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**D E C I S I O N**  
**of 10 May 2005**

**Case Number:** T 0285/03 - 3.4.3

**Application Number:** 93105581.8

**Publication Number:** 0573754

**IPC:** G09G 3/22

**Language of the proceedings:** EN

**Title of invention:**

Cathodoluminescent display assembly and addressing method

**Patentee:**

MOTOROLA, INC.

**Opponent:**

Canon Kabushiki Kaisha

**Headword:**

Field emission device/MOTOROLA

**Relevant legal provisions:**

EPC Art. 56, 84, 100(b), 123(2)

**Keyword:**

"Inventive step (no)"

"Support by the description (no)"

**Decisions cited:**

G 0001/03

**Catchword:**

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Case Number: T 0285/03 - 3.4.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.4.3  
of 10 May 2005

**Appellant:** MOTOROLA, INC.  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 2 January 2003  
revoking European patent No. 0573754 pursuant  
to Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** G. L. Eliasson  
**Members:** V. L. P. Frank  
P. Mühlens

## Summary of Facts and Submissions

I. This is an appeal by the patent proprietor from the decision of the Opposition Division revoking the European patent No. 0 573 754 according to Article 102(1) EPC on the ground of lack of inventive step (Article 56 EPC).

The opposition was directed against the patent as a whole and was based on the grounds mentioned in Article 100(a), (b) and (c) EPC.

II. The following prior art documents were cited *inter alia* in the opposition procedure:

D1: WO-A-92/05571

D5: EP-A-0 479 450

D6: Television Engineering by D.G. Fink, McGraw-Hill Book Company, Inc., New York 1952, pp. 124-130

III. The appellant patent proprietor argued essentially as follows:

- The present invention is based on the recognition that a row by row addressing of a matrix based flat panel field emission display device and the use of current controlled sources permits to operate the cathodoluminescent material in a non-saturated mode and overcomes, therefore, the inconveniences of the dwell time problem of traditional cathode ray tube (CRT) devices.

- The analysis on inventive step in the contested decision is based on hindsight. Although document D1 suggests the use of constant current sources for driving field emission devices, it does not disclose to do so in any particular type of display device. The skilled person in the art has, without hindsight, no idea of (i) which type of display to pursue, (ii) what type of cathodoluminescent material to use, and (iii) which particular operating parameter or characteristic of the unknown cathodoluminescent material to consider. In particular, there is no motivation in document D1 to choose the current density level to operate the cathodoluminescent device in a non-saturated mode.
  
- Document D5 discloses a method for controlling the brightness of a matrix-addressed flat panel field emission display device by controlling both the duty cycle and the voltage applied to the drive lines of the intersecting conductors of the matrix. It would, therefore, be contrary to the whole teaching of this document to replace the voltage sources driving the field emission devices by constant current sources as disclosed in document D1, as this would require a complete change of the manner in which the brightness control is achieved.
  
- The independent claims of the first auxiliary request specify that the current density is not only sufficiently low to operate the cathodoluminescent material in the non-saturated mode, but that this is done with a cathodoluminescent material that is conventionally

only used in the saturated mode. In other words, the scope of protection is limited to a novel, non-saturated mode of driving only those cathodoluminescent materials which are conventionally driven in saturated mode and does not extend to cathodoluminescent materials that coincidentally are driven in non-saturated mode in display types other than field emission devices, e.g. cathode ray tubes (CRTs).

- The independent claims of the second auxiliary request comprise further the feature of a sequential cyclic operation, with the cycle providing connection to the first voltage source for approximately 20 microseconds during each cycle. This feature is very particular and could not be arrived at without knowledge of the present invention.

IV. The respondent opponent argued essentially as follows:

- There is no clear delimitation in the patent between operating a cathodoluminescent material in a saturated and in a non-saturated mode and the boundary between both modes is also not disclosed. For this reason, the wording of the claims does not allow a clear distinction between the claimed subject-matter and known subject-matter. This feature is meaningless and can, therefore, be ignored when assessing novelty and inventive step.
- Document D5 discloses a display device comprising all the features of claim 1 apart from having a plurality of constant current sources for driving

the FEDs. However, document D1 teaches that due to fabrication inconsistencies there will be slight variations in the beam current for each microtip and therefore proposes providing a controlled constant current source in each column conductor stripe. A skilled person would consider implementing the solution proposed in document D1 in a display device according to document D5.

- Claim 1 of the first auxiliary request comprises undisclosed subject-matter, since a "shifting" of the current density of the FED's electron current is not disclosed in the application as originally filed. A "shifting" implies that at one point in time the cathodoluminescent materials operates in a saturated mode and at a later point in time operates in a non-saturated mode. Moreover, the interpretation given by the patent proprietor that only cathodoluminescent materials are to be used that are usually employed in the saturated mode is neither disclosed in the application nor supported by the description (Articles 123(2) and 84 EPC).
  
  - Claim 1 of the second auxiliary request indicates further the duration of the row's connection cycle. This, however, is merely a design consideration depending on the display's size and the refresh rate and does not involve an inventive step.
- V. At the oral proceedings before the Board the appellant (patent proprietor) requested the reversal of the contested decision and the maintenance of the patent as granted (main request) or on the basis of the first or

second auxiliary requests submitted during the opposition procedure.

The respondent (opponent) requested that the appeal be dismissed.

VI. The wording of the independent claim 1 as granted and forming the appellant's main request is as follows (the labelling of the paragraphs has been added by the Board):

"1. A method for addressing an image display comprising the steps of:

- (a) providing an image display device including a viewing screen (105) whereon a cathodoluminescent material (108) is disposed and an array of field emission devices distally disposed with respect to the viewing screen and further providing a plurality of conductive paths (204A, 204B) separated into a first group of conductive paths (204A) and a second group of conductive paths (204B) substantially perpendicular to the first group of paths, with each field emission device being selectively independently operably connected both to one of the conductive paths separated into a first group of paths (204A) and to one of the conductive paths separated into a second group of paths (204B), each conductive path being operably connected to a plurality of field emission devices;
- (b) providing a switching circuit (202) having an input terminal (211) and a plurality of output terminals (216) wherein each of the plurality of

- output terminals is operably connected to a different conductive path of the plurality of conductive paths of the second group;
- (c) providing a first voltage source (203) operably coupled between the switching circuit input terminal and the reference potential whereby the switching circuit functions to operably connect the first voltage source to one selected conductive path of the plurality of conductive paths (204B) of the second group at a given time;
  - (d) switching the switching circuit so that substantially all of the plurality of field emission devices connected in a selected conductive path of the plurality of conductive paths of the second group are simultaneously placed in an ON mode; and
  - (e) providing a second voltage source (310) operably coupled between the viewing screen and the reference potential; the method being characterised by the further steps of:
  - (f) providing a plurality of controlled constant current sources (201A-201C) each operably coupled between a conductive path (204A) of the plurality of conductive paths of the first group and a reference potential; and
  - (g) controlling the constant current sources so that each of the plurality of field emission devices placed in an ON mode emits an electron current substantially determined by a controlled constant current source of the plurality of controlled constant current sources; wherein
  - (h) the current density of each electron current emitted by each field emission device is sufficiently low to ensure that the



cathodoluminescent material is operated in a non-saturated mode."

In claim 1 according to the first auxiliary request the last paragraph of claim 1 as granted is replaced by the following wording (emphasis added by the Board):

"(h) the step of controlling the constant current sources is performed such that the incident current density at the cathodoluminescent material **is shifted** by the current density of each electron current emitted by each field emission device being controlled to be sufficiently low to ensure that operation of the cathodoluminescent material **is shifted** to operation in a non-saturated mode."

Claim 1 of the second auxiliary request differs from claim 1 as granted in that the following feature is added at its end:

"and

(i) the selected conductive path (204B) is electronically selected, the electronic selection being sequential and cyclic, with the cycle being determined to provide that each selected conductive path is operably connected to the first voltage source for approximately 20 micro-seconds during each cycle."

Each set of claims according to the main, first and second auxiliary requests also include an independent claim directed to an image display assembly. As the present decision is based only on the independent

method claim, the wording of the device claims is not reproduced.

### **Reasons for the Decision**

1. The appeal is admissible.
2. *The expression "operated in a non-saturated mode"*
  - 2.1 The respondent argued that the contested patent does not provide a clear definition of what has to be considered as operating the cathodoluminescent material in a non-saturated mode nor where the boundary between a non-saturated and a saturated mode of operation lies (cf. item IV).
  - 2.2 Although the Board concurs with the respondent that there is a transition region between these two modes, as can be seen e.g. in Figure 4 of the contested patent, the Board cannot see why the existence of this transition region could render the disclosure of the invention so unclear that it cannot be carried out by a skilled person in the sense of Article 100(b) EPC. As explained in the patent in suit, the non-saturated operation mode is the range of current density in which the phosphor's luminous output is roughly directly proportional to the current density (cf. column 2, lines 50 to column 3, line 18 and Fig. 4). A skilled person would not have any difficulty in operating a cathodoluminescent device in this mode, as this only requires using a sufficiently low current density. Furthermore, a non-saturated operating mode has already been employed in the prior art. Cathode ray tubes, for

example, have been used in a current range in which the beam current and the luminous output are closely proportional (cf. document D6, page 126). Moreover, as was argued by the respondent, the display device disclosed in document D5 is also operated in the non-saturated mode.

2.3 The Board is aware that under certain circumstances a lack of clarity in the claim's wording may raise an objection of lack of sufficient disclosure under Article 100(b) EPC. However, it lies in the nature of language that even technical terms do not always have a clearly delimited meaning. This is for example the case with terms like conducting/ non-conducting, transparent/ non-transparent, etc. for which a transition region exists between both regimes and no clear boundary can be defined. To forbid the use of such terms in the drafting of claims would be absurd.

2.4 For these reasons, the Board is not persuaded by the respondent's arguments that the expression "operated in a non-saturated mode" should be ignored in the construction of claim 1.

### 3. *Novelty*

The respondent has argued that the addressing method lacked novelty over the disclosure of document D1, since the feature "operated in a non-saturated mode" was meaningless and should therefore be ignored.

As discussed above this feature cannot be ignored. In consequence none of the prior art documents on file discloses a method for addressing an image display according to claim 1 of any of the appellant's requests.

4. *Main request - Inventive step*

4.1 The Board considers that document D5 is the closest state of art on file. It discloses a matrix-addressed flat panel display using field emission devices (FED) at each intersection of the matrix to generate a luminous pixel element. At each intersection of the matrix array a FED is formed by a conical structure 40 connected to a row conductor 14 and by a column conductor 16 in which openings 36 are formed surrounding the tip of the conical structure, the column conductor acting as the gate of the FED. Controlled voltages are applied to the row and column lines intersecting at the position of a given pixel to control the brightness of the pixel element. The voltage applied to the row lines is increased stepwise so that the emitted current and the pixel's brightness doubles for each step. The voltage applied to the column lines, i.e. the gate lines, merely switches the selected pixel element on and off at the desired brightness level. A phosphor coated glass 20 is biased by an accelerating potential and forms the anode of the device. The display is preferably addressed in a row by row mode and the brightness of the pixel element is proportional to the current emitted by the FED, i.e. the phosphor is operated in a non-saturated mode (cf. column 5, lines 3 to 56; column 6, lines 53 to 57; column 9, lines 13 to 16; column 9, line 52 to column 10, line 12; Figures 1 to 4).

- 4.2 It results, therefore, that the method of addressing the display device according to claim 1 differs from the addressing method disclosed in document D5 in that the former specifies that a controlled constant current source instead of a controlled voltage source is connected to each FED.
- 4.3 Document D1 discloses that emitter electron emission of a FED is not accurately controllable when a controlled voltage source is used for modulating the electron emission. This is due at least in part to FED fabrication inconsistencies (cf. page 1, lines 22 to 24). It is suggested instead to use a controlled current source (101) to control the current emitted by the FEDs (cf. page 2, lines 9 to 12 and Figs. 1 to 4).
- 4.4 The objective technical problem addressed by the contested patent taking document D5 as closest state of the art therefore relates to improving the control of the emission characteristics of the known FED display device.
- 4.5 In the Board's view, the skilled person would take the teaching of document D1 into account and would replace the controlled voltage sources used for driving the emitters in document D5 by controlled current sources in order to solve the above stated technical problem.
- 4.6 The appellant argued that the replacement of the voltage sources by current sources in the device of document D5 would require a complete change contrary to the disclosure of this document, as the gist of document D5 is to control the brightness of a FED

display device by a sophisticated control of the voltages applied to the gate and the emitter.

