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D E C I S I O N
of 5 July 2005

Case Number: T 0684/04 - 3.2.5

Application Number: 94107492.4

Publication Number: 0630748

IPC: B41J 2/045

Language of the proceedings: EN

Title of invention:
Ink jet recording head

Patentee:
SEIKO EPSON CORPORATION

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 0684/04 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 5 July 2005

Appellant: Océ-Technologies B.V.
(Opponent) St. Urbanusweg 43
NL-5914 CC Venlo (NL)

Representative: Rongen, Josephus Wilhelmus
Océ-Technologies B.V.
Corporate Patents,
P.O. Box 101
NL-5900 MA Venlo (NL)

Respondent: SEIKO EPSON CORPORATION
(Proprietor of the patent) 4-1, Nishishinjuku 2-chome
Shinjuku-ku
Tokyo (JP)

Representative: Diehl, Hermann, Dr.- Dipl.-Phys.
DIEHL, GLÄSER, HILTL & PARTNER
Patentanwälte
Augustenstrasse 46
D-80333 München (DE)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 1 April 2004
rejecting the opposition filed against European
patent No. 0630748 pursuant to Article 102(2)
EPC.

Composition of the Board:

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

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal against the decision of the Opposition Division rejecting the opposition filed against European Patent No. 0 630 748.

The Opposition Division held that the subject-matter of claim 1 as granted involved an inventive step.

II. Oral proceedings were held before the Board of Appeal on 5 July 2005.

III. The appellant requested that the decision under appeal be set aside and that the European Patent No. 0 630 748 be revoked in full.

The respondent (patentee) requested as a main request that the appeal be dismissed. As an auxiliary measure, the respondent requested that the decision under appeal be set aside and that the patent be maintained on the basis of the following documents:

- (i) claims 1 to 12, presented as first auxiliary request during oral proceedings; or
- (ii) claims 1 to 11, filed as second auxiliary request on 3 June 2005; or
- (iii) claims 1 to 10, filed as third auxiliary request on 3 June 2005.

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

D1: US-A-5,144,342
D2: US-A-5,128,694
D3: JP-A-60-90770, together with a translation thereof
D4: EP-A-0 443 628

V. Claim 1 of the main request reads as follows:

"An ink jet recording head for ejecting ink drops by expanding or shrinking a pressure generation chamber (52) of an ink flow route forming member (6), said ink jet recording head comprising:
piezoelectric vibrators (7;46;61;71), in a vertical vibration mode, disposed and fixed in a row with a predetermined pitch to a piezoelectric vibrator support plate (25;44;60;70), said support plate is formed of a material having a resistance to cutting by a cutter which is the same as that used to cut said piezoelectric vibrators; and
a base (30;45;62;72;80) made of material having a rigidity which is higher than that of said support plate, said base (30;45;62;72;80) being fixed to said support plate (25;44;60;70)."

Claims 1, 2 and 3 of the first auxiliary request are all based on claim 1 of the main request and include the following additional features, respectively:

"wherein said piezoelectric vibrators are fixed to said support plate with an adhesive";

"wherein inactive areas (LB) of said piezoelectric vibrators are fixed to said support plate"

"wherein said support plate has slits (27) formed therein through an overlaying electrode layer (26) into said support plate (25)."

VI. The appellant has argued substantially as follows in the written and oral proceedings with reference to the main and first auxiliary requests:

Document D3 discloses the use of a metal base at page 5, lines 15 and 16. There is, however, no disclosure in document D3 of which metal to choose. The person skilled in the art would nevertheless choose a rigid metal. The reference in claim 1 to the vibrators being fixed to the support plate does not exclude the piezoelectric element of document D3. It is noted that claim 8 of the patent in suit indicates that the support plate may be integrally formed with the vibrators by sintering.

The rigidity of a member depends upon the material chosen and the dimensions of the member. It would be obvious to choose a rigid metal as the material of the base.

The subject-matter of claim 1 of the main request of the respondent thus does not involve an inventive step.

