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Datasheet for the decision of 31 August 2010

Case Number: T 1578/07 - 3.4.01

Application Number: 99305632.4

Publication Number: 0973152

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Language of the proceedings: EN

Title of invention:
Parametric audio system

Patentee:
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Opponent:
Sennheiser electronic GmbH & Co. KG

Headword:
-

Relevant legal provisions:
EPC Art. 123(2)

Relevant legal provisions (EPC 1973):
-

Keyword:
"Added subject-matter (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1578/07 **-** 3.4.01

D E C I S I O N
of the Technical Board of Appeal 3.4.01
of 31 August 2010

Appellant: (Patent Proprietor)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 27 June 2007 revoking European patent No. 0973152 pursuant to Article 102(1) EPC 1973.

Composition of the Board:

Chairman: B. Schachenmann
Members: P. Fontenay
H. Wolfrum

Summary of Facts and Submissions

I. The appeal lies from the decision of the opposition division to revoke European patent No. EP-B-973 152. The decision was based on the grounds that independent claim 1 of the main request for a parametric audio generator contained added subject-matter (Article 123(2) EPC 1973) and that independent claim 1 of the first and second auxiliary requests, respectively, lacked clarity (Article 84 EPC 1973) and, due to the resulting ambiguities, also infringed the requirements of Article 123(2) EPC 1973. The decision was announced during oral proceedings held on 24 May 2007 and was dispatched on 27 June 2007.

In the "Reasons" for their decision to revoke the patent, the opposition division held, more specifically, that the original disclosure did not provide a basis for feature (f) in granted claim 1. It was, in particular, considered that paragraphs [0056] and [0057] of the published patent specification in combination with Figure 9 disclosed a specific circuit for controlling the modulation depth and output level of the modulated signal which did not suffice to provide a basis for feature (f) in the claimed generality.

II. The appellant (patentee) filed an appeal against said decision by facsimile dated 24 August 2007 and paid the prescribed appeal fee on the same day. The appellant requested cancellation of the decision in its entirety.

In the written statement setting out the grounds of appeal received on 5 November 2007, the appellant

requested as its main request that the European patent as granted be held to comply with the provisions of Article 123 EPC. Alternatively, the appellant requested that the patent, as amended according to sets of claims of auxiliary requests 1 to 5 filed with the statement of grounds, be held to comply with the provisions of Article 84 EPC 1973 and Article 123 EPC. Auxiliary request 5 was limited to granted method claims 20 to 32 on which the opposition division had not commented. In the case that one of these requests was held to be allowable under Articles 84 and 123 EPC, the appellant further requested that the opposition be remitted back to the opposition division for an assessment of the grounds for opposition under Article 100(a) and 100(b) EPC 1973.

III. In a facsimile received on 21 May 2008, the respondent (opponent) replied to the statement of grounds of appeal. In the respondent's view, the passages of the description referred to by the appellant in the statement of grounds did not provide a basis for granted claim 1. The view that Figure 9 in the granted patent and the corresponding passages of the patent specification related to a specific circuit and thus could not be seen as a basis for the generalised feature (f) in granted claim 1 was reiterated. Similarly, the subject-matter of independent claim 1 of each of auxiliary requests 1 to 5 also contained added subject-matter contrary to Article 123(2) EPC. Furthermore, in the respondent's opinion, independent claim 1 according to each of auxiliary requests 1 to 4 did, in addition, not meet the requirements of Article 84 EPC 1973.

The respondent thus requested that the appeal be dismissed.

IV. At the appellant's request, a summons to attend oral proceedings, scheduled to take place on 19 August 2010, was issued.

In preparation for the oral proceedings, the Board issued a communication pursuant to Article 15(1) Rules of Procedure of the Boards of Appeal (RPBA) expressing its provisional opinion on points raised by the parties with regard to the various requests on file.

Particular attention was drawn to the fact that the passages of the original description relating to Figure 9, which were relied on for providing a basis for feature (f) in granted claim 1, contained unclear and confusing indications. This situation made it difficult for the skilled reader to get a clear picture of the technical teaching actually provided by the application as filed.

