Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 20 January 2022

Case Number: T 0454/18 - 3.4.03

Application Number: 07753508.6

Publication Number: 1997159

IPC: B06B1/02, B08B3/12

Language of the proceedings: EN

Title of invention:
MEGASONIC PROCESSING APPARATUS WITH FREQUENCY SWEEPING OF THICKNESS MODE TRANSDUCERS

Patent Proprietor:
Megasonic Sweeping Incorporated

Opponent:
Weber Ultrasonics GmbH

Headword:

Relevant legal provisions:
EPC Art. 52(1)
EPC 1973 Art. 54(2), 56

Keyword:
Inventive step - obvious combination of known features
Internet disclosure - publication date

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 0454/18 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 20 January 2022

Appellant: (Patent Proprietor)	Megasonic Sweeping Incorporated Scotch Road P.O. Box 7266 Trenton, NJ 08628 (US)
Representative:	Reeve, Nicholas Edward Reddie & Grose LLP The White Chapel Building 10 Whitechapel High Street London E1 8QS (GB)
Respondent: (Opponent)	Weber Ultrasonics GmbH Im Hinteracker 7 76307 Karlsbad-Ittersbach (DE)
Representative:	Lemcke, Brommer & Partner Patentanwälte Partnerschaft mbB Siegfried-Kühn-Straße 4 76135 Karlsruhe (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 21 December 2017 revoking European patent No. 1997159 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	T. Häusser
Members:	J. Thomas
	T. Bokor

Summary of Facts and Submissions

I. This is an appeal by the appellant-patent proprietor (hereinafter "the appellant") against the decision of the opposition division to revoke the European patent EP 1 997 159 based on objections under Article 100(a) and (c) EPC 1973 in conjunction with Article 52(1) EPC and Article 56 EPC 1973 and under Article 84 EPC 1973.

II. Oral proceedings were held before the Board, at the end of which the parties requested the following:

The appellant requested that the decision under appeal be set aside and maintenance of the patent according to the main request or alternatively maintenance according to one of the first to ninth auxiliary requests, all requests filed with the grounds of appeal dated 30 April 2018.

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

III. The following documents are referred to in this decision:

S2: US2005/0098194 A1;

S13: "Fundamentals of Ultrasonic Cleaning", Hessonic, downloaded from Hessonic's website "hessonic.com";

S14: "The Ultrasonic Cleaning Process" from "tm associates" archived by the Wayback Machine "web.archive.org" on 14 October 2002;

S18: Screenshot of the Wayback Machine "web.archive.org" showing an archiving date for document S13;

S19: Affidavit of James R. Hesson concerning the publication date of document S13;

S20: Screenshot of the Wayback Machine "web.archive.org" showing an archiving date in relation with document S13;

S21: Screenshot of the Wayback Machine "web.archive.org" showing an archiving date in relation with document S13.

IV. The independent claim 1 of the **main request** reads as follows:

Claim 1:

A megasonic processing apparatus, comprising:
a tank (12) adapted to contain fluid (14) and one or more parts (15) to be processed;
a plurality of piezoelectric transducers (16) adapted for providing vibrations to the tank (12) and its contents, wherein each transducer (16) has a fundamental resonant frequency of at least 300 Khz [sic];
and a generator (26) coupled to the transducers for supplying a driving signal;
wherein at least some of the fundamental resonant frequencies of the transducers (16) are different and define a range of transducer resonant frequencies, the fundamental resonant frequency of one piezoelectric transducer defining a maximum fundamental resonant frequency and the fundamental resonant frequency of another piezoelectric transducer defining a minimum fundamental resonant frequency; and

the generator (26) has a sweeping frequency function that is operable to supply the driving signal at a variable frequency throughout a predetermined frequency sweep range (30) that ranges from a maximum drive frequency that just exceeds the maximum fundamental resonant frequency, and a minimum drive frequency that is just less than the minimum fundamental resonant frequency, wherein the amount that the maximum drive frequency exceeds the maximum fundamental frequency is equal to the amount that the minimum drive frequency is less than the minimum fundamental resonant frequency, and

wherein the generator (26) includes a user interface for setting an adjustable frequency range and an adjustable sweep rate.

V. Compared to claim 1 of the main request, independent claim 1 of the **first auxiliary request** is amended by adding the following underlined feature (underlining by the Board):

"a plurality of piezoelectric transducers (16) adapted for providing vibrations to the tank (12) and its contents, wherein each transducer (16) has a fundamental resonant frequency of at least 300 KHz, and the processing action in the tank is based on micro-streaming;".

VI. Compared to claim 1 of the main request, independent claim 1 of the **second auxiliary request** is amended by adding the following underlined features and deleting the crossed out features (underlining and strike-through by the Board):

"wherein the generator (26) includes a user interface for setting ~~an~~ user programmed sweep rate and ~~adjustable~~ frequency range ~~and an adjustable sweep rate~~for the generator".

VII. Compared to claim 1 of the main request, independent claim 1 of the **third auxiliary request** is amended by adding the following underlined features and deleting the crossed out features (underlining and strike-through by the Board):

"wherein the generator (26) includes programmable means for defining the frequency sweep range and sweep rate for the driving signal, and a user interface for selecting or setting ~~an~~ user programmed sweep rate and ~~adjustable~~frequency range ~~and an adjustable sweep rate~~for the generator".

VIII. Compared to claim 1 of the main request, independent claim 1 of the **fourth auxiliary request** is amended by adding the following underlined features and deleting the crossed out features (underlining and strike-through by the Board):

"at least two ~~a~~ generators (26) coupled to the transducers for supplying a driving signal",

"each of the generators (26) has a sweeping frequency function ...", and

"~~and~~ wherein both the generators (26) include~~s~~ a user interface for setting an adjustable frequency range and an adjustable sweep rate; and
wherein the transducers (16) are grouped by similar resonant frequencies to divide the frequency sweep range into smaller subranges, and wherein each group of

transducers is powered by one of the at least two generators (26) that generate a driving signal having a variable frequency that varies within a frequency range that includes and exceeds the range of fundamental resonant frequencies of all the transducers of its associated group".

IX. Respective claim 1 of the **fifth to ninth auxiliary requests** is based on claim 1 of the main request and first to fourth auxiliary requests, respectively, with the following additional underlined feature (underlining by the Board):

"*... the minimum fundamental resonant frequency, the amount being either 1 kHz or 2 kHz,*".

X. The findings of the opposition division, insofar as they are relevant to the present decision, may be summarised as follows:

Public availability of document S13:

The opposition division considered S13 being published in December 2005 and consequently part of the state of the art according to Article 54(2) EPC 1973. The public availability of S13 had not been challenged during the opposition proceedings.

Inventive step

Lack of inventive step was assessed in relation to the fifth auxiliary request considering document S2 as representing the closest prior art. The subject-matter defined in claim 1 was considered not inventive when starting from document S2 and combining it with the teaching of S13 and common general knowledge.

XI. The arguments of the appellant, insofar as they are relevant to the present decision on the main request, may be summarised as follows. The arguments concerning the auxiliary requests are directly dealt with in the "Reasons for the Decision".

Public availability of document S13:

Document S18 indicated that document S13 was archived only on 2 May 2006. There was no verified evidence that the Internet links shown in documents S20 and S21 were functional and led indeed to document S13 and gave access to it in its present version at the time before the priority date. The only existing proof of a publication date for S13 was document S18. Consequently there was no conclusive proof that the content of S13 was available before the priority date of the patent.

Inventive step

Document S2 was considered as representing the closest prior art. It disclosed in paragraphs [0052] to [0055] the selection of a frequency range starting from exactly the lowest to exactly the highest resonant frequencies of the excited transducers or a narrower range, but not going beyond, let alone going symmetrically beyond the lowest and highest resonant frequencies of the excited transducers. Document S2 did not disclose the use of a user interface for selecting and adapting the frequency sweep range and rate, either. Both partial problems defined by the respondent were linked together, because they solved a single technical problem being the improvement of the uniformity of the power generated in the liquid by the megasonic device.

Document S13 taught away from a combination with document S2, because, paragraph "MULTI FREQUENCY / SWEEP FREQUENCY (*7)" on page 7 of S13 in relation with "drawing B" did not refer to the megahertz frequency range but to frequencies around 40 kHz. Further, document S13 taught that a transducer should not be driven at more than 2 kHz from its manufactured frequency in order to avoid poor power output and possible overheating due to mismatched frequencies (see S13, page 7, paragraph "MULTI FREQUENCY / SWEEP FREQUENCY (*7)").
The combination with document S14 was not obvious, either, as S14 dealt with frequencies in the kilohertz frequency range and therefore related to other applications.

XII. The arguments of the respondent, insofar as they are relevant to the present decision on the main request, may be summarised as follows:

Public availability of document S13:

The snapshots shown in documents S18, S20 and S21 indicated the moments when these pages were randomly crawled by the wayback machine "web.archive.org". The indicated dates were consequently due to random hits. Document S20 was archived on 1 December 2005, document S21 on 8 February 2006 and document S18 was admittedly archived on 2 May 2006. This however does not mean that these pages were not accessible earlier than these dates. The author of document S13, M. Hesson, testified in his affidavit that document S13 was added in December 2005 to his Internet page and no further changes were applied to the document at a later moment. There was no evidence that one of the links shown in documents S20 and S21 did not correctly function and

there was no evidence that document S13 was amended after having been published in December 2005, as testified by M. Hesson in the affidavit.
Moreover, the publication date of December 2005 could not be doubted as there were no indications to the contrary and the allegations about non-functioning links or documents not being linked to the relevant Internet pages were not further substantiated by the appellant and were therefore not proven and remained pure speculation.

Balance of probabilities should be used as standard of proof in relation to the public availability of S13 in accordance with established case law of the Boards of Appeal. Based thereon and considering the above presented facts and evidences the publication date of December 2005 should be accepted.

Inventive step

Document S2 represented the closest prior art. The observed two differentiating features related to separate partial problems which did not provide a synergetic effect, because the solution to one had no effect on the other. Hence, they should be dealt with separately.

In relation with the first partial problem, document S2 was not limited to a frequency range not going beyond the lowest and highest resonant frequencies of the transducers. Paragraph [0054] of S2 did not refer to the individual resonant frequencies of the crystals, as the term "to encompass" had to be understood as meaning "to surround", "to hold within", "to go completely around" or "to envelope". The frequency sweep range

mentioned in paragraph [0054] of S2 went beyond the resonant frequencies of the transducers.
The symmetric extension was part of the common general knowledge even without relying on document S13. The frequency range should have enough coverage and should therefore go beyond the lowest and highest resonant frequencies of the transducers and the selection of an equal amount of excess was the most obvious choice.
Document S13 was a back-up illustration and the skilled person would understand that the indicated frequency extension of 1kHz to 2 kHz should be applied to the borders of the selected frequency range.
Also the second differentiating feature was obvious based on the teaching of document S14, which also related to an ultrasonic cleaning apparatus. S14 indicated at the bottom of page 2 the possibility of implementing a user interface for adjusting the frequency sweep range and the frequency sweep rate.
Hence, the subject-matter defined in claim 1 was obvious, when starting from the teaching of S2 and combining it with common general knowledge and the teaching of S14, or when combining the teaching of S2 with common general knowledge and the teaching of both S13 and S14.

Reasons for the Decision

1. The appeal is admissible.

2. The invention

The impugned patent relates to a megasonic processing apparatus involving a plurality of piezoelectric transducers which are employed in a liquid filled tank used for cleaning purposes. The transducers are bonded to the sides or the bottom of the tank and excited at

their fundamental resonant frequencies which are all different and rather individual for each of the transducers. Exciting the piezoelectric transducers creates a pressure wave in the tank which allows cleaning of objects contained in the liquid. To optimise and homogenise the generated energy of all piezoelectric transducers, the transducers are excited simultaneously with varying frequencies using a frequency sweep over a range of frequencies. The exciting frequencies are swept in a frequency sweep range according to a frequency sweep rate. The frequency sweep starts at a frequency which is a certain amount below the lowest resonant frequency of the transducers and goes up beyond the highest resonant frequency of the transducers, whereby the excess amounts beyond the lowest and highest resonant frequencies are chosen to be equal.