As regards claim 1 of the first auxiliary request, document D4 discloses in connection with Figures 3a to 3f and 10 the use of an adhesive for securing the vibrators to the support plate. It is obvious to use

the rigid base known from document D3 in the device of document D4 in order to reduce crosstalk.

As regards claim 2 of the first auxiliary request, document D4 discloses in Figure 9 an arrangement in which inactive areas of the vibrators are fixed to a support plate. Either document D3 or D4 could be regarded as being the closest prior art. In either case, it would be obvious to combine the teachings of documents D4 and D3, since this merely constitutes an aggregation of known and obvious features not having any synergistic effect.

As regards claim 3 of the first auxiliary request, document D2 discloses an ink jet recording head comprising a piezoelectric element having slits which extend through the last electrode into the support plate. There is further provided a base in the form of a layer of substrate made of resin for maintaining the shape of the piezoelectric element (column 4, lines 13 to 16). The subject-matter of claim 3 is distinguished over the disclosure of document D2 solely insofar as document D2 does not specify that the base is made of material having a rigidity which is higher than that of said support plate. The person skilled in the art would, however, readily choose such a material for the base of the device of document D2 in order to reduce crosstalk in view of the teaching of document D3.

The subject-matter of claims 1 to 3 of the first auxiliary request thus does not involve an inventive step.

VII. The respondent has argued substantially as follows in the written and oral proceedings with reference to the main and first auxiliary requests:

Document D3 is an old document. Further, there is no mention of a support plate. The use of the term "fixed" in claim 1 excludes the construction of document D3, in which a piezoelectric element is integrally formed by sintering.

It would not be obvious to the person skilled in the art to choose a material having a high rigidity for the base of the ink jet recording head of document D3. Document D3 teaches primarily the use of polysulphone as a base material. This material is markedly less rigid than the piezoelectric material forming the vibrator support plate.

References in document D3 refer to the bending rigidity of the base rather than the modulus of elasticity of the material of the base. As stated in the paragraph bridging pages 3 and 4 of document D3, the teaching of document D3 is to adjust the thickness of the base rather than to use an alternative material in order to obtain the required stiffness.

In order to reduce crosstalk, document D3 suggests the complete separation of the vibrators (page 5, lines 18 to 22).

As regards the reference to the use of a metal base as proposed in document D3, this is in order that it may serve as an electrode, so that there is no reason to

choose a particularly rigid metal, but rather a highly conductive material.

Starting from document D3, the objective problem to be solved is to reduce crosstalk and the formation of ink mist. According to the invention which is the subject of the patent in suit, this problem is solved by increasing the rigidity of the base material.

According to document D3, the problem of crosstalk is solved by cutting the piezoelectric element up to complete separation (page 5, lines 19 to 21). Following this teaching results in the elimination of the support plate.

Neither document D1 nor document D2 leads the person skilled in the art towards the subject-matter of claim 1 as granted. The teaching of document D3 leads away from the subject-matter of claim 1 as granted.

The subject-matter of claim 1 of the main request thus involves an inventive step.

As regards claim 1 of the first auxiliary request, the ink jet head of document D4 has either no support plate or no base. It is not possible to combine documents D3 and D4 so as to arrive at the subject-matter of the claim.

As regards claim 2 of the first auxiliary request, it is similarly not possible to combine documents D3 and D4 so as to arrive at the subject-matter of the claim. Document D3 teaches the separation of the teeth in

order to solve the problem of crosstalk (page 5, lines 18 to 22).

As regards claim 3 of the first auxiliary request, it is not possible to combine documents D2 and D3 so as to arrive at the subject-matter of the claim.

The subject-matter of claims 1 to 3 of the first auxiliary request thus involves an inventive step.

Reasons for the Decision

1. *Main Request*

1.1 Inventive Step

1.1.1 Construction of claim 1

Claim 1 refers to the support plate being "formed of a material having a resistance to cutting by a cutter which is the same as that used to cut said piezoelectric vibrators". The claim is, however, construed as requiring that the resistance of the material to cutting is the same as or similar to the resistance of the piezoelectric material of the vibrators to cutting. This construction is confirmed by the passage in the description of the patent in suit at column 4, lines 47 to 52. In addition, it is noted that claim 7, which gives as examples of the material of the support plate "glass and a piezoelectric material", is consistent with this interpretation.