Concerning auxiliary request 5, the Board indicated that it intended to address the issue of added subject-matter with regard to claim 1, despite the fact that granted claims 20 to 32 had not been initially opposed under Article 123(2) EPC. In the Board's provisional view, the fact that the patent had been opposed in its entirety and that feature (b) in method claim 1 of the fifth auxiliary request corresponded to device feature (f) of granted claim 1 justified this course of action.

The Board's communication also contained observations regarding lack of clarity of auxiliary requests 1 to 4.

V. Oral proceedings were cancelled following a letter of the appellant dated 30 July 2010, in which it informed the Board that it did not wish to attend the oral proceedings and requested that the procedure be continued in writing.

The respondent confirmed, in a facsimile dated 11 August 2010, its request for the appeal to be dismissed and further requested oral proceedings in the case that the Board intended to reach a different conclusion.

VI. Claim 1 of the main request, i.e. as granted, reads as follows:

"1. A parametric audio generator comprising:
(a) an ultrasonic signal source (18) providing a carrier;
(b) a source (20_1-20_N) of audio signals;
(c) means (26) for modulating the carrier with the audio signals, the frequency of the carrier being greater than 40 kHz;
(d) at least one ultrasonic transducer (10, 12; 75, 76) for radiating ultrasonic signals through a propagation medium for subsequent demodulation of the radiated signals within the propagation medium;
(e) means (16, 27; 27a, 27b, 74) for applying the modulated carrier to the or each transducer; and
(f) means (133) for controlling the modulation depth and output level of the modulated signal so that (i) it corresponds to the level of the audio signal and (ii) when there is no audio signal, there is little

or no output from the at least one transducer (10, 12; 75, 76)."

Independent claim 20 of the main request is directed to a method of selectively transmitting audio signals to a selected location. It reads:

"20. A method of selectively transmitting audio signals to a selected location, the method comprising the steps of:
(a) modulating an ultrasonic carrier with at least one audio signal, the frequency of the carrier greater than 40 kilohertz;
(b) controlling the modulation depth and output level of the modulated signal so that (i) it corresponds to the level of the audio signal and (ii) when there is no audio signal, there is little or no output from the at least one transducer (10, 12; 75, 76); and
(c) directing a beam containing the modulated carrier toward the location, through a propagation medium for subsequent demodulation of the audio signal within the propagation medium whereby the audio signal appears to emanate from the location or is confined thereto."

Claims 2 to 19 and 21 to 32 are dependent claims depending respectively on independent claims 1 and 20. Claims 15 and 16 refer, more specifically, to a parametric audio system comprising ***inter alia*** a parametric audio generator as claimed in claim 1 or a plurality of such generators, respectively. Claim 17 refers to a display system comprising ***inter alia*** a

steerable parametric audio generator according to claim 1.

With regard to the auxiliary requests, emphasis has been added below in bold type by the Board to mark the differences from granted claim 1 and granted claim 20, respectively.

Independent claim 1 of auxiliary request 1 differs from claim 1 of the main request in that feature (f) has been specified in more detail and reads:
"(f) means (133) for controlling the modulation depth and output level of the modulated signal ***to maintain a modulation depth near unity by adapting the amplitude of the carrier in response to changes in the audio signal level,*** *so that (i) it corresponds to the level of the audio signal and (ii) when there is no audio signal, there is little or no output from the at least one transducer (10, 12; 75, 76)* ***to automatically inhibit the transmission of ultrasound when the incoming audio is absent.***"

Corresponding amendments were made in feature (b) of claim 20.

Independent claim 1 of auxiliary request 2 differs from claim 1 of the main request in that feature (f) has been amended by reciting at the end: "***said means for controlling comprising: a signal control unit comprising:***
(i) a level sensor (133) sensing the audio signal level from said audio source, and
(ii) control means (132, 137) for controlling the intensity of the carrier in response to the sensed

audio signal level, the modulated carrier signal having a modulation depth, wherein the control means (132, 137) includes means for controlling the depth of modulation of the carrier in response to the sensed audio signal level". *The added features correspond to selected features from dependent claims 8 and 9 as granted.*

Independent claim 18 of auxiliary request 2 differs from claim 20 of the main request in that the features of dependent claim 27 as granted have been incorporated in feature (b).

Independent claim 1 of auxiliary request 3 differs from claim 1 of the main request in that feature (f) has been amended by incorporating all the features of dependent claims 8 and 9 as granted. Independent claim 18 of auxiliary request 3 is identical to claim 18 of auxiliary request 2.

Independent claim 1 of auxiliary request 4 differs from claim 1 of the main request in that feature (f) has been specified in further detail and reads:
"(*f) means (133) for controlling the modulation depth and* ***overall primary amplitude*** *of the modulated signal so that (i) it corresponds to the level of the audio signal and (ii) when there is no audio signal, there is little or no output from the at least one transducer (10, 12; 75, 76),* ***the means for controlling comprising a peak-level sensor (133) for sensing a peak level (L(t)) of the integrated audio signal, a summer (132) which receives the audio signal and also the output of the sensor (133), a square root circuit (137) connected to the output of the summer (132) and a modulator***

multiplier (138) to multiply the resulting audio signal from the square root circuit (137) by the carrier whereby the transmitted primary beam p(t) is synthesised as $p'(t)=P_1\left(L(t) + m\int\int g(t)dt^2\right)^{1/2} \sin(\omega_c t)$ ***where*** P_1 ***is the carrier amplitude,*** $L(t)$ ***is the output of the level sensor (133),*** m ***is the modulation depth,*** $g(t)$ ***is the audio signal,*** ω_c ***is the carrier frequency, the quantity*** $L(t) + m\int\int g(t)dt^2$ ***is the output of the summer (132), the square root of the latter quantity is provided by the square root circuit (137), and the final multiplication by*** $P_1 \sin(\omega_c t)$ ***is provided by the multiplier (138)".***

Independent claim 20 of the fourth auxiliary request differs from granted claim 20 in that feature (b) has been specified in further detail and reads:
"(b) controlling the modulation depth and output level of the modulated signal so that (i) it corresponds to the level of the audio signal and (ii) when there is no audio signal, there is little or no output from the at least one transducer (10, 12; 75, 76) ***the controlling comprising sensing a peak level (L(t)) of the integrated audio signal and synthesising the transmitted primary beam p(t) as***
$p'(t)=P_1\left(L(t) + m\int\int g(t)dt^2\right)^{1/2} \sin(\omega_c t)$
where P_1 ***is the carrier amplitude,*** $L(t)$ ***is the integrated audio signal,*** m ***is the modulation depth,*** $g(t)$ ***is the audio signal, and*** ω_c ***is the carrier frequency;".***

VII. The present decision is issued after the entry into force of the EPC 2000 on 13 December 2007. Reference is made to the relevant transitional provisions for the

amended and new provisions of the EPC, from which it may be derived which Articles of the EPC 1973 are still applicable to the present patent and which Articles of the EPC 2000 are to apply.

Where Articles or Rules of the former version of the EPC apply, their citations are followed by the indication "1973".

Reasons for the Decision

1. Since the issues to be decided under Article 123(2) EPC in relation with all pending requests are directly related to the question whether, and if so, to what extent the specific disclosure of Figure 9 of the application as originally filed could be generalised, a preliminary aspect to be addressed consists in establishing, if at all possible, which technical teaching actually derives from Figure 9 and the associated passages of the description.

As underlined by the appellant in the statement of grounds, selected passages of a patent application should not be considered in isolation but be construed in the light of the disclosure of the entire document. It appears thus justified in the present case to consider the teaching of Figure 9, not only in the light of the sole paragraphs [0051] and [0052] of the application (corresponding to paragraphs [0056] and [0057] in the B-publication), but in the context of the whole relevant section, which encompasses paragraphs [0046] to [0053] of the published patent application. These paragraphs correspond to paragraphs [0051] to

[0058] of the patent specification (the B-publication) to which reference shall be made in the following, except if stated otherwise. The content of original claims 1, 8 and 9 appears also relevant in this regard.

