denoted by the drive scheme index number. By
using this time value associated with each of the
stored drive schemes, the claimed method could generate
the output signal individually for each pixel. The time
value represented the time elapsed since the
commencements of the use of the drive scheme and with
it it was possible to know exactly when a drive scheme
was completed, since the time value was reset to zero.
The system would know that the drive scheme ended and a
new update could start (see also [Para 43] to [Para
46]).

In the board's view, with the insertion of the
definition of the time value in the claim, the skilled
person has all the necessary information to be able to
carry out the necessary steps and achieve the claimed
result (the two schemes beginning at different times
and running independently from one another).
2.2.4 The board is, thus, satisfied that the claims of the Main Request fulfil the requirements of Article 84 EPC.

2.3 Novelty and Inventive Step (Articles 52(1), 54(1) and 56 EPC)

2.3.1 Disclosure of D3

D3 describes a method and an apparatus for driving bistable electronic displays in a manner which permits pixels in a part (region) of the display to operate at a different bit depth (i.e. different number of gray levels) from the pixels of the rest of the display. In a similar way as in the present application, D3 recognises the need to update a particular region of a display faster than the rest of the display. Different drive schemes (in the terminology of the claims) are used for different regions of the screen, depending on the bit depth (number of gray levels) the pixels in each region should be able to display (see paragraph [0035] of D3). Depending on the image to be displayed, the display is divided in regions and the bit depth of each region is determined. For example, the pixels in a region that is to display a black and white image (e.g. a dialog box or a request for user input) need to be able to display only two colours (black/white) and therefore they have a bit depth of one (1). The pixels in the region of the display that are to display a colour image need to be able to display more colours (grey levels) and hence have a higher bit depth. In order to keep track of the bit depths of the pixels in the different regions, the controller of the display keeps an array of storage elements, one element for each pixel in the display. Each element stores a value representing the bit depth of each pixel. When a new image is sent to the controller, and the pixels of the
display need to be updated (changed), the pixels are updated with drive schemes (waveforms) corresponding to their respective bit depth. There are thus several different drive schemes running simultaneously, one for each region of the display. As an example D3 describes a display with two regions: a main region at full bit depth and a dialog box region in one-bit mode (see paragraphs [0469] to [0488]).

A contested point during the proceedings before the examining division was whether D3 disclosed the feature at least two of the drive schemes begin at different times and run independently of one another. The appellant did not contest, however, that the remaining features of claim 1 of the Main Request in the version underlying the impugned decision were disclosed in D3 (see statement of grounds of appeal, pages 5 to 7, points 3 and 4).

2.3.2 As a first point, the board notes that D3 does not disclose any time value according to the definition of claim 1 of the current Main Request. At least for this reason, the subject-matter of claim 1 is new (Article 54(1) EPC).

2.3.3 Secondly, regarding the contested feature, the board notes that D3 discloses that when the two drive schemes (waveforms) are applied simultaneously, the shorter one-bit waveforms must be zero-padded appropriately to match the length of the grayscale update (see paragraph [0480]). The pixels driven with the faster drive scheme (one bit depth) will reach their final state before the pixels driven with the slower drive scheme (grayscale). In the method of D3, however, the two drive schemes are synchronised and the corresponding waveforms must have the same length. This is achieved by adding zeros (0)
("zero-padding") to the shorter waveform of the faster drive scheme, introducing thus the necessary delay allowing the slower drive scheme to be completed before a new update can start.

The examining division was of the opinion that the important issue in D3 was that the two waveforms (of the drive schemes) had the same length, so that the zeros could as well be added in the beginning of the waveform, before the actual driving of the pixels starts. In this way, the two drive schemes would end at the same time but they would start at different times (see paragraph bridging pages 6 and 7 of the impugned decision, as well as point 4.1 of the reasons).

