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**D E C I S I O N**  
**of 19 January 2000**

**Case Number:** T 0491/94 - 3.4.1

**Application Number:** 88302850.8

**Publication Number:** 0286309

**IPC:** G09G 3/36

**Language of the proceedings:** EN

**Title of invention:**  
Display device

**Applicant:**  
Canon Kabushiki Kaisha

**Opponent:**  
-

**Headword:**  
Display device/CANON K.K.

**Relevant legal provisions:**  
EPC Art. 56

**Keyword:**  
"Inventive step (no)"

**Decisions cited:**  
-

**Catchword:**  
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Boards of Appeal

Chambres de recours

**Case Number:** T 0491/94 - 3.4.1

**D E C I S I O N**  
**of the Technical Board of Appeal 3.4.1**  
**of 19 January 2000**

**Appellant:**

CANON KABUSHIKI KAISHA  
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Tokyo (JP)

**Representative:**

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**Decision under appeal:**

**Decision of the Examining Division of the  
European Patent Office posted 27 January 1994  
refusing European patent application  
No. 88 302 850.8 pursuant to Article 97(1) EPC.**

**Composition of the Board:**

**Chairman:** G. Davies

**Members:** H. K. Wolfrum

M. G. L. Rognoni

## Summary of Facts and Submissions

- I. European patent application No. 88 302 850.8 (publication No. 0 286 309) was refused by a decision of the examining division dated 27 January 1994, on the ground of lack of inventive step (Articles 52(1) and 56 EPC).
- II. The appellant lodged an appeal against the decision on 25 March 1994 and paid the prescribed fee on the same day. A statement of grounds of appeal was filed on 6 June 1994.
- III. In a communication dated 28 September 1998 the Board made reference *inter alia* to the following documents:
- D1: EP-A-0 149 899, and
- D3: FR-A-2 581 209.
- IV. Oral proceedings were held on 19 January 2000.
- V. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 and 2 filed during the oral proceedings with the description as originally filed (with errors corrected as requested on 23 August 1991) and the Figures as originally filed.
- VI. Independent claim 1 reads as follows:
- "1. A liquid crystal device comprising first and second sets of intersecting electrodes (COM, SEG,) arranged on either side of bi-stable liquid crystal

material to provide a matrix of display elements;

drive means (200, 300) for supplying respective drive and scanning voltages for said electrodes;

first and second selection means (273-275, 371-375) for selecting from the drive and scanning voltages and applying the selected voltages to the electrodes to change the state of the liquid crystal material at selected display elements;

means (600, 700) for delivering to said drive means data to be displayed by said display device so as to control operation of said selection means; and

temperature sensing means (400) for sensing the temperature of the matrix of the display element,

and characterized in that the drive voltages for a display element which are selected by said first selection means comprise three different DC level signals (V3, VC, V4) supplied in parallel to said selection means, the three DC level signals consisting of a reference signal (VC), a positive data signal (V3) and a negative data signal (V4), and in that the scanning voltages for a display element are selected by said second selection means from three different DC level signals (V1, VC, V2), the three signals consisting of the reference signal (VC), a positive scanning signal (V1) of higher amplitude than said positive data signal (V3) and a negative scanning signal (V2) of higher amplitude than said negative data signal (V4); and

control means (900) responsive to said temperature sensing means for controlling the DC levels of the signals (V1, V2, V3, V4, VC) selected by said first and second selecting means so that the ratios of the respective positive drive and scanning voltages (V1, V3) and of the respective negative drive and scanning

voltages (V2, V4) with respect to the reference voltage (VC) remain the same."

VII. The appellant's submissions in support of its request may be summarised as follows:

The invention concerned a specific type of liquid crystal display, i.e. displays employing a bistable liquid crystal material, and a specific type of temperature compensation of DC control voltages, simplifying the manufacturing process. As indicated on page 118, line 8 to page 119, line 3, of the description as originally filed, it became easier to check whether the multitude of circuit components required to generate and control the operating voltages of the large number of pixel elements of a display would operate within a predetermined range of technical specifications if one voltage was fixed and the other voltages were defined as predetermined ratios with respect to the fixed voltage. Furthermore, the DC levels of the scanning and drive signals could be easily adjusted in accordance with temperature conditions so that the ratios of the respective scanning and drive voltages remained the same.

Documents D1 and D3 referred to a different technical field of display devices which required the superposition of AC voltage signals to the operating voltages in order to maintain the liquid crystal material in a stable state. Moreover, none of these documents addressed the specific problem of simplifying the manufacturing process of liquid crystal displays. Though document D1 briefly hinted at the possibility of changing an operating voltage in accordance with

temperature, it required operating voltages different in nature and number from the invention, and did not teach to keep the ratios of DC voltage levels with respect to a reference voltage constant as temperature adjustments were made. Temperature compensation of DC voltage levels was not even mentioned in document D3.

