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D E C I S I O N
of 9 October 1997

Case Number: T 0244/94 - 3.4.1

Application Number: 86111751.3

Publication Number: 0216168

IPC: G09G 3/36

Language of the proceedings: EN

Title of invention:
Method of driving a display panel

Applicant:
Canon Kabushiki Kaisha

Opponent:
-

Headword:
-

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

Keyword:
"Main and first auxiliary request: inventive step (no)"
"Second auxiliary request: not allowable under Art. 123(2) EPC"
"Disclosure in figure contradicting remaining parts of application"

Decisions cited:
T 0119/82, T 0056/87, T 0523/88

Catchword:



Europäisches
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Beschwerdekammern

Boards of Appeal

Chambres de recours

Case Number: T 0244/94 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 9 October 1997

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

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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 3 November 1993
refusing European patent application
No. 86 111 751.3 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: H. J. Reich
Members: G. Assi
A. C. G. Lindqvist

Summary of Facts and Submissions

- I. European patent application No. 86 111 751.3 (publication No. 0 216 168) was refused by a decision of the Examining Division.
- II. The reason given for the refusal was that the subject-matter of claim 1 filed with letter dated 18 December 1992 did not satisfy the requirements of Articles 52 and 56 EPC having regard to documents:

D1: GB-A-2 134 300 and

D2: GB-A-2 149 181,

for the following reasons. The preamble of claim 1 specifies a number of generally known features of a liquid crystal display device, such as transistor switches, gate and source lines, a common counter electrode and sample and hold capacitors. Document D1 discloses means for inverting the voltage polarity of the video signal to be input into the source in synchronism with a horizontal scanning period, in order to avoid brightness differences between the top and the bottom of the display due to leakage currents in the transistor switches. The display device disclosed in document D1, requires too high video voltages for driving the liquid crystal. This problem also underlies the present application. Document D2 suggests minimising the required amplitude of the video signal by applying the specific voltage to the counter electrode as claimed. The teaching of document D2, i.e. inverting at field frequency and reducing power consumption is not contradictory to a higher power consumption in the device disclosed in document D1 inverting at line frequency, since the operation of the voltage minimising technique disclosed in D2 is not

limited to a specific driving frequency. A simultaneous use of the solutions presented in documents D1 and D2 falls within the design competence of the skilled person and does not lead to any unexpected effect.

III. The appellant lodged an appeal against this decision on 28 December 1993, paying the appeal fee the same day, and filed with the grounds of appeal dated 3 March 1994 a new claim 1 as main request starting from document D2 and based on the subject-matter of claim 1 underlying the appealed decision, and a new claims 1 as first auxiliary request.

Claim 1 of the **main request** reads as follows:

"1. A display apparatus, comprising:

a) a display panel (11) having transistors (12) arranged along a plurality of rows and columns,

a gate line (G_1-G_n) commonly connecting gate electrodes (G) of said plurality of transistors (12) of the same row,

a source line (S_1-S_m) commonly connecting source electrodes (S) of said plurality of transistors (12) of the same column,

a drain electrode (D) per each transistor (12), and a counter electrode (15; 31) opposed to said drain electrode (D);

b) a group of capacitors (C_1-C_m) for sampling and holding a signal (COM) input into said source electrode (S);

c) means (3, 4) for inverting the voltage polarity of said signal (COM) to be input into said source electrode (S);

d) means for supplying said counter electrode (15; 31) with a voltage of $V_{TPO} = \pm(V_1 \pm V_2) / 2$, wherein V_1 and V_2 represent voltages respectively at the beginning and the end of a state transition with regard to a

driving voltage and transparency of the liquid crystal;
and

e) means for inverting the polarity of said voltage (V_{ITO}) to be supplied to said counter electrode (15; 31),

said display apparatus being characterised in that

f) said signal (COM) to be input into said source electrode (S) and said voltage (V_{ITO}) to be supplied to said counter electrode (15; 31) are inverted in synchronism with a horizontal scanning period, so that said voltage (V_{ITO}) supplied to said counter electrode (15; 31) has a polarity opposite to that of said signal (COM) input into said source electrode (S)."