Claim 1 further refers to the base being "made of material having a rigidity which is higher than that of said support plate". This is construed as requiring that the modulus of rigidity of the material of the base is greater than that of the material of the support plate. It is not specified in the claim that the base itself has a rigidity higher than that of the support plate.

1.1.2 Closest prior art

The closest prior art is represented by document D3. The fact that this document bears a priority date roughly ten years earlier than that of the remaining cited prior art does not prevent this document from being considered to be the closest prior art. The Board is not aware of any reason for the person skilled in the art to ignore the teaching of this document.

Document D3 discloses an ink jet recording head for ejecting ink drops by expanding or shrinking a pressure generation chamber 2 of an ink flow route forming member 1. A piezoelectric element 4 has a comb-like shape, with individual vibrators fixed in a row with a predetermined pitch, separated by grooves 7 (Figures 1 and 2). The vibrators operate in a vertical vibration mode (page 4, line 25 to page 5, line 10).

The portion of the piezoelectric element which connects the individual vibrators is regarded as forming a support plate which has a resistance to cutting which is the same as the resistance of the piezoelectric material of the vibrators to cutting, in view of the fact that it is made of the piezoelectric material. The

reference in claim 1 to the vibrators being fixed to the support plate is considered to include a construction such as that disclosed in document D3, in which a piezoelectric element including the vibrators and a support plate are integrally formed as a comb-like piezoelectric element, as shown in Figures 1 and 2 of document D3.

In addition, in the ink jet recording head of document D3, there is provided a rigid member 9 which, in the embodiment illustrated in Figures 1 to 3 of the drawings, is formed of polysulphone (page 4, line 12). As explained at page 4, lines 25 to 38 of document D3, the function of the rigid member is to ensure that expansion and contraction of the piezoelectric element 4 is almost completely transmitted to the vibration plate 3, by virtue of the fact that, whilst the rigid member is made of the same material as the vibration plate, the rigid member is many times thicker than the vibration plate.

In an alternative construction, disclosed in document D3 at page 5, lines 15 and 16, the rigid member is made of a metal, and also serves the function of the electrode 10. Thus, in this embodiment, the support plate of the piezoelectric element 4 is fixed directly to the rigid member 9. This alternative construction comprising a rigid member made of an electrically conductive metal constitutes the closest prior art. There is, however, no disclosure in document D3 of which metal should be used.

The subject-matter of claim 1 is thus distinguished over the disclosure of document D3, since document D3 does not disclose a base made of material having a rigidity which is higher than that of said support plate.

1.1.3 Problem and Solution

The person skilled in the art is thus faced with the problem of selecting a suitable metal for the rigid member which is also to function as an electrode.

In the view of the Board, the person skilled in the art would choose, without the exercise of inventive ingenuity, a conductive metal such as copper, which has a modulus of rigidity which is greater than that of the material of the support plate, which is made of a piezoelectric material. In this connection, it is noted that, according to column 1, lines 46 to 48 of the patent in suit, materials having excellent cutting properties, such as the piezoelectric material, are low in rigidity.

Thus, the person skilled in the art would arrive at a construction falling within the scope of claim 1 without the exercise of inventive ingenuity and the subject-matter of claim 1 lacks an inventive step.

2. *First Auxiliary Request*

2.1 Amendments

Claim 1 as granted is replaced by three independent claims, claims 1 to 3.

The features introduced into claims 1 to 3 are disclosed in the application as filed, published version, at column 3, lines 34 to 39. The introduction of these features in each case involves the introduction of limiting features. Finally, the amendments are occasioned by the ground of opposition of lack of inventive step.

The amendments thus comply with the requirements of Article 123(2) and (3) EPC and Rule 57a EPC.

The description at column 2, line 2, is amended for consistency with the amended claims by replacing the reference to "claim 1" by a reference to "claims 1 to 3".

