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**D E C I S I O N**  
**of 17 August 2000**

**Case Number:** T 0050/96 - 3.4.1

**Application Number:** 85304770.2

**Publication Number:** 0167398

**IPC:** G09G 3/36

**Language of the proceedings:** EN

**Title of invention:**

Ferro-electric liquid crystal electro-optical device

**Patentee:**

SEIKO INSTRUMENTS INC.

**Opponent:**

Canon Inc.

**Headword:**

Ferro-electric liquid crystal electro-optical device/SEIKO  
INSTRUMENTS INC

**Relevant legal provisions:**

EPC Art. 83, 123(2)

**Keyword:**

"Sufficiency of disclosure (yes - on the basis of the  
information provided by the application specification and the  
skilled person's general knowledge)"

"Subject-matter extending beyond the content of the  
application as filed (no)"

"No reason to discuss issues not challenged by the appellant  
in the opposition appeal procedure"

**Decisions cited:**

T 0292/85

**Catchword:**

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**Case Number:** T 0050/96 - 3.4.1

**D E C I S I O N**  
**of the Technical Board of Appeal 3.4.1**  
**of 17 August 2000**

**Appellant:** Canon Inc.  
(Opponent) No. 30-2, Shimomaruko 3-chome  
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Tokyo 146 (JP)

**Representative:** Field, Howard John  
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**Respondent:** SEIKO INSTRUMENTS INC.  
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**Representative:** Sturt, Clifford Mark  
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**Decision under appeal:** Interlocutory decision of the Opposition Division  
of the European Patent Office posted 7 November  
1995 concerning maintenance of European patent  
No. 0 167 398 in amended form.

**Composition of the Board:**

**Chairman:** G. Davies  
**Members:** H. K. Wolfrum  
G. Assi

## Summary of Facts and Submissions

- I. The appellant (opponent) lodged an appeal against the interlocutory decision of the opposition division, dispatched on 7 November 1995, maintaining European patent No. 0 167 398 in amended form. The notice of appeal was received on 5 January 1996, the prescribed fee being paid on the same day. The statement setting out the grounds of appeal was received on 18 March 1996.

Of the grounds raised in opposition, only insufficiency of disclosure (Articles 83 and 100(b) EPC) and unallowable extension of subject-matter (Articles 123(2) and 100(c) EPC) were argued in the grounds of appeal. The further ground of Article 100(a) on which the opposition had been based was not addressed in the appeal.

The appellant requested that the decision under appeal be set aside and that the European patent be revoked.

- II. Upon the request of both parties oral proceedings were arranged for and held on 17 August 2000.

The appellant did not appear, although duly summoned, having informed the Board by letter received on 19 July 2000 that it would not be represented at the oral proceedings.

The respondent (proprietor of the patent) requested that the appeal be dismissed and the patent be maintained with the following documents:

Main request: claims, description and figures as

maintained by the opposition division.

First, second, third, fourth, fifth and sixth auxiliary request : claims 1 to 4 respectively filed on 17 July 2000 with the description and figures as for the main request.

III. Independent claim 1 of the main request reads as follows:

"1. A liquid crystal electro-optical display device driven in a time sharing mode, having a panel (6) with a liquid crystal material disposed between scanning electrodes and display electrodes, a drive circuit (4) arranged for scanning the scanning electrodes for driving the panel, and a control circuit (2) for controlling the drive circuit, characterised in that the liquid crystal material is a ferro-electric liquid crystal material and in that the control circuit and the drive circuit are arranged to co-operate so that the panel can be driven by scanning only those scanning electrodes associated with portions of the display to be changed, with the waveform applied between those scanning electrodes which are scanned and the display electrodes comprising a relatively high pulse to change the (*"the the" corrected by the Board*) display state followed by relatively low a.c. pulses to maintain the display state."

Independent claim 4 of the main request differs from claim 1 only in that the terms "drive circuit (4)" and "control circuit (2)" are replaced by the terms "drive portion (4)" and "control portion (2)", respectively.

IV. In the contested decision, page 10, last paragraph, the

opposition division held that it was clear in particular from Figure 10 of the patent what was to be done and that the skilled person, given the description and his technical knowledge, would have known that the low a.c. pulses were necessary for maintaining the display state in a bi-stable liquid crystal display device. Moreover, the division found the amendments to have a basis in the originally-filed application documents and the amended patent as a whole to comply with the requirements of the EPC.