Claim 1 of the **first auxiliary request** adds to the wording of claim 1 of the main request the feature:

"and

g) high-speed integrated circuits are used for driving said signal (COM) input into said source electrode (S)."

Claims 2 to 4 of the main and first auxiliary request as filed with letter dated 18 December 1992 are dependent on the respective claim 1.

Furthermore, the appellant cited in the grounds of appeal document

D3: E. Gelder: "Integrierte Digitalbausteine", Vogel-Buchverlag Würzburg, 5. Auflage, 1984, pages 93 to 99 and 427

in order to evidence that the dynamic power consumption of an integrated circuit increases with its switching frequency. The appellant submitted that an extremely

higher power consumption at the line frequency represents a prejudice which diverted the skilled person away from combining document D1 with D2 such as to arrive at the subject-matter of the present claim 1.

IV. In an annex to a summons to oral proceedings, the Board expressed its preliminary view which can be summarized as follows: In agreement to the appellant's view, document D2 should be regarded as the closest prior art. In addition to the technical features of the pre-characterising part of claim 1 of the **main request** document D2 discloses as well features defined in the characterising part of claim 1, so that by substituting the inversion with the **field** period in the device of D2 by an inversion "with a **horizontal scanning** period" as disclosed in document D1 a skilled person would arrive at the subject-matter of claim 1. Such substitution appeared to be obvious in view of the advantageous reduction of the leakage current disclosed in document D1, page 3, lines 62 to 76, and the fact that document D3 evidences no prejudice that it is technically impossible to change the rate of inversion in document D2 from the field to the horizontal period. A skilled person will be aware of the higher power consumption and only expect temperature problems to be solved additionally. Having regard to claim 1 of the **first auxiliary request**, nothing inventive may be seen in filling out the gap of information in document D2 that "high speed" integrated circuits should be used.

V. For preparing oral proceedings the appellant filed with letter dated 22 August 1997 a new claim 1 as second auxiliary request.

Claim 1 of the **second auxiliary request** is directed to a "display apparatus, comprising" features (a), (b) and (d) as worded in the main request and features (c) and (e) having the following wording:

"c) means (3, 4) for generating the voltage of said signal (COM) to be input into said source electrode (S), so that the voltage of the signal to be input into the source is set within a range V_2-V_1 for at least two continuous horizontal scannings, the voltage of a signal input into the source is inverted in polarity with reference to a voltage shifted to a value V_2-V_1 respectively between earlier and later ones of the two horizontal scannings;

e) means for inverting the polarity of said voltage (V_{ITO}) to be supplied to said counter electrode (15; 31), in synchronism with a horizontal scanning period, so that said voltage (V_{ITO}) supplied to said counter electrode (15; 31) has a polarity opposite to that of said signal (COM) input into said source electrode (S)."

Claims 2 to 4 of the second auxiliary request are dependent on claim 1 and correspond to claims 2 to 4 of the main request.

VI. Oral proceedings were held on 9 October 1997, at the end of which the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main or first auxiliary request submitted with letter dated 3 March 1994 or the second auxiliary request submitted with letter dated 22 August 1997.

VII. In support of his requests the appellant argued essentially as follows:

(a) The subject-matter of claim 1 of the **main request** differs from the closest prior art disclosed in document D2 (allowing to input a lower video signal by feeding to source and counter electrode voltages of different polarity so that they add)

in that the polarity of the video input is inverted with the horizontal scanning period. Hence, the objective problem underlying the main request consists in avoiding display contrast differences within the pixel matrix produced by leakage currents from the capacitors sampling and holding the video signal. Its solution consists in inverting (switching) with the horizontal scanning period, i.e. with the display of the signals in each row. Document D2 teaches to solve the above problem of diverging display contrast (page 2, lines 9 to 11) either by increasing the counter electrode voltage gradually in order to compensate for the leakage loss of voltage of the signal held in the capacitors (page 3, lines 69 to 97; Figures 4(c) and (d)) or by splitting the counter electrode into stripes (page 3, lines 97 to 104). Hence, a skilled person derives from document D2 no hint or technical motif to refer to document D1 and would not use the teaching of document D1 for reducing display contrast differences in the display disclosed in document D2. It is thus not obvious to combine the teachings of documents D1 and D2 since the present invention points into a direction which is different from the prior art disclosed in document D2.

