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**Datasheet for the decision
of 26 January 2010**

Case Number: T 0926/06 - 3.4.03

Application Number: 97106000.9

Publication Number: 0803918

IPC: H01L 41/09

Language of the proceedings: EN

Title of invention:

Piezoelectric vibrator unit, ink jet recording head using the piezoelectric vibrator unit and method of manufacturing the same

Patentee:

Seiko Epson Corporation

Opponent:

Xaar Technology Limited

Headword:

-

Relevant legal provisions:

EPC Art. 123(2)

Relevant legal provisions (EPC 1973):

EPC Art. 54, 56, 84

Keyword:

-

Decisions cited:

T 0169/83, T 0191/93

Catchword:

-



Case Number: T 0926/06 - 3.4.03

DECISION
of the Technical Board of Appeal 3.4.03
of 26 January 2010

Appellant: Seiko Epson Corporation
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 7 April 2006
revoking European patent No. 0803918 pursuant
to Article 102(1) EPC 1973.

Composition of the Board:

Chairman: G. Eliasson
Members: E. Wolff
J. Van Moer

Summary of Facts and Submissions

- I. The opposition division revoked European patent No. 803918 for lack of novelty.
- II. The opposition division relied in its decision on prior art document

D4 = US-A 4 418 354.

- III. At oral proceedings before the board, the appellant proprietor requested that the decision of the opposition division be set aside and the patent maintained as granted (main request) or, in the alternative, that the decision under appeal be set aside and the patent be granted on the basis of one of the auxiliary requests 1 to 7.

The respondent opponent requested that the appeal be dismissed.

The appellant filed auxiliary requests 1-7 together with a letter dated 12 February 2008. With his letter dated 23 December 2009, the appellant renumbered auxiliary requests 5, 6 and 7 as 7, 5 and 6 respectively. During the oral proceedings, the (renumbered) auxiliary request 7 was replaced by a fresh auxiliary request 7. The requests are listed here in their ultimate sequence.

- (a) Independent claim 1 of the main request reads as follows:

"1. A piezoelectric vibrator unit comprising:

an elastically deformable plate (1) made of a piezoelectric material having curved portions (2; 45) when a drive signal is not applied;

a first common electrode (3; 47) formed on one side of said elastic plate (1); and

discrete electrodes (4; 46) formed on said curved portions (2; 45) of said elastic plate (1)

characterised in that said piezoelectric material is a ceramic material."

- (b) Independent claim 1 of the first auxiliary request reads as follows:

"1. A piezoelectric vibrator unit comprising:

an elastically deformable plate (1) made of a piezoelectric material, wherein said piezoelectric material is a ceramic material;

a first common electrode (3; 47) formed on one side of said elastic plate (1); and discrete electrodes (4; 46) formed on said elastic plate (1),

characterised in that

said elastic plate (1) has curved portions (2; 45) when a drive signal is not applied, in that

said discrete electrodes (4; 46) are formed on said curved portions (2; 45) of said elastic plate (1), and

said first common and said discrete electrodes are arranged for contraction and extension of said elastic plate (1) when a drive signal is applied, such that the contraction and extension (L,L') of said elastic plate (1) are converted into deflection displacements (ΔH)."

- (c) Independent claim 1 of the second auxiliary request reads as follows:

"1. A piezoelectric vibrator unit comprising: an elastically deformable plate (1) made of a piezoelectric material, wherein said piezoelectric material is a ceramic material;

a first common electrode (3; 47) formed on one side of said elastic plate (1); and discrete electrodes (4; 46) formed on said elastic plate (1),

characterised in that

said elastic plate (1) has curved portions (2; 45) when a drive signal is not applied, wherein said curved portions (2; 45) are lengthwise arrayed at fixed pitches; in that

said discrete electrodes are formed on said curved portions (2; 45) of said elastic plate (1), and in that

said first common and said discrete electrodes are arranged for extension and contraction of said elastic plate (1) in a length direction thereof when a drive signal is applied, such that the extension and contraction (L,L') of said elastic plate (1) are converted into a variation of curvature of said curved portions (2; 45)."

- (d) Independent claim 1 of the third auxiliary request reads as follows:

"1. A piezoelectric vibrator unit comprising:

an elastically deformable plate (1) made of a piezoelectric material, wherein said piezoelectric material is a ceramic material;

a first common electrode (3; 47) formed on one side of said elastic plate (1); and discrete electrodes (4; 46) formed on said elastic plate (1),

characterized in that

said elastic plate (1) has curved portions (2; 45) when a drive signal is not applied, in that

said discrete electrodes (4; 46) are formed on said curved portions (2; 45) of said elastic plate (1), and by

a spacer (22) forming pressure generating chambers (23), wherein said elastic plate (1) covers and seals one of the sides of said spacer (22)."

- (e) Independent claim 1 of the fourth auxiliary request reads as follows:

"1. A piezoelectric vibrator unit comprising:

an elastically deformable plate (1) made of a piezoelectric material, wherein said piezoelectric material is a ceramic material;

a first common electrode (3; 47) formed on one side of said elastic plate (1); and discrete electrodes (4; 46) formed on said elastic plate (1),

characterised in that

said elastic plate (1) has curved portions (2; 45) when a drive signal is not applied, in that

said discrete electrodes are formed on said curved portions (2; 45) of said elastic plate (1), and by

a spacer (22) forming pressure generating chambers (23) therein, wherein said elastic plate (1) covers and seals one of the sides of said spacer (22) and said pressure generating chambers (23)."

(f) Independent claim 1 of the fifth auxiliary request reads as follows:

"1. A piezoelectric vibrator unit comprising:

an elastically deformable plate (1) made of a piezoelectric material, wherein said piezoelectric material is a ceramic material;

a first common electrode (3; 47) formed on one side of said elastic plate (1); and discrete electrodes (4; 46) formed on said elastic plate (1);

characterized in that

said elastic plate (1) has curved portions (2; 45) when a drive signal is not applied, in that

said discrete electrodes (4; 46) are formed on said curved portions (2; 45) of said elastic plate (1), and by

a spacer (22) forming pressure generating chambers (23), wherein said elastic plate (1) covers and seals one of the sides of said spacer (22)

wherein the piezoelectric vibrator unit is constructed and arranged such that when the drive signal is applied, the curved portions (2; 45) are deflected to expand the pressure generating chambers (23)."

- (g) Independent claim 1 of the sixth auxiliary request reads as follows:

"1. A piezoelectric vibrator unit comprising:

an elastically deformable plate (1) made of a piezoelectric material, wherein said piezoelectric material is a ceramic material;

a first common electrode (3; 47) formed on one side of said elastic plate (1); and

discrete electrodes (4; 46) formed on said elastic plate (1);

characterized in that

said elastic plate (1) has curved portions (2; 45) when a drive signal is not applied, and in that

said discrete electrodes (4; 46) are formed on said curved portions (2; 45) of said elastic plate (1);further comprising

a spacer (22) forming pressure generating chambers (23), wherein said elastic plate (1) covers and seals one of the sides of said spacer (22) and a nozzle plate (35), wherein said spacer (22) is provided between the elastic plate (1) and said nozzle plate (35)."

- (h) The independent claims of the seventh auxiliary request read as follows:

Claim 1

"1. A piezoelectric vibrator unit comprising:

an elastically deformable plate (1) made of a piezoelectric material, wherein said piezoelectric material is a ceramic material;

a first common electrode (3; 47) formed on one side of said elastic plate (1); and discrete electrodes (4; 46) formed on said elastic plate (1);

characterised in that

said elastically deformable plate has curved portions (2; 45) when a drive signal is not applied, in that

said discrete electrodes (4; 46) are formed on said curved portions (2; 45) of said elastic plate (1), and by

a vibration inducing plate (40) layered on an inwardly curved side of each of said curved portions (2)."

Claim 7

"7. A method of manufacturing a piezoelectric vibrator unit comprising the steps of:

forming a common electrode on one side of a green sheet made of piezoelectric material and discrete electrodes on another side of said green sheet;

forming curved portions in said green sheet by a compressing said green sheet between a first molding member and a second molding member; and

sintering said green sheet having said curved portions thus formed."

Reasons for the decision

1. *Admissibility*

The appeal is admissible.

Main Request

2. In the words of claim 1 of the main request and the reference numerals of **document D4**, there was no dispute that document D4 discloses:

A piezoelectric vibrator unit comprising a deformable plate (23) of a piezoelectric material. The plate is elastically deformable (Figures 1-7 and column 5, lines 44 to column 6, line 3). A common electrode (13, 39) is formed on one side (29) of the elastic plate (23). Discrete electrodes (11, 37) are formed on the opposite side of the elastic plate (23). The plate is made of piezoelectric ceramic material (column 3 lines 22-24).

3. *Novelty*

3.1 In order to decide whether or not claim 1 is novel, the two issues to be decided are these:

(a) Is the plate in document D4 an elastically deformable plate, and

(b) what is the meaning of the feature that the plate has curved portions?

3.2 If it is found that the plate (23) of document D4 is an elastically deformable plate and that this plate has, on account of the grooves (35, 53), curved portions when a drive signal is not applied, then the claim lacks novelty.

3.3 The appellant proprietor submitted that Figures 1(a) and 1(b) of the patent illustrated the change of shape upon application of an electric signal to a plate according to the invention. This change consists of a shortening in length (L , L') of the plate, thereby raising the mid-section of the plate by a height difference ΔH . In document D4 the channels formed by the grooves (35) and the top 25 contracted in a radial direction (document D4, column 3, lines 21-23), that is, the plate in document D4 changed volume but not shape and was not, therefore, a deformable plate.

3.4 Concerning the feature that the plate has curved portions, the distinction between the invention claimed in claim 1 and document D4 was, in the view of the appellant, supported by paragraph [0016], lines 50 to 52 of the patent. Paragraph [0016] states, *inter alia*,

- that the elastic plate 1 has a surface including troughs or curved portions 2 which are laterally spaced at fixed pitches. This was quite unlike the plate in document D4, which was a plate with grooves.
- 3.5 It was, the appellant submitted, also apparent from the different way in which the plate of document D4 responded to an electric signal that there was a difference between the curved portions of the plate in claim 1 of the main request and the curved surfaces of the grooves of the plate of document D4.
- 3.6 The board is not convinced by the appellant's arguments. As argued by the respondent opponent, it is not permissible to import into a claim worded in general terms, arbitrary specific features from the description.
- 3.7 The skilled person will no doubt understand from the description of the operation of the piezoelectric device of document D4, that in order to constrict in a radial direction the channel containing the tube 3, at the very least the radius of curvature of the hemicylindrical grooves must alter in some way. Hence, application of an electric field will not merely change the volume but also the shape of the plate. Moreover, this change in shape is reversible, and therefore the plate is an elastically deformable plate.
- 3.8 Secondly, the common feature of all the examples described in the patent is a piezoelectric plate which is bent, the radius of curvature of the bend being altered upon application of an electric signal. What is claimed, however, is not a bent plate, but a plate with "curved portions". For the following reasons, the board

is in no doubt that the plate of the device in document D4 also has curved portions.

3.8.1 The bottom of the troughs - or grooves - (35) and the sides of the troughs - or grooves - (53) as variously shown in Figures 3 to 7 are without doubt curved, so that according to the ordinary meaning of the words "portions" and "curved", there are portions of the plate which are curved (rather than being straight as are the top and bottom surfaces (27) and (29), respectively of the plate (23) in which the troughs are formed). That is, in the ordinary sense of the phrase, the plate in document D4 has curved portions.

3.8.2 The board furthermore does not agree with the appellant's argument (statement of the grounds of appeal, paragraph 3) that the plate in document D4 had no portion which was curved per se, because the thickness of the plate varied substantially. The appellant argued his point with reference to Figure 3 of document D4. This argument seems to suggest that the criterion which determines whether a plate has curved portions was that the thickness of the plate needed to be reasonably constant. As the respondent remarked, even this requirement can be considered to be met by the embodiment of Figure 7 of document D4. In Figure 7, the plate 23 has cuts 63 in the surface in which the grooves 35 are formed. These cuts serve mechanically to decouple the individual grooves 53 (whether or not they contain tubes 3 - c.f. document D4, column 3, lines 14-20), so that the respective sections of the plate 23 of piezoelectric material surrounding each

of the tubes 3 (or, if there is no tube, the corresponding tubular duct) are seen to be both curved and of roughly constant thickness.

3.8.3 For the sake of completeness, it should be mentioned that the opposition division had addressed the effect of replacing the wording "*plate ... having curved portions*" used in claim 1 as granted by the expression "*said plate is curved at portions thereof*". The division concluded, in the board's view correctly, that this change in wording did not provide a clear and unambiguous restriction of the structure of the piezoelectric plate relative to the granted version. The opposition division considered in particular, that in document D4 the region between the curved portion at the bottom of groove 35 and an adjacent groove 53 can be referred to as a region at which the plate is curved. The opposition division had concluded on that basis that document D4 deprived claim 1 of novelty.

3.9 The conclusion of the board is that the plate 23 of document D4 is an elastically deformable plate which, on account of the grooves formed in it, has curved portions. These curved portions are present when no drive signal is applied. Therefore, claim 1 of the main request lacks novelty.

First auxiliary request

4. In addition to some re-arrangement of the order in which features are presented, independent claim 1 of the first auxiliary request differs from claim 1 of the main request in that it additionally requires that "*the*

first common and the discrete electrodes are arranged for contraction and extension of said elastic plate (1) when a drive signal is applied, such that the contraction and extension (L,L') of said elastic plate (1) are converted into deflection displacements (ΔH)."

5. *Clarity*

5.1 The appellant contended that the feature now added to claim 1 was clear and also served to distinguish the claimed invention from the disclosure in document D4. In particular, as regards the expression "the electrodes are arranged for contraction and extension" meant that the claim merely covered both alternatives when a drive signal was applied, since the drive signal could either cause a contraction or and extension of the plate, depending where on the plate the signal was applied. Whether application of a drive signal caused "contraction or extension" depended on the location of the electrodes and the potentials applied, and could be determined with ease. Equally clear was the requirement that this contraction or extension of the plate was converted into deflection displacements, which distinguished the invention from document D4 since any deformation of the plate in document D4 was clearly not a deflection.

5.2 The board is not persuaded by these arguments. As stated by the respondent, expansion and contraction in response to a signal applied to suitably located electrodes itself is nothing more than a description of the piezoelectric effect itself, and therefore the statement that "*the electrodes are arranged for contraction and extension*" contributes nothing towards

clarifying how or in what manner extension or contraction manifests itself in the claimed invention. The electrodes are stated to be formed on the curved portions of the plate, but their being arranged for contraction and extension is not associated with any particular direction with respect to the elastic plate or the curved portions. Neither it is clear what is meant by a conversion of that extension or contraction nor what in the context of the claimed device is a deflection displacement. Finally, the meaning of the phrase conversion of the extension or contraction into a deflection displacement bears no clear relationship to the device structure set out in the claim.

- 5.3 For the foregoing reasons, the board concludes that claim 1 of the first auxiliary request is not clear in the sense of Article 84 EPC 1973.

Second Auxiliary request

6. Compared to claim 1 of the first auxiliary request, claim 1 of the second auxiliary request has the following further features:
- (a) the "*curved portions are lengthwise arrayed at fixed pitches*"
 - (b) the contraction and extension of the elastic plate (1) "*is in a length direction*" when a drive signal is applied and
 - (c) the contraction and extension of the elastic plate are converted into "*a variation of curvature of*

the curved portions" instead of into a displacement deflection.

7. *Clarity*

7.1 The respondent had argued that the geometry of the claimed device was not sufficiently defined in the claim to allow a particular direction to be uniquely defined as lengthwise, and that the reference to "length" and "lengthwise" therefore made the claim unclear.

7.2 The board does not agree. As the appellant argued, "length" and "lengthwise" in the context of the claimed invention refer clearly to the direction of the array in which "*said curved portions (2; 45) are lengthwise arrayed at fixed pitches*" (c.f. claim 2 as filed). Therefore, claim 1 of the second auxiliary request is clear (Article 84 EPC 1973).

8. *Novelty*

8.1 The further features introduced into the third auxiliary request fail, as the respondent persuasively argued, for the following reasons to confer novelty over the disclosure in document D4.

8.2 The "length" direction is defined by the claim as the direction in which the curved sections are arrayed at fixed pitches. In all of Figures 3 to 7 of document D4, the curved portions formed by the troughs 35 are shown arranged equally spaced from left to right, fulfilling the requirement of curved portions arranged at fixed pitches. The same applies in Figures 6 and 7

additionally in respect of the troughs 53. The board concurs with the respondent's submissions in this respect and concludes that, consistent with the meaning of the term "curved portions" adopted for purposes of the main request, document D4 shows "curved sections arrayed at fixed pitches".

8.3 Furthermore, Figures 4 to 7 of document D4 shows by means of arrows 45 the direction in which the piezoelectric plate 23 contracts to compress the tube 3 when a voltage is applied between metal layers 41 and 43, thereby causing a variation in curvature of the troughs 35. Some of the arrows are at an angle to the vertical and hence show without question that the contraction must have a component in the horizontal direction, thereby causing as well a contraction or expansion of the plate 23 in the lengthwise direction, as required by claim 1 of the request.

8.4 The board therefore concludes, that claim 1 lacks novelty over document D4.

Third auxiliary request

9. In addition to some re-arrangement of the order in which features are presented, independent claim 1 of the third auxiliary request differs from claim 1 of the main request in that it additionally requires "*a spacer (22) forming pressure generating chambers (23), wherein said elastic plate (1) covers and seals one of the sides of said spacer (22).*"

9.1 The respondent argued that the claim did not define the geometry of the device in detail sufficient for it to be clear what was meant by "*a spacer forming pressure generating chambers*" and "*[one of] the sides of the spacer*". The board takes the view that, as contended by the appellant, that is sufficiently clear from the claim what is meant. The application relates to the field of layer-type printing heads and the skilled reader will understand without difficulty the purpose and general configuration of a spacer which has one side sealed by the plate, and, on account of the reference to "forming pressure generating chambers" that there will be a hollow space within its periphery to space for that chamber. The reference to one of the sides being sealed by the plate itself explains what is meant by a side of the spacer.

10. *Novelty*

10.1 The appellant submitted that the device disclosed in document D4 had neither a spacer (22) forming pressure generating chambers nor a spacer one side of which is covered and sealed by the plate, and that the subject matter of claim 1 was therefore new.

10.2 The respondent replied, and the board finds that reply convincing, that a structure in which a spacer forms a pressure chamber and has one of its sides sealed by the plate was as such disclosed in document D4. Although not illustrated by a drawing, the description (column 3, lines 55 to 61) refers to an arrangement in which both plates 23 and 25 are of approximately equal thickness with each plate being provided with channels 35 whose depth amounts to about half the diameter of the tube 3.

Accordingly, so argues the respondent, the lower half forms the plate, and the upper half, which is an inverted copy of the lower half is the spacer, thereby "*forming pressure generating chambers*" between the two halves. Moreover, as explained with reference to Figure 5, (column 4, lines 17 to 31), the metal surfaces of the first and second plates are covered with adhesive (epoxy resin or solder) and, in the case of adhesive, rigidly interconnected after curing.

10.3 The further requirement of the claim that "*the elastic plate covers and seals one of the sides of said spacer (22)*" follows from the description in document D4 which provides for the possibility of forming the pumping member with or without the tube 3 (Column 3, lines 15 and 16), since at least in the alternative version without the tube, the adhesive between the two plates must of necessity form a sealing connection.

11. For the foregoing reasons, the board concludes the features which distinguish claim 1 of the third auxiliary request from those of the main request fail to confer novelty on the claim.

Fourth auxiliary request

12. Independent claim 1 of the fourth auxiliary request differs from claim 1 of the main request in that at the end of the last paragraph it stipulates "*a spacer (22) forming pressure generating chambers (23), wherein said elastic plate (1) covers and seals one of the sides of said spacer (22) and said pressure generating chambers (23)*".

13. *Novelty*

13.1 It is the board's view that the feature added to claim 1 of the third auxiliary request to arrive at the wording of claim 1 of the fourth auxiliary request does not add anything of substance. The elastic plate covers and seals one of the sides of the "spacer forming pressure generating chambers". Accordingly, the plate perforce also covers and seals said pressure generating chambers. Claim 1 of the fourth auxiliary request therefore lacks novelty for the same reasons as claim 1 of the third auxiliary request.

Fifth auxiliary request

14. In addition to some re-arrangement of the order in which features are presented, independent claim 1 of the fifth auxiliary request differs from claim 1 of the main request in that it additionally requires "*a spacer (22) forming pressure generating chambers (23), wherein said elastic plate (1) covers and seals one of the sides of said spacer (22) wherein the piezoelectric vibrator unit is constructed and arranged such that when the drive signal is applied, the curved portions (2; 45) are deflected to expand the pressure generating chambers (23).*"

15. *Amendment*

15.1 The board is satisfied that the amendment to the claim has a basis in the description (column 8, lines 32 to 41 of the published application).

16. *Novelty*

16.1 The feature that "*the piezoelectric vibrator unit is constructed and arranged such that when the drive signal is applied, the curved portions (2; 45) are deflected to expand the pressure generating chambers (23)*" is not as such known from document D4. The subject matter claimed in claim 1 of the fifth auxiliary request is therefore new.

17. *Inventive step*

17.1 The appellant presented the argument that document D4 did not mention a drive signal at all. Instead, document D4 merely disclosed that when an electric voltage was applied between the electrodes, the pumping member contracted to constrict the tube 3 (column 3, lines 20 to 24). There was, the argument continued, a significant difference between, on the one hand, a drive signal, which had a wave form which involved a temporary increase in the signal level and, on the other hand, an electric voltage applied between the electrodes as described in document D4. Moreover, even if one were to see the similarity between application of an electric voltage and the presence of a drive signal, document D4 unquestionably stated that the application of such a voltage caused a contraction. In contrast, claim 1 of the fifth auxiliary request specified that the application of a drive signal expanded the pressure generating chambers.

17.2 The board does not find this argument persuasive. The text which forms the basis of the amendment explains that applying the drive voltage to the electrodes

causes an increase in the volume of the pressure generating chamber which is reversed when the drive voltage is removed. In document D4, application of an electric voltage causes the pumping member to expand longitudinally and contract in the radial direction (Column 3, lines 20 to 23), which appears to be the opposite of the operation described in the patent in suit. However, apart from choosing the polarity of the signal, about which the description of the patent is wholly silent, there are only two possible ways of operation, that is either to apply a voltage to cause the chamber to expand, or to apply a voltage to cause the chamber to contract. Added to that, the claim specifies not the application of a drive voltage but the application of a drive signal. The term "drive signal", as correctly remarked by the respondent, does not of itself signify the presence or absence of a drive voltage. Instead, it merely signifies that there must be a change in the drive voltage. Moreover, even if the presence of a drive signal were to signify the presence of a drive voltage, as argued by the appellant, there are, as already stated, only two modes in which the device can be operated, with there being no mention in the description of any advantage that might be gained by causing an increase in the volume of the pressure generating chamber upon application of the drive voltage as opposed to causing a decrease in the volume by applying a voltage. The only context in which advantages are referred to is in the next-following paragraph which, however, merely explains the benefits of using an elastic plate having curved portions as opposed to employing expansion and contraction of a planar vibrating plate (column 8, line 55 to column 9, line 10). Hence the skilled person faced with the

problem of implementing the teaching of document D4 would have to decide on a suitable drive voltage. There are only two alternative modes (expansion or contraction) and the skilled person, in the absence of any indication that one alternative would have any advantages over the other, would consider both.

- 17.3 For the reasons set out in the preceding paragraph, the board concludes that the subject matter of claim 1 of the fifth auxiliary request does not involve an inventive step within the meaning of Article 56 EPC 1973.

Sixth auxiliary request

18. In addition to some re-arrangement of the order in which features are presented, independent claim 1 of the first auxiliary request differs from claim 1 of the main request in that it additionally requires "*a spacer (22) forming pressure generating chambers (23), wherein said elastic plate (1) covers and seals one of the sides of said spacer (22) and a nozzle plate (35), wherein said spacer (22) is provided between the elastic plate (1) and said nozzle plate (35).*"
19. *Added matter (Article 123(2) EPC)*
- 19.1 Among the features which are intended to define the invention more clearly is the requirement that the spacer 22 is provided between the elastic plate and the nozzle plate. According to the appellant, this feature is based on the drawing of Figure 5.

- 19.2 It is established case law of the boards of appeal that there is no objection in principle against further defining by reference to the drawings any features which were already claimed. This extends to features shown only in the drawings being introduced into the claim for greater precision. (T 169/83, OJ EPO 1985, 193, paragraph 2.5).
- 19.3 The incorporation into the claim of features taken from the drawings is, nevertheless, subject to the same restrictions that apply to any amendment, which is to say that the feature concerned - unless found *expressis verbis* in the application as filed - must be clearly and unambiguously derivable by the skilled person from the content of the application as a whole. If it is not, the amendment does not comply with Article 123(2) EPC.
- 19.4 It is also established case law that while it is permissible to use the drawings as a basis for providing greater precision in respect of features already claimed, it is not permissible to introduce new features which are selected arbitrarily from among the features of the drawings in the sense that it is not directly derivable from the application as originally filed that the feature can be isolated from other features of the drawings (T 191/93, paragraph 2.1).
- 19.5 In the present case, the feature introduced into the claim from the drawings, in particular from Fig 5 of the drawings, is that a "*spacer (22) is provided between the elastic plate (1) and said nozzle plate (35)*" (emphasis added by the board). The appellant submitted that the term "between" is clear in that its meaning can be ascertained from the description

(published application, column 7 line 41 onwards) which indicates the order in which the layers are stacked. Thus, the term "between" itself served to set up the defining geometry of plate, spacer nozzle plate.

- 19.6 However, as convincingly argued by the respondent, the alleged structure of the spacer being located "between" the plate and the nozzle plate is itself not uniquely defined by the drawings, since Figure 5, which the appellant stated as basis for the claim amendment (as well as other Figures of the drawings (Fig.6, Fig.7)), show the presence of several other layers separating the plate 1 from the nozzle plate 35. The requirement of being in between the plate and the nozzle plate would be satisfied by any position of the spacer among the other layers, which clearly also satisfy the condition of being located between the plate and the nozzle plate. A clear and precise meaning for the term "between" is thus not directly and unambiguously derivable from the application as originally filed in the sense that this particular feature can be isolated from other features of the drawings. The board therefore concludes that the amendment introduced into claim 1 of the sixth auxiliary request does not comply with the requirements of Article 123(2) EPC.