The board does not agree. It is true that the passage of paragraph [0480] cited above does not specify how the "zero-padding" of the waveforms is done and in particular it does not indicate whether the zeros are added in the beginning or at the end of the waveform. As explained in D3, the purpose of using faster drive schemes (update methods in the terminology of D3) for some regions of the display is to enable faster updates ("swift transitions") so that certain information is presented to the user with minimal delay (see paragraph [0035]). The aim of the described display driving method is, thus, to achieve that certain pixels of the display reach their final state faster than others (see also paragraphs [0470] and [0471]). In this context, the skilled person would not contemplate to implement the zero-padding in the beginning of the waveform because it would delay the update of the pixels which are driven with the faster drive scheme (shorter waveform) and would be at odds with the purpose of the described method. In the board's view the skilled person would directly and unambiguously derive that, in
the context of D3, the described zero-padding is done by adding zeros at the end of the waveform of the faster drive scheme. The pixels that arrive at their final state first (due to the shorter waveform) will have to "wait" for the remaining pixels of the display to reach their final state before a new update of the display starts.

This implies that the two drive schemes start at the same time and finish at different times. The zero-padding of the waveform implies also that the two drive schemes are synchronised, i.e. they do not run independently from one another. The contested feature is thus not disclosed in D3.

2.4 Difference and technical problem

2.4.1 Hence, claim 1 of the Main Request differs from D3 by its characterising features:
- at least two of the drive schemes begin at different times and run independently from one another; and
- the time value stored for each drive scheme represents the period since the commencement of the current update effected with the drive scheme.

2.4.2 The technical effect of these features is that the pixels that are updated with the faster drive scheme and reach their final state first do not need to wait until the slower update of the other pixels is finished. The pixels reaching first their final state can start a new update towards a newly defined final state. This reduces the time pixels have to remain idle and "wait" for the whole of the display to be updated to the final state of all the pixels (the "unresponsive period" in the terminology of the application, see
[Para 23] of the application as published).

2.4.3 Starting from D3 the problem the skilled person is faced with is how to reduce the unresponsive period of some pixels in the display and accelerate the overall operation of the display.

2.5 Solution and obviousness

2.5.1 The claimed method solves the defined technical problem by driving the pixels with at least two different drive schemes that start at different times and run independently from one another. Using the time value associated with the drive scheme of every pixel, it is possible to know exactly when a drive scheme is completed and the corresponding pixel has reached its final state. Subsequently, a new final state for that pixel can be defined so that the new update can start without waiting for the pixels driven with the slower drive scheme(s) to reach their corresponding final states (see [Para 23] to [Para 28] and [Para 42] to [Para 46] of the published application).

2.5.2 As mentioned before, in D3 it is explicitly mentioned that the one-bit waveform (faster drive scheme) is zero-padded to match the length of the greyscale waveform (slower update). The two drive schemes are synchronised and start at the same time.

2.5.3 The skilled person would not find any information or suggestion in D3 that would motivate them to modify the described display driving method and arrive at the claimed method without exercising any inventive skill. In addition, even if the skilled person attempted to carry out such a modification to the display driving method of D3, there is no disclosure or suggestion in
D3 of a time value associated with each drive scheme according to claim 1 of the Main Request that would help them to arrive at the claimed subject-matter in obvious manner.

2.5.4 The conclusion of the board is therefore that the subject-matter of claim 1 of the Main Request involves an inventive step with respect to D3. The same applies for independent claim 2, which defines the corresponding bistable electro-optic display. Claims 3 to 10, which depend directly or indirectly on claim 2, are considered new and inventive, as well.

3. The board is, thus, satisfied that the patent application according to the Main Request and the invention to which it relates meet the requirements of the EPC and a patent is to be granted according to Article 97(1) EPC.
Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent in the following version:

   - Description: pages 1-7, 9-11, 15, 16 as published, pages 8, 12, 13, 17 filed during the oral proceedings before the board (page 14 as published to be deleted)
   - Claims 1-10 as filed during the oral proceedings before the board
   - Drawings: Sheets 1/2, 2/2 as published.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated