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D E C I S I O N
of 6 July 2004

Case Number: T 1133/02 - 3.2.5

Application Number: 94301508.1

Publication Number: 0613780

IPC: B41J 2/175

Language of the proceedings: EN

Title of invention:

Apparatus and method for heating ink in an ink-jet printhead

Patentee:

TEKTRONIX, INC.

Opponent:

Océ-Technologies B.V.

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step, main request (no), first auxiliary request (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 1133/02 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 6 July 2004

Appellant: Océ-Technologies B.V.
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Representative: Grünecker, Kinkeldey
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted 10 September 2002
rejecting the opposition filed against European
patent No. 0613780 pursuant to Article 102(2)
EPC.**

Composition of the Board:

Chairman: W. Moser
Members: W. R. Zellhuber
P. E. Michel

Summary of Facts and Submissions

- I. The appellant (opponent) lodged an appeal against the decision of the Opposition Division rejecting the opposition against the European patent No. 0 613 780.
- II. The Opposition Division held that the grounds for opposition submitted by the appellant under Article 100(a) EPC (lack of novelty, Article 54 EPC, and lack of inventive step, Article 56 EPC) did not prejudice the maintenance of the patent in suit as granted.
- III. Oral proceedings were held before the Board of Appeal on 6 July 2004.
- IV. The appellant requested that the decision under appeal be set aside and that the European patent No. 0 613 780 be revoked in its entirety.

The respondent (patent proprietor) requested as a main request that the appeal be dismissed; or that the decision under appeal be set aside and that the patent be maintained on the basis of the following documents:

- (a) first auxiliary request: claims 1 to 23 presented as first auxiliary request during oral proceedings; or
- (b) second auxiliary request: claims 1 to 23 filed as third auxiliary request on 8 June 2004; or
- (c) third auxiliary request: claims 1 to 23 filed as fourth auxiliary request on 8 June 2004; or

(d) fourth auxiliary request: claims 1 to 23 filed as first auxiliary request on 8 June 2004.

V. Claim 1 of the patent in suit as granted (main request) reads as follows:

"1. An apparatus for maintaining a predetermined ink temperature profile throughout a multiple-orifice, phase-change ink-jet print head 44, the print head losing heat at different rates from a set of regions distributed along multiple axes of the print head, the apparatus comprising a temperature sensor 104 electrically connected to a temperature controller and thermally connected to the print head 44, and a print head heater 58 electrically connected to the temperature controller, the print head heater having multiple heating zones each in thermal communication with a corresponding region of the print head, the heating zones having a proportional watt-density that compensates for the rates of heat loss from each of the regions to maintain the predetermined ink temperature profile throughout the print head."

VI. Independent claims 1, 21, and 23 according to the first auxiliary request read as follows:

"1. An apparatus for maintaining a predetermined ink temperature profile throughout a multiple-orifice, phase-change ink-jet print head (44), the print head losing heat at different rates from a set of regions distributed along multiple axes of the print head, the apparatus comprising a temperature sensor (104) electrically connected to a temperature controller and

thermally connected to the print head (44), and a print head heater (58) electrically connected to the temperature controller, the print head heater having multiple heating zones each in thermal communication with a corresponding region of the print head, wherein each heating zone has a preferred resistance value so that the heating zones have a proportional watt-density that compensates for the rates of heat loss from each of the regions to maintain the predetermined ink temperature profile throughout the print head."

"21. A method for maintaining a uniform ink temperature throughout an orifice array width of a substantially media-width, phase-change ink-jet print head, the print head losing heat at different rates from a set of regions located throughout the orifice array width of the print head, the method comprising sensing the temperature of the print head; communicating the sensed temperature to a temperature controller; controlling a print head heater that is thermally connected to the print head; and partitioning the print head heater into multiple differential heating zones each in thermal communication with a corresponding region of the print head, wherein each of the differential heating zones has a preferred resistance value so that the heating zones compensate for the different rates of heat loss from the set of regions to maintain a uniform ink temperature throughout the orifice array width of the print head."

"23. A print head system for an inkjet printer operable with phase-change ink, the system comprising a multiple orifice print head which in use loses heat at different rates from a set of regions distributed along multiple

axes thereof, a temperature sensor, a temperature controller, the temperature sensor being thermally connected to the print head and electrically connected to the temperature controller, and a print head heater electrically connected to the temperature controller, the print head heater having multiple heating zones each in thermal communication with a corresponding region of the print head, wherein each heating zone has a preferred resistance value so that the heating zones have a proportional watt-density that compensates for the rates of heat loss from each of the regions to maintain the predetermined ink temperature profile throughout the print head."

VII. The following documents are referred to in the present decision:

D1: US-A 5,041,718;

D4: EP-A 0 353 925;

D6: US-A 4,418,355.

VIII. In the written procedure and during oral proceedings, the appellant argued essentially as follows:

Main request

In order to solve the generally known problem of providing a uniform temperature profile throughout an ink-jet print head, document D4 suggested the solution claimed in claim 1 of the patent in suit, namely providing heating zones having a proportional watt-density that compensated for the rates of heat loss

from each of the regions. The heating zones included temperature keeping heaters and several ink ejection heaters. The only difference, namely that the print head was a phase-change ink-jet print head, concerned an obvious selection.

The subject-matter of claim 1 according to the main request thus did not involve an inventive step.

First auxiliary request

According to column 11, lines 21 to 24, of document D4, the material of the temperature keeping heaters might be the same as that of the heat generating resistor layer of the ink ejection heaters. Since the configurations of these heaters were different, their resistance values were also different. Furthermore, the resistance value of each of the temperature keeping heaters had to be appropriately selected in order to achieve a predetermined temperature profile.

Document D4 thus disclosed a print head comprising heating zones wherein each heating zone had a preferred resistance value.

Therefore, the subject-matter of claim 1 according to the first auxiliary request did not involve an inventive step either. The same arguments applied to claims 21 and 23 of the first auxiliary request.

IX. In the written procedure and during oral proceedings, the respondent argued essentially as follows:

Main request

Document D4 suggested a solution which was different from that of the patent in suit. The two temperature keeping heaters (heating portions H1 and H2) were controlled independently from each other thereby using respective control circuits and temperature sensors. Moreover, the heating portions H1 and H2 did not have a proportional watt density within the meaning of claim 1. A person skilled in the art would not understand the wording of claim 1 according to the main request so as to mean that the print head heater claimed therein comprised some of the ink ejecting heaters of the print head.

The subject-matter of claim 1 thus involved an inventive step.

First auxiliary request

In the print head according to document D4, the temperature keeping heaters both had equal resistance values. They were individually energised or de-energised according to respective control signals. The ejecting heaters could not be designed so as to have different resistance values. Document D4 did thus not suggest a printing head having multiple heating zones, wherein each heating zone had a preferred resistance value so that the heating zones had a proportional watt-density that compensated for the rates of heat loss from each of the regions to maintain the predetermined ink temperature profile throughout the print head.

The subject-matter of claim 1 thus involved an inventive step. The same applied to independent claims 21 and 23.

Reasons for the Decision

1. *Main request*

1.1 Novelty (Article 54 EPC)

None of the cited documents discloses an apparatus for maintaining a predetermined ink temperature profile throughout a multiple-orifice, **phase-change** ink-jet print head according to claim 1 of the patent in suit wherein the apparatus comprises a print head heater having multiple heating zones each in thermal communication with a corresponding region of the print head.

The objection of lack of novelty, in fact, was not maintained by the appellant.

1.2 Inventive step (Article 56 EPC)

1.2.1 Document D4 is regarded as representing the closest prior art. It relates to the problem arising from a non-uniform temperature distribution throughout a multiple-orifice ink-jet print head, which gives rise to a degradation of the quality of the recorded image, cf. column 1, lines 44 to 47, column 2, lines 1 to 11 and lines 22 to 29, and discloses an apparatus for providing and maintaining a predetermined, in particular, a uniform ink temperature profile, cf.

column 31, line 8, to column 39, line 2, and Figures 9A, 9B, 38 and 40.

The print head according to document D4, cf. Figures 9A and 9B, comprises temperature keeping heaters 8 disposed adjacent two temperature sensors 2 and ink ejection heaters 5. The temperature keeping heaters plus several ejection heaters form different heating portions, cf. column 31, lines 30 to 35, column 32, lines 49 to 53, and column 37, lines 20 to 49. The print head heater thus has multiple heating zones. The energy supply to the multiple heating zones is controlled so that a predetermined temperature profile throughout the entire print head can be provided and maintained, which, consequently, requires compensating for the rates of heat loss from each of the regions, cf. column 31, line 51, to column 32, line 30; column 36, line 36 to column 37, line 2; column 37, lines 34 to 49; and column 38, lines 27 to 37.