2. *Determination of the actual technical teaching derivable from Figure 9*

2.1 The relevant part of the circuit illustrated by Figure 9 shows an audio source 130, the output of which leads in parallel to the input of a level sensor 133 and to a first input of a summer 132. The output of the level sensor 133 is fed to a second input of the summer 132. The output of the summer 132 is applied to a square-root circuit 137, the resulting output of which is input to a modulator-multiplier 138. A carrier generator is connected to another input of modulator-multiplier 138. The output of modulator-multiplier 138 is amplified by an amplifier 139 before passing to driver circuits.

2.2 A first ambiguity results from the statement in paragraph [0051] preceding the detailed description of Figure 9 according to which "*it is preferred to maintain a modulation depth near unity by adapting the amplitude of the carrier in response to changes in the audio signal level*". In this respect, the Board observes that according to amplitude modulation techniques of the kind illustrated in Figure 9, the amplitude of the carrier signal, i.e. the signal produced by the carrier generator, does not affect the modulation depth of the modulated signal, but only affects its amplitude. Adapting the amplitude of the carrier signal appears in this regard to have merely

the effect of amplifying or dampening the modulated signal.

2.3 Similarly, the indication in paragraph [0056] that the disclosed circuit controls both the modulation depth and the overall primary amplitude P_1 to "***(b) maintain an audible level corresponding to the level of the audio signal g(t) by adjusting*** P_1 ***appropriately***" does not appear to reflect the actual teaching of Figure 9. The Board has, in fact, serious doubts as to whether this indication indeed refers to the modulated signal. The spectrum of the modulated signal is centred on the central frequency of 60 kHz and in effect covers, for a maximum frequency of the audio signal of 20 kHz, a spectrum extending from 40 kHz to 80 kHz (cf. paragraph [0017] in the published application). By their very nature, these signals are inaudible to human beings. Moreover, the reference to g(t) does not make technical sense if the modulated signal is meant. In the Board's view this statement would only make sense if it were to relate to the signal following demodulation within the propagation medium, i.e. the signal to be heard by the individual.

The indication following in paragraph [0057] as to the use of a conventional amplitude modulator, as an alternative to the circuitry of Figure 9, adds to the confusion since it suggests controlling of both the level of the audio signal to be applied to the modulator and the carrier amplitude P_1 according to the peak level of g(t). While such control is indeed feasible, it is not clear, in the absence of any details, how this alternative could actually permit to synthesize the signal p'(t) as defined in equation (4)

given in paragraph [0056]. More importantly, the peak level of the signal g(t) does also not appear to be relevant as such to control the level of the audio signal input to the modulator since the signal to be modulated is not g(t) but the signal actually generated by the audio source 130, i.e. as shown below under point 2.5, a signal reflecting the integral $m\int\int g(t)dt^2$.

2.4 In the Board's judgement, the statement in paragraph [0053] that some of the functions of the circuit elements in Figure 9 may be accomplished by suitably programmed signal processors may support the view that the type of the required functional units is not essential. However, this statement is not, as such, sufficient to establish which other configurations have indeed been envisaged.

2.5 The meaning of the term "modulation depth" as it appears throughout the description is obscure. This term appears in connection with parameter "m" in equation (2) in paragraph [0054], where it is associated with a normalized peak value of the audio signal g(t). This paragraph relates to prior art parametric audio generators for which transmission of the carrier signal still occurs in the absence of the audio signal to be transmitted. The precise significance of parameter "m" in equation (2) is however unclear. Assuming that a positive value of the quantity $(1 + \int\int mg(t)dt^2)$ in the expression (2) of the variable E(t) in paragraph [0054] is intended, as is normally the case in AM modulation systems in order to avoid over-modulation, then the normalising of function g(t) would not help since it is the integral $\int\int g(t)dt^2$ which should then be normalized in this expression.

Likewise, the reference to the parameter "m" in equation (4) is disconcerting. A precise analysis of the circuit of Figure 9 is required here. Since the quantity $(L(t)+ m\int\int g(t)dt^2)$ refers to the output of the summer 132 (cf. paragraph [0056]) and since L(t) reflects the output of the level sensor 133, it follows that $m\int\int g(t)dt^2$ defines the output of the audio source 130. The parameter m derives thus from the preprocessing of the signal in the audio source and has no bearing on the actual modulation depth which is defined by the association of the elements 132 (summer), 133 (level sensor) and 137 (square-root circuit) of the circuit of Figure 9. It is therefore questionable whether this parameter "m" indeed refers, in the context of the original application, to the common understanding of the term "modulation depth" as normally accepted in the art.

On the other hand, the Board acknowledges that the output of the summer 132 is such that the ratio between the level of the audio signal, i.e. the signal emitted by the audio source 130, and the level of the signal L(t) corresponds to unity when assuming that the level sensor 133 is able to reproduce the peak level of the audio signal with sufficient accuracy. This ratio would thus match the general understanding of the concept of "modulation depth" in conventional amplitude modulation techniques. This interpretation would apply independently of the signal actually emitted by the audio source. In particular, whether the audio source generates a signal corresponding to $m\int\int g(t)dt^2$ or to $\int\int g(t)dt^2$ would be irrelevant and would not affect this finding. The Board observes that, on the other hand,

said ratio at the output of summer 132 is directly affected by the presence of the square-root circuit 137 in the circuit of Figure 9.

2.6 The repeated statement in the description that the amplitude of the carrier is adjusted when relating to an embodiment which *de facto* does not allow such an adjustment casts doubts on the intended meaning of this statement, which thus appears to diverge from its actual literal understanding. In this respect, the reference signs 132 and 137 in original claim 8, when referring to the "means for controlling the intensity of the carrier in response to the sensed audio signal level", suggest that the "envelope" of the modulated signal, which corresponds to the signal obtained before multiplication with the carrier in modulator-multiplier 138, is actually meant by "intensity of the carrier". This interpretation would also be in agreement with the indication that a modulation depth near unity can be maintained by adapting the amplitude of the carrier, as recited in paragraph [0051].

On the other hand, this interpretation of original claim 8 would merely reflect the principle inherent to all amplitude modulating circuits according to which the amplitude of the carrier signal is in some way affected by the modulating signal. Furthermore, this interpretation would also be contradicted by the explicit references in paragraph [0056] to the control or adjustment of the parameter P_1, which defines the amplitude of the signal generated by the carrier generator. In the absence of any clear and unambiguous indications in the application as filed, the skilled

person is thus not in a position to decide which interpretation should be retained.

2.7 It may be considered, in favour of the appellant, that the amplitude of the carrier signal is sometimes associated, in standard reference books relating to AM modulation techniques, to the parameter U_{car} in the following expression for a modulated signal:
$u(t) = [U_{car} + U_{Mod} .\sin(\omega_{Mod}t)].\sin(\omega_{car}t)$, which can also be expressed in the form:
$u(t) = U_{car}[1 + m \sin(\omega_{Mod}t)].\sin(\omega_{car}t)$ with $m=U_{Mod}/U_{car}$;

wherein $u(t)$ is the modulated signal, $U_{Mod} .\sin(\omega_{Mod}t)$ is the modulating signal and $U_{car}.\sin(\omega_{car}t)$ defines the carrier signal.

This definition tends to integrate the value of the signal which is added to the modulating signal to avoid over-modulation in the definition of the carrier amplitude. In the present case, such an interpretation would mean to equate the term "carrier amplitude" with the product $(L(t).P_1)$. While this interpretation would indeed make sense for the statement in paragraph [0051] that modulation depth is maintained near unity by adapting the amplitude of the carrier - since the signal L(t) indeed directly affects the modulation depth - it must nevertheless be rejected. It is noted, in this respect, that such an interpretation would be at odds with the definition in paragraph [0054] that P_1 defines the carrier amplitude and the explicit statements in paragraph [0056] concerning the control or adjustment of the parameter P_1.