3. Public availability of document S13

3.1 Document S13 is an article from the company "Hessonic" titled "Fundamentals of Ultrasonic Cleaning" which does not show any publication date on the publication itself. It was submitted by the respondent with the notice of opposition citing 1 December 2005 as publication date.

3.2 The appellant objected that document S13 was part of the state of the art according to Article 54(2) EPC in the statement setting out the grounds of appeal indicating that the wayback machine "web.archive.org" archived this document for the first time only on 2 May 2006 (see document S18).

3.3 With their reply to the statement setting out the grounds of appeal, the respondent filed documents S19

to S21 in order to provide further evidence for their allegation that document S13 was part of the state of the art according to Article 54(2) EPC 1973.

3.4 Three screenshots from the wayback machine "web.archive.org" of three different Internet pages submitted as documents S18, S20 and S21, all linked to document S13, show different archiving dates. These three Internet pages are related to each other as follows:

The screenshot shown in document S20, which was archived on 1 December 2005, i.e. before the priority date of the impugned patent (17 March 2006), shows the website of the company "Hessonic" on which a link to a document "Fundamentals of Ultrasonic Cleaning" is shown, i.e. to a document with the same title as document S13.

If one follows this link (in the lower part of the left-hand column shown in document S20), one arrives at the screenshot shown in document S21, which was archived on 8 February 2006, i.e. also before the priority date of the impugned patent, showing a document's cover page which is identical to that of document S13.

If one follows this cover page shown in document S21 to call up the article stored behind it, one actually arrives at document S13. This Internet page was archived on 2 May 2006, as screenshot S18 shows, i.e. after the priority date of the impugned patent.

3.5 It is known that the wayback machine "web.archive.org" randomly crawls the Internet, without necessarily accessing each and every web page, and archives crawled

web pages using the date and time when the web page was crawled. The archiving dates of the wayback machine "web.archive.org" thus do not indicate the earliest date of public availability, but a date for which the public availability can be more or less safely assumed. However, this does not exclude an earlier publication date.

3.6 In the present case, when crawling the Internet, the wayback machine "web.archive.org" has recognised and archived the Internet pages S20 and S21 prior to the priority date of the impugned patent. The Internet page shown by document S18, being the lowest page from a hierarchical point of view, was only archived later on 2 May 2006.

3.7 The indicated archiving date of 2 May 2006 does however not exclude that document S13 was already publicly available by the links shown in documents S20 and S21 in December 2005. In particular, since the wayback machine "web.archive.org" crawls the Internet randomly, it can be assumed that the crawling of the wayback machine "web.archive.org", due to its randomness, accesses subordinate pages of lower hierarchy less frequently than it does higher level pages. This could explain a publication date of S13 in December 2005 (as shown in document S20) without being in contradiction to the archiving date of 2 May 2006 as shown by document S18. In any case, from a purely technically point of view, document S13 could well have been available when the pages S20 and S21 were archived.

3.8 However, it is also possible that document S13 was either not accessible at all via the links of the Internet pages shown by S20 and S21 or at least not in the version of the present document S13. Therefore, the

combination of documents S18, S20 and S21 provide a proof that document S13 was publicly available as of 2 May 2006, but are neither a proof nor a rebuttal of a publication date of 1 December 2005.

3.9 According to the affidavit S19 by James R. Hesson, founder of Hessonic Ultrasonic LLC and author of document S13, document S13 was added in December 2005 to his website, thus publicly available from that moment on. Further, according to his affidavit, no changes were made to document S13 after December 2005.

3.10 Since the public availability of document S13 in December 2005 is disputed and there is no other documentary proof of this public availability, the Board had to assess the available evidence and decide the matter. According to established case law of the Board of Appeal (see *Case Law of the Boards of Appeal*, 9th Edition, 2019, I.C.3.2.3), the standard of proof for a decision on the publication date of S13 should be the balance of probabilities.

3.11 The Board evaluates the question whether document S13 was publicly available in December 2005, i.e. prior to the priority date of the impugned patent, as follows.

Firstly, there is no reason to believe that the author of document S13 in his affidavit is not telling the truth. He appears to be an independent person who does not seem to have any business, economic or other relationship with any of the parties involved in the proceedings. Nor did the appellant contest the validity of the affidavit.

There is also no convincing reason not to believe the author's statement in his affidavit that document S13 is unchanged since December 2005.

Secondly, the probability that the Internet links functioned correctly is estimated to be higher than the opposite. There is no reason to provide Internet links which do not function. The probability that the Internet links worked correctly, but that the wayback machine "web.archive.org" in its random crawls did not arrive at the lowest hierarchical page S18 earlier than 2 May 2006, is estimated to be higher than the opposite. Given the affidavit, it also seems unlikely that a version published in December 2005 had different content from document S13.

Moreover, it is considered unlikely that an Internet link to a document is indicated but leads nowhere. Even if this was the case, the interested reader could have contacted the author directly to ask for document S13 that was displayed on the Internet pages as of December 2005 and which, according to the author's affidavit, was publicly available at that time in its present version.

Consequently, in the light of all the above considerations, the Board concludes that the likelihood that document S13 was publicly available in December 2005 is far greater than the opposite.

3.12 Therefore, the Board concludes that document S13 is part of the state of the art according to Article 54(2) EPC 1973.

4. Main request - Inventive step

4.1 Document S2 represents the closest prior art since it deals with the cleaning of semiconductors or wafers in sonified liquids using megasonic energy and a plurality of piezoelectric crystals as sources which are excited by frequency sweeping.

4.2 In particular, document S2 shows (the references in parentheses in the following paragraph refer to document S2) a processing apparatus, working in the megasonic range ([0036]) comprising:
a tank (10) adapted to contain fluid (18) with objects in it to be processed ([0031]);
a plurality of piezoelectric transducers (36, 44) adapted for providing vibrations to the tank ([0034]) and its contents, wherein each transducer (36, 44) has a fundamental resonant frequency of at least 300 Khz ([0004], [0054]);
and a generator (32, 42) coupled to the transducers for supplying a driving signal ([0036], [0037]); wherein at least some of the fundamental resonant frequencies of the transducers ([0042], [0049]) are different and define a range of transducer resonant frequencies ([0049]), the fundamental resonant frequency of one piezoelectric transducer defining a maximum fundamental resonant frequency and the fundamental resonant frequency of another piezoelectric transducer defining a minimum fundamental resonant frequency (this is implicit when the fundamental frequencies of the different piezoelectric transducers vary); and the generator (32, 42) has a sweeping frequency function ([0050] to [0054]) that is operable to supply the driving signal at a variable frequency throughout a predetermined frequency sweep range ([0054]) that encompasses the resonant frequencies of the piezoelectric transducers ~~from a maximum drive frequency that just exceeds the maximum fundamental~~

~~resonant frequency, and a minimum drive frequency that is just less than the minimum fundamental resonant frequency, wherein the amount that the maximum drive frequency exceeds the maximum fundamental frequency is equal to the amount that the minimum drive frequency is less than the minimum fundamental resonant frequency, and wherein the generator () includes a user interface for setting an adjustable frequency range and an adjustable sweep rate~~.

4.3 Differentiating features

The subject-matter defined in claim 1 differs from the teaching of document S2 by the following two features:

- The frequency sweep range exceeds the range of resonant frequencies in such a way that it goes beyond the lowest and highest resonant frequency by an equal amount.
- The generator includes a user interface for setting an adjustable frequency range and an adjustable sweep rate.

4.4 Objective technical problem - technical effect

4.4.1 The first differentiating feature solves the problem of setting the frequency sweep range so that all transducers are reliably and efficiently excited.

4.4.2 The second differentiating feature solves the problem of providing a device that is easy to handle by the user for various applications.

4.4.3 Although both differentiating features relate to the frequency sweep range, they solve two different, separate objective technical problems (see points 4.4.1 and 4.4.2 above). The solution of each of the two

objective technical problems has no influence on the other, so that the two solutions together do not provide a synergetic effect. Therefore, they present two independent partial problems which are dealt with separately.

4.5 Obviousness

4.5.1 The Board is of the opinion that the solutions to both partial problems are obvious to the skilled person, as will be explained in the following.

4.5.2 With respect to the first partial problem solved by the first differentiating feature, it is known to the skilled person from document S2 that the selected range for the sweep frequencies must comprise the resonant frequencies of all selected transducers to be excited. Whether the wording "encompass" in paragraph [0054] of document S2 is to be interpreted as meaning that the limits of the frequency range correspond exactly to the lowest and highest resonant frequencies or not is merely a linguistic question. What is important in the present case is that from a technical point of view, it is not only difficult to realise an exact match of the lowest and highest resonant frequencies within the frequency sweep, but it is also considered common practice not to start exactly at the lowest resonant frequency and to go exactly to the highest resonant frequency. This is also true because the resonant frequencies of this type of piezoelectric transducers are known to be subject to numerous variations, such as deviations or fluctuations due to production inaccuracies, ageing drift or variations due to environmental influences such as temperature variations or the like.

The Board is therefore of the opinion that the selected frequency range going beyond the lowest and highest resonant frequencies of the excited transducers is already evident from paragraph [0054] of document S2, even if not explicitly disclosed by the wording of this paragraph. The appellant's reasoning is based on a purely linguistic interpretation that disregards physical and technical considerations of a technically meaningful implementation as explained above. In the Board's view, the wording "a megasonic system that includes crystals that individually resonate at frequencies in the range of 965 kHz to 975 kHz" in paragraph [0054] does not mean that each of the two borders corresponds exactly to a resonant frequency of at least one of the crystals. This is all the more true as document S2 points out the non-uniformities of piezo-crystals (see, e.g., paragraphs [0042] and [0049]).

Hence, a technically reasonable implementation of the teaching of S2 would go slightly beyond the specified resonant frequency range on both sides, as the resonant frequencies of the transducers may be subject to small deviations or fluctuations. The skilled person also makes no distinction between the excess of a range in the two directions, as tolerances are generally indicated with an equal plus/minus value in both directions. The skilled person would therefore choose a range that is slightly below and above the lowest and highest resonance frequency by an equal value, if they had not already done so in document S2. The solution of the first partial problem by the first differentiating feature therefore belongs to the skilled person's common general knowledge and thus cannot lead to the recognition of an inventive step.

The solution to the problem chosen here, is also suggested by the teaching of S13. Document S13 discloses on page 7, paragraph "MULTI FREQUENCY / SWEEP FREQUENCY (*7)", that the transducers are best excited when being operated "within plus or minus 1 to 2 Khz [sic] from its resonant frequency". Therefore, it is obvious that the frequency sweep range should go beyond the lowest and highest resonant frequencies in order to be sure to well excite the transducers, but an excess of 1 to 2 kHz would be fully sufficient. The fact that document S13 teaches that a transducer should not be driven at more than 2 kHz from its manufactured frequency is not considered pertinent as this does not correspond to the claimed feature.

4.5.3 The solution of the second partial problem by the second differentiating feature also belongs to the skilled person's common general knowledge. It is standard practice for a device that uses adjustable parameter ranges to allow the user to make this adjustment via a user interface. Since the adjustable parameters in the present device for frequency sweeping are the frequency sweep range and the frequency sweep rate, it is obvious to provide a user interface permitting the adjustment of these parameters.

Moreover, document S14, dealing with frequency sweep devices, also shows a corresponding user interface that allows the selection and adjustment of the frequency sweep range and sweep rate (document S14, page 2, last section "Sweep Frequency Control"). The fact that the frequency range indicated in document S14 is in the kilohertz range is without any importance because the skilled person derives from document S14 the teaching that the adjustable parameters varying from one use to another can be adjusted via a user interface. Hence,

the solution of the second partial problem is also obvious when combining the teaching of document S2 with the one of document S14.