For these reasons, the skilled person setting out to facilitate the manufacture of bistable liquid crystal displays and, at the same time, looking for a simple temperature compensation of the DC operating voltages could not expect a solution from documents D1 and D3. Moreover, even by combining the teachings of these documents, he would not have arrived at the complete solution as defined in the characterizing part of claim 1.

## **Reasons for the Decision**

1. The appeal complies with the requirements of Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. *Amendments*

The Board is satisfied that the subject-matter of the amended claims on file has a basis of disclosure in the originally-filed description (cf. in particular Figures 6, 29B and 31B with the corresponding description; page 64, line 2 to page 67, line 5; and page 118, line 1 to page 119, line 3) so that the amendments comply with the requirements of Article 123(2) EPC.

3. *Inventive step (Articles 52(1) and 56 EPC)*

3.1 Document D3 (cf. in particular the abstract and Figures 1 to 4 and 7 with the corresponding description) is considered the closest prior art. It refers to a liquid crystal display (LCD) comprising the type of materials used in devices according to the application (cf. application as originally filed, page 12, lines 5 to 12). The molecules of these ferroelectric materials possess an electric dipole moment and, under certain conditions, can assume two distinct stable orientations in response to a static electric field (DC field). Switching between the two stable orientations is caused by a DC field of sufficient strength and duration which is produced by selected drive and scanning voltages applied to intersecting electrodes forming a matrix of display elements. It is further known from D3 (cf. page 1, lines 29 to 33 and page 3, line 34 to page 5, line 13) that the stability of the selected orientations after removal of the DC field is achieved either by making the liquid crystal layer thin enough or by exposing the material to a high-frequency electrical signal (i.e. an AC field superposed to the DC field). Therefore, the LCD known from D3 comprises the features listed in the preamble of claim 1 under consideration. Moreover, the first and second selection means for selecting the drive and scanning voltages, respectively, select the drive voltages for the data signals from three different DC level signals (V, 0, -V) and the scanning voltages from three other DC level signals (2V, 0, -2V), wherein the positive and negative scanning signals are higher in amplitude than the respective positive and negative data signals. Furthermore, the ratios of

the drive and scanning signals (V, -V, 2V, -2V) with respect to the ground voltage shown in D3 are the same as those specified in the present application (cf. Figure 6). According to D3 (cf. page 15, lines 11 to 21), however, changes in the operating temperature of the LCD are compensated for by controlling the amplitude and/or frequency of the AC signal which is superposed to the DC signal to maintain the liquid crystal in a stable state.

D3 is silent as to the structure and manner of operation of the selection means.

3.2 Consequently, the subject-matter of claim 1 under consideration differs from the liquid crystal display known from D3 in that:

- (a) the control means for temperature compensation control the DC levels of the various data and scanning signals so that the ratios of the respective drive and scanning voltages with respect to the reference voltage remain the same; and
- (b) the drive means are such that the DC level signals from which the drive and scanning voltages are selected are applied in parallel to the respective first or second selection means.

3.3 In view of these differences, the technical problem addressed by the invention is to provide simple and effective means to drive the liquid crystal display and to compensate for temperature variations.



3.4 The first aspect of the problem relating to simplified drive means is, in principle, already addressed and solved by an LCD according to D3 by defining the drive and scanning voltages as ratios with respect to a reference voltage, thus avoiding the need for generating a plurality of independent voltages.

The second aspect relating to an effective compensation of temperature variations according to the aforementioned feature (a) is addressed and solved by a bistable LCD known from document D1. D1 (cf. Figures 25 and 26 with the corresponding description; and in particular page 8, lines 6 to 9, and page 30, lines 9 to 15) refers to an LCD of a type similar to that of D3 and discloses means for compensating for the effects of temperature variations which include for instance means for adjusting a DC operating voltage ( $V_{ap}$ ) applied for switching between the two stable states. The drive and scanning voltages are predetermined fractions of the voltage  $V_{ap}$  so that a temperature adjustment of  $V_{ap}$  implies that the ratios of the signal levels with respect to  $V_{ap}$  remain the same. The teaching of D1 is thus based on the recognition that, to compensate for the effects of temperature variations, it is sufficient to adjust a single DC voltage level.

Furthermore, the aforementioned feature (b) concerns a straightforward design option which is explicitly shown in Figures 25 and 26 of document D1.

As the problem to be solved and the claimed solution were both known in the same narrow technical field of bistable LCDs, no inventive step can be attributed to the recognition of the technical problem defined above

and to the application of the solution principles known from D1 to the LCD shown in D3 to solve it. Therefore, it would have been obvious to the skilled person to arrive at the subject-matter of claim 1 under consideration by combining the teachings of D1 and D3.

3.5 For the foregoing reasons, in the Board's judgement, the subject-matter of claim 1 on file does not involve an inventive step within the meaning of Article 56 EPC. Claim 1 is therefore not allowable.

3.6 Dependent claim 2 is also not allowable because of its dependency on an unallowable claim 1.

## **Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:

M. Beer

G. Davies