The Board is, however, not persuaded by this argument. In the device disclosed in document D5 the emitters are connected to the row drive lines and a periodic staircase waveform of increasing voltages ( $V_0$ ,  $V_1$ ,  $V_2$ , etc) is applied to them. The voltage of each step is selected so that the emitted electron beam current produces a brightness level which is twice the brightness of the previous step. This is done, however, by determining the relation between the beam current and the applied gate-cathode voltage and choosing the voltages  $V_0$ ,  $V_1$ ,  $V_2$ , so that a binary beam current progression is formed, i.e. the selected second beam current is twice the first current, the third is twice the second, etc., since the beam current vs. gate-cathode voltage plot is very non linear (cf. column 6, lines 53 to 57; column 9, lines 13 to 16; column 9, line 52 to column 10, line 12; Figures 4 and 5).

It follows, therefore, that according to document D5 the essential physical characteristic that has to be controlled for controlling the display's brightness is the beam current. This is done in document D5 by controlling the gate-cathode voltage. It would, however, be a straightforward measure to directly control the beam current, as disclosed in document D1. The skilled person would not only not be prevented from combining the teaching of documents D5 and D1, but on a proper understanding of document D5 would be strongly encouraged to do so.

4.7 For the reasons set out above, it is the judgement of the Board that the addressing method according to claim 1 does not involve an inventive step in the sense of Article 56 EPC.

5. *First auxiliary request*

5.1 Feature (h) of claim 1 of the main request, i.e. the step specifying that the cathodoluminescent material is operated in a non-saturated mode, has been replaced in this request by a statement specifying essentially that the operation of the cathodoluminescent material **is shifted** to operation in a non-saturated mode.

5.2 According to the appellant, this feature should be construed as limiting the scope of the claim to a novel non-saturated manner of driving only those cathodoluminescent materials which were conventionally used in saturated mode.

5.3 The Board finds that this interpretation offered by the appellant amounts to a disclaimer although it is not phrased in the usual form. However, this disclaimer is not based on a particular prior art disclosure, whether accidental or not, but tries to delimit the claim against any potential prior art disclosure, contrary to the principles set out in decision G 1/03 dealing with the allowability of disclaimers (cf. OJ EPO 2004, 413).

5.4 The Board, moreover, concurs with the respondent that feature (h) is neither supported by the description nor disclosed in the application documents as originally filed (Article 84 and 123(2) EPC). As the respondent pointed out, the expression "shifted" implies that at

some point in time the cathodoluminescent material is operated in the saturated mode and that at a later point in time its operation is shifted to the non-saturated mode. Such a manner of operating the display device is not derivable from the patent in suit.

5.5 In the judgement of the Board, claim 1 according to the first auxiliary request does not meet the requirements of Article 84 and 123(2) EPC and is therefore not patentable.

6. *Second auxiliary request - Inventive step*

6.1 Claim 1 according to this request comprises further to the features of claim 1 of the main request an electronic sequential cyclic selection of each row line, with a cycle duration of approximately 20 microseconds.

6.2 The Board concurs with the respondent that there is no synergy as alleged by the appellant between this feature and the other features of the claim. An electronic sequential cyclic selection of the row lines is the standard way of activating a display device and this was not contested by the appellant. The duration of the cycle is determined inter alia by the display's size, i.e. the number of rows, and the refresh frequency which are not specified in claim 1. The cycle duration taken out of its context is therefore an arbitrary selection which does not contribute to inventive step.



7. For the reasons set out above, it is the Board's judgement that the method for addressing an image display according to claim 1 of all the requests of the appellant is not patentable.

## **Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:

C. Eickhoff

G. Eliasson