4.5.4 In conclusion, the subject-matter defined in claim 1 of the main request does not involve an inventive step within the meaning of Article 56 EPC 1973 when starting from document S2 and combining its teaching with common general knowledge and/or the teaching of documents S13 and S14.

5. First auxiliary request

The effect of "micro-streaming" inevitably occurs in the apparatus of S2 in the claimed frequency range and therefore cannot add anything in relation to inventive step. Micro-streaming is also mentioned in document S13, on page 8, second paragraph, and has to be considered an effect which necessarily occurs also in the apparatus of S2.

The Board therefore concludes that claim 1 of the first auxiliary request does not involve an inventive step over the combination of the teaching of S2 with the common general knowledge and/or the teaching of documents S13 and S14 for the same reasons as the ones presented for the main request.

6. Second and third auxiliary requests

In relation to the second and third auxiliary requests the appellant argued that the added features should overcome the objection that the solution to the second partial problem was obvious, however without providing any detailed reasoning.

In the Board's opinion the additional features introduced into claim 1 of the second and third auxiliary requests do not go beyond a standard further development of the user interface known to the skilled person. An inventive step cannot be based on this.

7. Fourth auxiliary request

7.1 The amendments according to this request concern the further development of the apparatus defined in claim 1 of the main request to the specific use of two generators grouping the transducers in different subgroups by similar resonant frequencies in order to divide the frequency sweep range into two smaller subranges. This however is already disclosed in document S2 ([0008], [0035] and [0036]). In particular, paragraph [0008] indicates that the frequency sweeping techniques can be applied when using subarrays and grouping the transducers into different subarrays. Hence, the added feature is disclosed in document S2, so that the reasoning against an inventive step as discussed above for the main request applies *mutatis mutandis* also for the fourth auxiliary request.

7.2 The appellant argued that all embodiments of document S2, being directed to the use of more than one generator and grouping transducers into different subarrays according to their resonant frequencies, did not use the frequency sweep technique but instead excited the transducers in each subgroup only by a single frequency common to the transducers of the subgroup. However, this cannot be followed, since paragraph [0008] of document S2 explicitly states that the frequency sweep technique can also be used when transducers with similar resonant frequencies are

grouped into subgroups, using separate generators for each subgroup.

8. Fifth to ninth auxiliary requests

8.1 The fifth to ninth auxiliary requests are based on the main request and first to fourth auxiliary requests, respectively, with the further added feature that the excess frequencies for the frequency sweep range beyond the lowest and highest resonant frequencies of the transducers being 1 kHz or 2 kHz.

These values, now used for the excess values, are known from document S13 (see page 7, paragraph "MULTI FREQUENCY / SWEEP FREQUENCY (*7)"). Apart from the fact that this selection might even be obvious to the skilled person using common general knowledge, it is explicitly indicated in document S13. An inventive step cannot be based thereon. Therefore, the reasoning set out above for the main request and the first to fourth auxiliary requests applies *mutatis mutandis* to the fifth to ninth auxiliary requests.

8.2 The appellant referred to the fact that S13 should not be used in combination with S2 as detailed for the main request. That the Board takes a different position on this point is explained above with regard to the main request. Also the fact that document S13 indicated possible disadvantages when exciting the piezo-electric transducers more than 2 kHz away from their respective resonant frequency does not hinder the skilled person to select the excess frequencies being not more than 2 kHz, as defined in the present case. On the contrary, it is a further indication that an excess frequency of 1 kHz or 2 kHz is a reasonable choice.

9. Conclusion

Since the subject-matter defined in claim 1 of the main request and the first to ninth auxiliary requests lacks inventive step contrary to the requirements of Article 52(1) EPC in combination with Article 56 EPC 1973, the questions of lack of novelty or added subject-matter as discussed in the appealed decision need not be dealt with.

Based on the conclusion of lack of inventive step of the subject-matter defined in respective claim 1 of all pending requests, the Board concludes that the appeal must fail.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Sánchez Chiquero T. Häusser

Decision electronically authenticated