2.8 In conclusion, the passages of the description corresponding to Figure 9 contain a plurality of indications and statements which are not consistent with each other and also not concordant with what is shown by this Figure. These discrepancies make it impossible for the skilled person to derive any clear teaching from this embodiment.

3. *Added subject-matter - Article 123(2) EPC*

3.1 The above finding is of fatal consequence for the requests on file. It is, more specifically, observed that claim 1 of the main request and of auxiliary requests 1 to 3, respectively, explicitly refers in feature (f) to "***means for controlling ... the output level of the modulated signal***" or, in claim 1 of auxiliary request 4, to "***means for controlling ... the overall primary amplitude of the modulated signal***". In view of the inappropriate or incoherent use of the terminology adopted throughout the original description and claims, the skilled person is in fact unable to identify in the relevant passages of the original description any clear teaching in relation to Figure 9 which could serve as a source of disclosure for amendment. While he would have undoubtedly recognized that various indications in the application as filed are confusing and even misleading, he would have been incapable, in view of the multiplicity of possible corrections, to appreciate what these corrections should have been. This difficulty appears to have been implicitly acknowledged by the appellant who, in accordance with auxiliary request 1, suggests that the main error resides in the elaboration of Figure 9 or, in accordance with auxiliary request 4, suggests on the

contrary that the description relating to Figure 9 is not reliable and that the Figure alone should be considered to reproduce the actual intention of the applicant.

Since, according to well established jurisprudence of the boards of appeal, amendments are only allowable under Article 123(2) EPC if a direct and unambiguous basis may be found in the original application documents, the above finding is sufficient as such to reject any amendment which relies on Figure 9 and its corresponding description. It is, in particular, stressed that the description does not constitute, under the present circumstances, a valid basis for any generalisation of the teaching of Figure 9.

3.2 More concretely, the original application does not provide any basis for feature (f) in claim 1 of the main request (i.e. claim 1 as granted). Even if original Figure 9, relied upon by the appellant (cf. applicant's letter dated 5 April 2004), discloses a circuit which permits some control of the modulation depth and (thus) of the output level of the modulated signal, this circuit only defines a specific construction which cannot justify the broad definition of feature (f). The Board is also unable to identify in the imprecise discussion of Figure 9 any practical indication which could justify such a generalisation.

3.3 By specifying in feature (f) of claim 1 of auxiliary request 1 that the means for controlling the modulation depth and output level are "***to maintain a modulation depth near unity by adapting the amplitude of the carrier in response to changes in the audio signal***

level", the claim reproduces part of the wording to be found in the description (cf. paragraph [0051]). Although the added statement finds a literal basis in the description, it does not constitute an adequate basis for feature (f) in claim 1 of auxiliary request 1. Paragraph [0051] must in effect be interpreted in the context of the application as a whole. As discussed above, the indication in the subsequent paragraph [0052] that "*A suitable adaptive system is depicted in Fig. 9*", when referring to a system in which the amplitude of the carrier does not affect the modulation depth and which *de facto* does not perform this claimed functionality, suggests that the actual meaning of this statement in the description is substantially distinct from its literal interpretation.

3.4 Similarly, by incorporating additional limitations selected from granted claims 8 and 9 into feature (f) of claim 1 of auxiliary request 2, the claim specifies *inter alia* that control means are provided for controlling the intensity of the carrier in response to the sensed audio signal level. The added features correspond in essence to the features of original dependent claims 8 and 9. Claim 1 of this request results thus from a combination of original claims 1, 8 and 9 with further limitations inferred from Figure 9.

The proposed wording suggests that the sensed audio signal permits an effective control of the carrier's intensity, i.e. of the parameter P_1 defining said intensity, and is thus contrary to the configuration illustrated in Figure 9 for which no such control exists. As indicated above (cf. point 2.6) it is also not possible to establish that this interpretation

derives directly and unambiguously from original claim 8 when interpreted in the light of the original description.

3.5 Independent claim 1 of auxiliary request 3 differs from claim 1 of the main request in that feature (f) has been amended by incorporating all features of dependent claims 8 and 9 as granted. It therefore includes all the features of claim 1 according to auxiliary request 2 and additional limitations regarding the audio signal and the level sensor.