2.2 Inventive Step

2.2.1 Claim 1

The closest prior art is represented by document D4, which refers at column 5, line 58 to column 6, line 6, to the piezoelectric plate being fixed onto the support plate (base 2) by a conductive bonding agent prior to the plate being cut to divide it into individual vibrators.

The subject-matter of claim 1 is thus distinguished over the disclosure of this document by virtue of the provision of a base fixed to the support plate and made of material having a rigidity which is higher than that of the support plate.

The presence of such a base serves to reduce the amount of crosstalk between the vibrators. The object of the invention can accordingly be regarded as being to provide an ink jet recording head capable of preventing crosstalk between the vibrators (see paragraph [0007] of the patent in suit).

The prior art does not, however, suggest the provision of a base fixed to the support plate and made of material having a rigidity which is higher than that of the support plate in order to solve this problem.

Whilst document D3 discloses the provision of a rigid base member, there is no suggestion that this would contribute to a solution of the problem of crosstalk. Rather, as explained at page 4, lines 25 to 38, the rigidity of the member 9 is intended to ensure that the expansion and contraction of the vibrators in the longitudinal direction is applied as far as possible to the vibration plate. To this end, the rigid member must be resistant to bending.

On the contrary, the person skilled in the art looking in document D3 for a solution to the problem of crosstalk is taught to increase the separation between the vibrators (page 5, lines 18 to 22).

It was suggested on behalf of the appellant that, in an alternative approach, document D3 could be regarded as being the closest prior art. However, in the ink jet head construction of document D3, there is no purpose served in using an adhesive to fix the vibrators to the support plate as opposed to forming the vibrators

integrally with the support plate, as taught in document D3. There is thus nothing which would induce the person skilled in the art to modify the device of document D3 in this way.

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

2.2.2 Claim 2

The closest prior art is represented by document D4, which discloses at column 9, lines 8 to 25, in conjunction with Figure 9 of the drawings, an arrangement in which inactive areas of piezoelectric vibrator elements are secured to a support plate.

As in the case of claim 1, discussed in the preceding section 2.2.1, the object of the invention is regarded as being to provide an ink jet recording head capable of preventing crosstalk.

Also for the reasons given in the preceding section 2.2.1, document D3 does not provide an inducement for the person skilled in the art to modify the device known from document D4 by the provision of a base fixed to the support plate and made of material having a rigidity which is higher than that of the support plate in order to solve the problem of crosstalk between the vibrators.

The subject-matter of claim 2 thus similarly involves an inventive step.

2.2.3 Claim 3

The closest prior art is represented by document D2, insofar as the slits 16a,b,c,d formed in the piezoelectric member 13 extend beyond the electrode layers into a region consisting solely of layers of piezoelectric material. Whilst document D2 discloses at column 4, lines 13 to 16, that "there may be included a layer of substrate, for example, made of resin on the side opposite to the plate 12 so as to maintain the shape of the piezoelectric element 13 after forming the slits 16", there is nothing to suggest the use of a material for the layer of substrate having a rigidity which is higher than that of the support plate, that is, the layers of piezoelectric material beyond the slits.

In addition, again for the reasons already set out in section 2.2.1 above, the teaching of document D3 would not induce the person skilled in the art to provide a base fixed to the support plate and made of material having a rigidity which is higher than that of the support plate either in place of, or in addition to, the layer of substrate in order to solve the problem of crosstalk between the vibrators.

The subject-matter of claim 3 thus similarly involves an inventive step.

Claims 4 to 12 are directly or indirectly appendant to claims 1 to 3 and relate to preferred embodiments of the ink jet head as defined in these claims. The subject-matter of the dependant claims thus also involves an inventive step.

In view of the above, it is not necessary to consider the remaining auxiliary requests of the respondent.

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 12 presented as first auxiliary request during oral proceedings; and
 - (b) description, page 2, presented during oral proceedings, and pages 3 to 6 as granted; and
 - (c) drawings, pages 9 to 19, as granted.

The Registrar:

The Chairman:

D. Sauter

W. Moser