- (b) Moreover, document D2 deals with minimising the power consumption in a liquid crystal display (page 2, lines 30 to 32). Enlarging the inversion frequency of the display of D2 from the field period to the horizontal scanning period according to D1 increases power consumption. Hence, the teachings of documents D1 and D2 are technically incompatible and cannot be combined with each other.

- (c) Moreover, document D1 teaches to invert only the signal input into the source electrode. Hence, the two steps of the solution according to the invention - changing the switching period of the source electrode voltage and that of the counter electrode - implies an inventive step.
- (d) While according to document D2 the reduction of the driving voltage causes a reduction of the power consumption, according to the present invention this voltage reduction enables the application of high-speed integrated circuits as claimed in claim 1 of the **first auxiliary request**. The reason of lowering the driving voltage in D2 is thus different from that of the present invention. None of the cited prior art documents discloses a use of high-speed integrated circuits in high frequency applications. Therefore, the subject-matter of claim 1 of the first auxiliary request constitutes patentable subject-matter.
- (e) In view of the Board's objection under Article 123(2) EPC, that the feature:

"the voltage of a signal input into the source is inverted in polarity with reference to a voltage shifted to a value $V_2 - V_1$ respectively between earlier and later ones of the two horizontal scannings"

as claimed in paragraph (c) of claim 1 of the **second auxiliary request**, is not disclosed in the application documents as filed, the appellant submitted that this feature is derivable from the form of the COM' signal in Figure 2 of the application.

VIII. At the conclusion of the oral proceedings, the decision was announced that the appeal is dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. *Inventive step - claim 1 - main request*
 - 2.1 From the closest prior art disclosed in document D2 there is known in the wording of claim 1:

"A display apparatus, comprising:

 - a) a display panel (see D2, 32 in Fig.6) having transistors (11 in Fig.1) arranged along a plurality of rows and columns, a gate line (12 in Fig.1) commonly connecting gate electrodes of said plurality of transistors of the same row, a source line (13 in Fig.1) commonly connecting source electrodes of said plurality of transistors of the same column, a drain electrode (connected to 14 in Fig.1) per each transistor, and a counter electrode (15 in Fig.1) opposed to said drain electrode;
 - b) a group of capacitors (in column electrode driver 34 of Fig.1, therein converting the serial input into a parallel output; see D2, page 1, lines 102 to 106 disclosing the claimed effect with different words) for sampling and holding a signal input into said source electrode;
 - c) means (36, 37, 38, and 39 in Fig.6) for inverting the polarity of said signal to be input into said source electrode;
 - d) means (40 in Fig.6 in combination with page 4, lines 44 to 55) for supplying said counter electrode with a voltage of $V_{ITO} = \pm(V_1 + V_2) / 2$,

wherein V_1 and V_2 represent voltages respectively at the beginning and the end of a state transition with regard to a driving voltage and transparency of the liquid crystal; and

e) means (39, 40 in Fig.6 and Fig.7 (c)) for inverting the polarity of said voltage to be supplied to said counter electrode,

said display apparatus being characterised in that

f) said signal to be input into said source electrode and said voltage to be supplied to said counter electrode are inverted in synchronism (page 2, lines 97 to 100) ..., so that said voltage supplied to said counter electrode has a polarity opposite to that of said signal input into said source electrode (page 2, lines 44 to 47)."

2.2 The problem of reducing display contrast differences within the pixel matrix of a display is already solved in the closest prior art disclosed in document D2 (see also paragraph VII-(a) above. There is no evidence on file which qualitatively compares the efficiency of the solutions disclosed in document D2 with that of the present invention. Therefore, the objective problem underlying the invention as claimed in claim 1 of the main request can only be seen in indicating an alternative solution of this known problem. Since a skilled person cannot exclude that a known solution of a technical problem may show imperfections in operation or difficulties in realisation when applied to devices in future development, in the Board's view, elaborating alternative solution for a known problem belongs to the normal tasks of a skilled person. In the present case, for instance, leakage currents in individual pixels may inadmissibly deviate from the average value which is compensated by the linear increase of the counter electrode voltage, or difficulties may arise in etching and additionally contacting the stripes of the counter electrode. The appellant has submitted no arguments

that the existing solutions render a development of alternatives superfluous for technical reasons. Hence, no contribution to inventive step is to be found in the definition of the objective problem.

2.3 It is not contested by the appellant that the claimed alternative solution of the objective problem by inverting source signal and counter electrode according to the remaining wording of claim 1 of the main request "with a horizontal scanning period" is disclosed in document D1; see paragraph VII-(a) above, and document D1, V_{in} in Figure 8, page 3, lines 91 to 98 and lines 62 to 76. The fact that the two solutions disclosed in document D2 point into a different technical direction (see paragraph VII-(a) above) cannot support an inventive step because the alternative solution applied in claim 1 exists already in the prior art of the identical technical field. In the established jurisdiction of the Boards of Appeal of the EPO, a mere exchange of known alternative means for producing the same qualitative effect, is regarded to fall within the discretion of a skilled person and thus to be obvious. In the event of a discretionary use of a known technique, no particular technical effect for motivating and thereby supporting the "would" of the exchange is required as an indispensable criterium of obviousness. Blocking by patent protection a free use of known alternatives in analogous situations within the same technical field would impede the normal technical development of the art and thus be contrary to the legal aim of Article 56 EPC.

2.4 The fact that a use of the higher inversion frequency according to document D1 in the display of document D2 leads to a higher power consumption in the resulting display, in the Board's view, represents no prejudice against such use. The appellant has submitted no evidence or reasons why it would be technically

impossible to change in the display of document D2 the inversion rate from the field period to the horizontal scanning period. Moreover, any possibly existing prejudice against an inversion of the signal input to the source electrode with the horizontal scanning period would have been overcome by the teaching of document D1. It was not contested by the appellant that the teaching of document D1 can be carried out in practice. There are not even arguments on file demonstrating that technical difficulties had to be overcome, when replacing control circuit 39 in Figure 6 of document D2 by an analogous one having the essential properties of signal modulation section 44 of Figure 5 of document D1. In the Board's view, the effect that an increased inversion rate increases the power consumption in the switching means of the display, belongs to a skilled person's general knowledge. Therefore, the Board sees in such higher power consumption as submitted by the appellant (see paragraph VII-(b) above) a disadvantage which a skilled person would expect. There is no evidence on file that the increase of inversion power is neglectable. From the original application documents it is not derivable that means had to be or are provided for compensating the effect of the inversion power on the operation of the display. Taking a predictable disadvantage for granted does not imply an inventive step; see also T 119/82, OJ EPO 1984, 217.

- 2.5 The Board regards a skilled person to be able to easily recognise that opposite polarities of the source electrode signal and the counter electrode voltage are indispensable measures for minimising the required amplitude of the video signal. More logical considerations are necessary to find out that for maintaining the minimum of said required amplitude, the inversion of the source electrode signal and that of the counter electrode voltage should be maintained in

synchronism also at the increased inversion rate. Hence, the Board considers the inversion of the counter electrode voltage with the horizontal scanning period (see paragraph VII-(c)) to be an adaptation measure which a skilled person establishes automatically in the obvious use of the teaching of document D1 in the display of document D2.

2.6 For the reasons set out above in paragraphs 2.1 to 2.5, claim 1 of the main request does not involve an inventive step and is not allowable pursuant to Articles 52(1) and 56 EPC.