It follows that the analysis made above in relation with claim 1 of auxiliary request 2 applies ***mutatis mutandis*** to claim 1 of auxiliary request 3.

3.6 The appellant made an attempt, in claim 1 of auxiliary request 4, to incorporate all the limitations actually derivable from Figure 9 into granted claim 1. While it is acknowledged that feature (f) in claim 1 of auxiliary request 4 constitutes a fair description of the circuit's structure of Figure 9, the Board is unable to find in the corresponding description any clear teaching regarding the function now recited in claim 1 concerning the synthesis of signal p'(t). As emphasized above under section 2, the skilled reader would indeed not be in a position to infer that the circuit of Figure 9 synthesises a primary beam p'(t) such that

$$p'(t) = P_1 \left(L(t) + m \int\int g(t) dt^2 \right)^{1/2} \sin(\omega_c t)$$

where P_1 is the carrier amplitude, L(t) is the output of the level sensor (133), m is the modulation depth, g(t) is the audio signal, ω_c is the carrier frequency and the

quantity $L(t) + m\int\int g(t)dt^2$ is the output of the summer (132).

More specifically, the equation reproduced in the claim suggests, in view of Figure 9, that the quantity $m\int\int g(t)dt^2$ corresponds to the actual output of the audio source 130 (cf. point 2.5 above), in contradiction to the statement in the claim that said output is represented by the signal g(t) and the further indication that the modulation depth (i.e. the parameter m) is controlled by the means recited under feature (f). Similarly, the circuit of Figure 9 is also incapable of controlling the overall primary amplitude of the modulated signal to such an extent that it corresponds to the level of the audio signal if said audio signal is defined as the function g(t) and not as the output of the audio source 130.

If it is assumed, ***a contrario***, that the signal generated by the audio source 130 in Figure 9 corresponds to signal g(t) as recited in the claim, added subject-matter would then result from the fact that the circuit of Figure 9 does not disclose any means for synthesizing a signal corresponding to the quantity $m\int\int g(t)dt^2$, contrary to the claim's wording.

3.7 The Board is also unable to find in the original disclosure any other passages which could constitute a suitable basis for the wording of any of claims 1 according to the main request or auxiliary requests 1 to 4.

As a consequence, all these requests are considered to define subject-matter extending beyond the content of

the application as filed in violation of Article 123(2) EPC.

4. *Auxiliary request 5 - Added subject-matter*

4.1 Although the notice of opposition did not explicitly substantiate the ground for opposition of added subject-matter with regard to granted method claim 20, the Board judges that this aspect must nevertheless be addressed in the present appeal proceedings with regard to corresponding claim 1 of auxiliary request 5. This approach is justified in view of the fact that the patent has been opposed in its entirety, that the ground of added subject-matter has been raised, and that feature (b) in method claim 1 of auxiliary request 5 corresponds to device feature (f) of granted claim 1, for which this objection has been sufficiently substantiated by the opponent.

The Board concurs with the appellant that in the first instance proceedings "***claim 20 was not held to contravene Article 123(2) EPC***" and that "***claim 20, and its dependent claims were not rejected under Article 123(2) EPC in the decision of the Opposition Division***". This situation appears however to result from the circumstance that no request corresponding to present auxiliary request 5 had been filed during the opposition proceedings and that claim 1 of each request then pending was considered unallowable. For these reasons, a remittal of the case to the opposition division for further examination of auxiliary request 5 would appear to be contrary to the principle of procedural economy inherent to proceedings before the EPO.

4.2 Feature (b) in claim 1 of auxiliary request 5 refers in terms of functions to the means recited in feature (f) in granted claim 1. Apart from this difference resulting from the category of the claim, the wording of feature (b) in claim 1 of auxiliary request 5 is identical with that of feature (f) in claim 1 as granted. The analysis developed above in relation to claim 1 of the main request thus applies ***mutatis mutandis*** to claim 1 of auxiliary request 5 which consequently also refers to undisclosed subject-matter contrary to Article 123(2) EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

R. Schumacher B. Schachenmann