- V. The appellant relied in writing on the following submissions:

**Sufficiency of disclosure**

The patent claimed the application of low a.c. pulses in order to maintain the display state of a pixel. However, the patent did not teach how relatively low a.c. pulses as shown in the single example provided by Figure 10 of the patent could be achieved and how low a.c. pulses having an amplitude-time product ( $A \times t$ ) equal to or larger than a switching threshold could be avoided. Using the drive signals shown in Figure 8 of the patent, which were the only disclosed signals to be applied to the scanning and display electrodes, the resulting waveforms of Figure 10 could not be reproduced. Moreover, the a.c. pulses resulting from the waveforms of Figure 8 inevitably generated waveforms including pulses, the ( $A \times t$ ) product of which was equal to or even exceeded that of a switching pulse, thus, instead of solving the posed problem, causing inadvertent switching.

**Subject-matter extending beyond the content of the**

**application as filed**

The drive signals to be applied to the electrodes as disclosed by the single embodiment of Figure 8 were so constituted that the writing of black and white pixels in the same line took place in different fields. There was no teaching of how the writing of black and white pixels in the same field could be achieved, as such writing would require the application of signals of opposite polarity in the same line period. As the amended claims defined the waveform to be applied to the pixels but did not address the writing of black and white pixels in different fields, the amendments to the independent claims resulted in the isolation of the added feature from the context of other features presented as essential to the added feature. This was an unallowable form of generalisation introducing added subject-matter in accordance with board of appeal decisions, such as T 17/86.

- VI. The arguments presented by the respondent in the oral proceedings may be summarised as follows:

**Sufficiency of disclosure**

The waveforms shown in the examples of Figure 10(b) and (c) of the patent were the result of the drive signals according to Figure 8 for the simplest case of writing into a column of the display either only white or only black pixels, whereas the waveform of Figure 10(a) occurred in this case at the non-selected electrodes. Thus it was shown that, contrary to the submission of the appellant, the waveforms according to Figure 10 could be reproduced from the drive signals according to Figure 8.

As regards the objection of inadvertent switching allegedly caused by a.c. pulses occurring at the electrodes of the panel in more general cases of applying the drive signals disclosed by Figure 8, the "worst case" which could indeed result at a pixel was a unipolar pulse having an amplitude  $1/3 V_{ap}$  and a duration  $4t$ ,  $V_{ap}$  and  $t$  being the parameters of a switching pulse. However, contrary to the appellant's allegation, such a pulse could not cause an inadvertent switching of the state of the pixel under normal operating conditions of a display panel, such as for switching pulses of about 15 Volt. The reasons for that were that the duration of the switching pulses applied was chosen to be almost the same as the molecular response time (i.e. the time required for the ferro-electric molecules to respond to an applied electric field pulse), as was stated on page 7, lines 17 to 18 of the originally-filed description, and that the molecular response time increased stronger than linearly with a decreasing amplitude of the pulse, as was known to the skilled person for instance from the document *Clark and Lagerwall : "Submicrosecond Bistable Electro-Optic Switching in Liquid Crystals"*, *Applied Physics Letters*, Vol. 36, No. 11, June 1980, pages 899 to 901, cited in the patent specification. It could be derived from the data presented in this document that a pulse width of 2  $\mu$ s was required for switching with  $V_{ap} = 15$  V, whereas a pulse width of 10  $\mu$ s was required for switching with  $V_{ap} = 5$  V. In this example, when reducing the pulse amplitude from 15 V to 5 V, the amplitude-time product ( $A \times \delta$ ) required for changing the display state increased by a factor of more than 1.6, which was significantly above the ( $A \times \delta$ ) product of any low a.c. pulse that could result from the drive signals according to Figure 8 of the patent.



**Subject-matter extending beyond the content of the application as filed**

The amendments made to the independent claims of the main request were almost literally taken from the sentence bridging pages 6 and 7 of the originally-filed description relating to waveforms disclosed by Figure 7. What was shown by Figure 7 did not form part of prior art knowledge, as this figure showed waveforms which were explicitly said to be made up from the drive signals disclosed by Figure 8 of the patent. There was no further requirement disclosed in the original application documents as to the application of low a.c. pulses to maintain the display state. In particular there was no discussion of "fields" for writing black and white pixels as referred to by the appellant.

**Reasons for the Decision**

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.
2. *Sufficiency of disclosure (Article 83 EPC)*
  - 2.1 An invention can be regarded as being sufficiently disclosed if at least one way is clearly indicated enabling the person skilled in the art to carry out the invention (cf. for instance T 292/85 OJ 1989, 275).

In the present case, the crucial question is whether the skilled person can, on the basis of his general knowledge, gather sufficient technical information from the application documents so as to devise waveforms for operating the display panel comprising low a.c. pulses

capable of maintaining the display state.

- 2.2 An example of drive waveforms to be applied to the pixels is given in Figure 10 of the patent. Such waveforms are the result of basic drive signals to be applied to the matrix of scanning and display electrodes. The only source of technical information concerning suitable basic drive signals is given by Figure 8 of the patent and the corresponding description.