3. *Inventive step - claim 1 - first auxiliary request*

3.1 The question of an inventive step underlying the subject-matter of claim 1 of the first auxiliary request is answered by examining whether it is obvious to use "high speed integrated circuits" for driving the signal input into the source electrode of the display disclosed in document D2. Document D2 is silent about the number of pixels and their driving frequency. The fact that a development of a display with an increased number of pixels would need microcircuits with increased switching speed, belongs to the basic knowledge of a skilled person. Since the technical development in the display art is generally known to work on larger screens and increased resolution, it is obvious for a skilled person to make use of high speed integrated circuits (ICs) also in the display disclosed in document D2.

3.2 The fact that high-speed ICs were known at the priority date of the present application was not contested by the appellant. (Otherwise Article 83 EPC would not have been satisfied, since the original description is totally silent about any structural features of high-

speed ICs). A skilled person can as well be supposed to know that high-speed ICs have low withstanding voltages. Nevertheless, the teaching in document D2, page 4, lines 80 to 87 - i.e. that the particular counter electrode voltage of the invention disclosed in document D2 allows to drastically minimise the required amplitude of the video signal - in the Board's view hints a skilled person to try whether the minimised video signal voltage falls below the known withstanding voltages of known high-speed ICs. The fact that the amplitude minimisation according to document D2 was developed for reducing power consumption (see paragraph VII-(d)), in the Board's view does not prevent a skilled person from recognising that the achievable minimum value of the video signal presets the admissible parameter limits of applicable ICs. Moreover, the original application documents are silent about any unexpected effects or difficulties in the use of high-speed ICs.

3.3 For the reasons set out in paragraphs 2.1. to 2.5, 3.1 and 3.2 above claim 1 of the first auxiliary request does not involve an inventive step and is not allowable pursuant to Articles 52(1) and 56 EPC.

4. *Article 123(2) EPC - claim 1 - second auxiliary request*

4.1 Claim 1 of the second auxiliary request comprises in paragraph (c) the feature:

"the voltage of a signal input into the source is inverted in polarity with reference to a voltage shifted to a value $V_2 - V_1$ respectively between earlier and later ones of the two horizontal scanings;" see also paragraph V above.

The original description is totally silent about shifting the reference potential of the video signal inversion. The appellant is of the opinion that this feature is disclosed in the form of the COM' signal in Figure 2 of the application.

4.2 In the established jurisdiction of the Boards of Appeal of the EPO a feature which is exclusively derivable from a schematic drawing, is only regarded as forming part of the disclosure of the corresponding document, if there is no technical contradiction with the remaining parts of this document; see also decisions T 56/87 OJ EPO 1990, 188 and T 523/88 (not published).

4.3 Figure 2 of the present application is disclosed to represent a time chart for the operation of the circuit of Figure 1 which is disclosed to be an embodiment of a driving circuit according to the present invention. Interpreting the information derivable from Figure 2, a skilled person may not be sure whether the constant amplitude $V_2 - V_1$ at the end of the right hand side horizontal scanning period is part of the video signal. Therefore, he would consult the circuit diagram of Figure 1. However, a skilled person derives from Figure 1 only an inversion of the video signal without any shift of the reference voltage of the inversion. Figure 1 does not show a circuit symbol corresponding to a voltage source allowing to shift the reference voltage during an inverted polarity of the video signal. In the parts of the circuit which would enable such shift - i.e. between the direct connection of amplifier 2 to a first input of change-over switch 4 (non inverted signal) and the connection of the output of inverter 3 to the second input of change-over switch 4 (inverted signal) - only the symbol "-1" of the inverter element 3 is present, and a symbol of a source for a reference voltage is missing. Also the description discloses only the inverter function of

circuit element 3 and is silent about any additional effect produced by this circuit element. Hence, the form of the COM' signal in Figure 2 technically contradicts the disclosure derivable from Figure 1 and the text of the description of the present application.

4.4 In view of the above technical contradiction the Board finds that the feature mentioned in paragraph 4.1 above, is not derivable from the original application documents as filed. Therefore, claim 1 of the second auxiliary request cannot be allowed with regard to Article 123(2) EPC.

5. Claims 2 to 4 of all requests fall because of their dependence on the respective claim 1.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Beer

H. J. Reich