Seventh auxiliary request

20. In addition to some re-arrangement of the order in which features are presented, independent claim 1 of the seventh auxiliary request differs from claim 1 of the main request in that it additionally requires a "*a vibration inducing plate (40) layered on an inwardly curved side of each of said curved portions (2)*"

21. *Amendment*

21.1 Claim 1 of the seventh auxiliary request is a combination of claim 1 and claim 5 as granted. Claims 2 to 24 correspond to claims 2 to 4, 6 to 17 and 19 to 26, respectively, as granted.

21.2 The combination of claims 1 and 5 as granted corresponds to a combination of claims 1 and 5 as originally filed with the added features that the plate has curved portions when no signal is applied and that the piezoelectric material is a ceramic material. Furthermore, the wording "characterised in that said elastic plate" was changed to "characterised in that said elastically deformable plate" in order to bring the wording in line with that of the second paragraph of the claim.

21.3 The opposition division concluded that neither of these features goes beyond the content of the application as filed. First, in respect of the piezoelectric material being a ceramic material, the opposition division accepted that each of the described embodiments refers to "green-sheet sintering" for forming the piezoelectric material. Secondly, they agreed that a basis for "curved portions" could be found in Figures 1-18, 20, and 25, and the associated description. The board has no reason to disagree with these conclusions, which were not challenged by the respondent.

- 21.4 The respondent did no longer pursue any of the objections raised in the notice of opposition against some of the other claims as granted.
- 21.5 As claim 1 is a combination of granted claims 1 and 5, the amendment merely limits the scope of claim 1.
- 21.6 Further amendments were made during the oral proceedings to bring the description into line with the amended claim 1.
- 21.7 The board is satisfied that the amendments fulfil the requirements of Article 123(2) and 123(3) EPC.

22. *Clarity*

- 22.1 Claim 1 is a straightforward combination of claims 1 and 5 as granted. The issue of clarity therefore does not fall to be considered.

23. *Novelty*

- 23.1 A vibration inducing plate (40) layered on an inwardly curved side of each of said curved portions (2) is not known from document D4. Claim 1 of this auxiliary request is therefore new.

24. *Inventive step*

- 24.1 The respondent submitted that, should the arrangement of the device in document D4 be found to be insufficiently rigid, the skilled person would as a matter of course add some form of stiffening. This could be in the form, e.g., of a sleeve, or in some

other non-inventive manner. The precise form of stiffening would depend on the precise configuration of the vibrating plate. A form of stiffening was apparent even in document D4, since the metal deposited to form the electrodes could be considered a form of vibration inducing plate.

24.2 The board does not find this argument persuasive. As contended by the respondent, the question is not "could" the skilled person have added a vibration inducing plate, but "would" the skilled person have done so. Document D4 contains neither an incentive to add vibration inducing measures, nor an indication that vibration inducing measures would in some cases be necessary. The board therefore concludes that the skilled person would not, on the basis of document D4, have chosen to add a vibration inducing plate as now claimed. The board therefore concludes that the invention claimed in claim 1 of this auxiliary request involves an inventive step within the meaning of Article 56 EPC 1973.

25. The respondent opponent declared during the oral proceedings that he no longer had any objections against independent claim 7.

26. For the foregoing reasons, the board finds that the seventh auxiliary request and the invention to which it relates comply with the requirements of the EPC.

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 with the following documents:
 - (a) Claims 1 to 24 (seventh auxiliary request filed at the oral proceedings).
 - (b) Description columns 1 to 16 filed at the oral proceedings.
 - (c) Figures 1 to 28 as granted.

Registrar:

Chair:

S. Sánchez Chiquero

G. Eliasson