In claim 1 according to the main request, reference is made to "heating zones having a proportional watt-density". The "watt-density" of a heating zone is dependent on the electrical resistance of the heating zone and on the electrical current flow, cf. page 4, lines 26 to 28, of the patent in suit. Claim 1 of the patent in suit does not specify whether a "proportional watt-density" is achieved by providing heating zones having specific electrical resistances and/or by appropriately controlling the energy supplied to the heating zones, as indicated on page 8, lines 1 to 5, of the patent in suit.

1.2.2 The subject-matter of claim 1 of the patent in suit thus differs from the apparatus described in document D4 only in that the apparatus is related to a phase-change ink-jet print head.

Since the problem of a degradation of the quality of the recorded image due to a non-uniform temperature profile is also present in a phase-change ink-jet print head, cf. page 2, lines 15 to 25 of the patent in suit, a person skilled in the art would consider using the apparatus for providing and maintaining a predetermined ink temperature profile as disclosed in document D4 also in connection with a phase-change ink-jet print head.

Therefore, the subject-matter of claim 1 according to the main request does not involve an inventive step within the meaning of Article 56 EPC.

Consequently, the main request of the respondent is not allowable.

2. *First auxiliary request*

2.1 Amendments (Article 123(2) and (3) EPC)

The subject-matter of claims 1, 21 and 23 is disclosed in the printed version of the application as filed in claims 1, 21 and 23, respectively, in connection with the passages on page 4, lines 29 to 33 and page 6, lines 47 to 50, and Tables 1 and 2 of the description.

Dependent claims 2 to 20 and 22 correspond to claims 2 to 20 and 22 of the application as filed.

The description was amended to bring it in line with the subject-matter of the independent claims 1, 21 and 23. The embodiment of a heater described on page 2, line 39, to page 3, line 5, and depicted in Figures 1 and 2 of the patent in suit as granted was indicated as representing internal prior art. The drawings correspond to the drawings of the application as filed.

In the Board's judgement, the amendments comply with the requirements of Article 123(2) EPC.

Furthermore, the scope of protection conferred by independent claims 1, 21 and 23 is more limited than that of the corresponding independent claims 1, 21 and 23 of the patent in suit as granted.

The patent in suit as amended thus also meets the requirements of Article 123(3) EPC.

2.2 Inventive step (Article 56 EPC)

2.2.1 According to claim 1 of the first auxiliary request, the print head heater has multiple heating zones **wherein each heating zone has a preferred resistance value** so that the heating zones have a proportional watt-density that compensates for the rates of heat loss from each of the regions to maintain the predetermined ink temperature profile throughout the print head.

2.2.2 Document D4 is silent about the electrical resistance values of the different heating zones. Admittedly, the resistance values of the temperature keeping heaters

are probably different from those of the ink ejection heaters. However, in order to provide a predetermined temperature profile, the energy supply to respective heating zones is increased or decreased depending on the temperatures detected by respective temperature sensors, cf. column 31, line 51 to column 32, line 9, and column 34, line 53 to column 35, line 3 of document D4.

Document D4 thus does not suggest relating the resistance value of each of the heating zones to the rates of heat loss from the respective regions.

2.2.3 The apparatus according to claim 1, is also not obvious with regard to the further documents cited in the appeal procedure. In particular, document D6 does not suggest any means for providing a predetermined temperature profile throughout a print head. Document D1 relates to copying machines and concerns a heating device for fixing a powder image on a receiving support. In order to improve the printing quality of an ink-jet print head, there was no incentive for a person skilled in the art to consider solutions suggested for heating devices of a copying machine.

2.2.4 The subject-matter of claim 1 of the first auxiliary request thus involves an inventive step within the meaning of Article 56 EPC. The same applies to the subject-matter of claims 21 and 23 for substantially the same reasons. Claims 21 and 23 both comprise the feature of each heating zone having a preferred resistance value.

Claims 2 to 20 and claim 22 relate to preferred embodiments of the apparatus according to claim 1 and the method according to claim 21, respectively, and thus similarly involve an inventive step.

- 2.3 Therefore, the first auxiliary request of the respondent is allowable.
3. Consequently, the further auxiliary requests of the respondent need not be considered.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent on the basis of the following documents:
 - (a) claims 1 to 23 presented as first auxiliary request during oral proceedings; and
 - (b) description: pages 2 and 3, presented during oral proceedings, and pages 4 to 8 as granted; and
 - (c) drawings, Figures 1 and 2, presented during oral proceedings, and Figures 3 to 8 as granted.

The Registrar:

The Chairman:

M. Dainese

W. Moser