Contrary to the appellant's submission that the drive waveforms shown in Figure 10 cannot be reproduced by the drive signals shown in Figure 8, the respondent has convincingly shown in the oral proceedings that the waveforms (b) and (c) of Figure 10 are indeed the result of drive signals according to Figure 8, albeit the patent documents do not include an indication that these waveforms are only obtained under the specific condition of writing a black or white column of pixels. Thus, there is no fundamental obstacle which would prevent the skilled person from recognizing the drive signals according to Figure 8 to be suitable for operating the display panel, notwithstanding the fact that normally the resulting waveforms would differ from the specific simplified case shown by Figure 10.

- 2.3 As conceded by the respondent, in normal operation of the display panel it cannot be avoided that a combination of drive signals according to Figure 8 required for displaying a desired distribution of black and white pixels eventually results in low a.c. pulses occurring at a pixel, which pulses have components of one polarity with an amplitude of one third of that of the relatively high pulse for changing the display

state and being up to four times longer than the switching pulse. Given the fact that the physical entity decisive for changing the display state of a bi-stable ferro-electric material is the product  $A \times t$  of pulse amplitude  $A$  and pulse width  $t$ , low. a.c. pulses having a product  $A \times t$  which is equal to and even larger than that of the high switching pulse could indeed imply the risk of inadvertent switching.

However, as is stated on original page 7, lines 17 to 18 of the description, the switching pulses should have a duration almost equal to the molecular response time  $\hat{\delta}$  of the bi-stable ferro-electric material, as such pulses are the shortest possible pulses with which maximal contrast between brightness and darkness of the display can be obtained. In this context, the Board considers the skilled person working in the field of liquid crystal displays to be familiar with the physical properties of the liquid crystal materials employed in such displays as discussed in documents such as the aforementioned document of *Clark et. al.* cited on original page 5, line 7 of the description. According to this document (cf. page 901, right-hand column), a strong increase of the threshold product  $A \times \hat{\delta}$  required for switching is observed with decreasing pulse amplitude  $A$ . Only for amplitudes above 10 V does an inverse proportionality exist between  $\hat{\delta}$  and  $A$  (rendering the threshold product a constant). Therefore, a risk of inadvertent switching by low a.c. pulses, as argued by the appellant, could occur only if the amplitude of the high pulses for changing the display state was at or above 30 V. In this respect, the Board accepts the argument of the respondent that a liquid crystal display was conventionally driven by voltages around 15 V as higher voltage switching would

have unnecessarily increased power consumption so that, applying normal operating conditions, the low a.c. pulses would indeed maintain the display state. Notwithstanding the fact that the present patent does not disclose operating parameters, the Board is convinced that the skilled person's knowledge of the physical properties of liquid crystal materials, as evidenced by the Clark et. al. document, would have enabled him to avoid the theoretical risk of inadvertent switching.

2.4 For these reasons, the Board is satisfied that, on the basis of the information provided by the application specification and his general knowledge, the skilled person had all the necessary information at hand to successfully put the claimed teaching into practice.

3. *Subject-matter extending beyond the content of the application as filed (Article 123(2) EPC)*

According to the main request, claims 1 and 4 as granted have been amended in opposition by the addition of the feature "with the waveform applied between those scanning electrodes which are scanned and the display electrodes comprising a relatively high pulse to change the display state followed by relatively low a.c. pulses to maintain the display state".

The amendment corresponds to the information given on page 6, line 31 to page 7, line 2, of the originally-filed description given in the context of the description of Figure 7 that "the liquid crystal molecules are moved to the +è or -è positions referred to above, when selecting a scanning electrode by a relatively high positive and negative voltage pulse,

and then maintaining the display condition (the position of the molecules) by low voltage AC pulses".

Given the fact that the waveforms shown in Figure 7 are made up of the basic drive signals according to the embodiment of Figure 8 (cf. original page 6, lines 16 to 17 of the description), in the Board's view the information provided by the description of Figure 7 is to be considered as forming part of the description of the invention.

Moreover, the waveforms defined in amended claims 1 and 4 are in principle identical for writing and maintaining both black and white pixels and thus functionally independent from the technical details of how black and white pixels would be written in the same line, such as the writing of black and white pixels in different fields apparent from Figure 8. Therefore, the Board cannot accept the appellant's submission that the amendments to the independent claims resulted in the isolation of the added feature from the context of other features presented as essential to the added feature.

For these reasons amended claims 1 and 4 according to the main request satisfy the requirement of Article 123(2) EPC.

4. Neither in the statement of the grounds of appeal nor in any later submission did the appellant challenge the reasoning of the opposition division with respect to novelty and inventive step. This means that the appellant is not adversely affected by the decision under appeal in this respect. Under the given circumstances and in view of the principle of party

disposition governing the procedure in opposition appeal proceedings, the Board sees no reason to raise any objections under Articles 52(1), 54 and 56 EPC of its own motion.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

R. Schumacher

G. Davies