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**Datasheet for the decision  
of 30 July 2020**

**Case Number:** T 1769/16 - 3.5.03

**Application Number:** 04761108.2

**Publication Number:** 1695590

**IPC:** H04R3/00, H04R1/40, H04R25/00

**Language of the proceedings:** EN

**Title of invention:**  
Method and apparatus for producing adaptive directional signals

**Patent Proprietor:**  
Cirrus Logic International Semiconductor Limited

**Opponent:**  
HIMPP A/S

**Headword:**  
Adaptive directional audio signals/CIRRUS

**Relevant legal provisions:**  
EPC Art. 123(2)

**Keyword:**  
Added subject-matter - (yes)



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Case Number: T 1769/16 - 3.5.03

**D E C I S I O N**  
**of Technical Board of Appeal 3.5.03**  
**of 30 July 2020**

**Appellant:** Cirrus Logic International Semiconductor Limited  
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**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
24 May 2016 concerning maintenance of the  
European Patent No. 1695590 in amended form.**

**Composition of the Board:**

**Chair** K. Bengi-Akyürek  
**Members:** K. Peirs  
R. Winkelhofer

## **Summary of Facts and Submissions**

- I. This appeal of the opponent is against the interlocutory decision of the opposition division to maintain the patent in amended form on the basis of the proprietor's third auxiliary request. The grounds for opposition invoked by the opponent were those pursuant to Article 100(a) EPC in conjunction with Articles 54 and 56 EPC as well as pursuant to Articles 100(b) and 100(c) EPC.
- II. In the impugned decision, the opposition division held that the main request underlying the decision under appeal fulfilled the requirements of Articles 83 and 123(2) EPC, but that it was not allowable for lack of novelty of claim 1 (Article 54 EPC). It further held that the invention as defined by the claims of the first and second auxiliary requests underlying the decision under appeal was not sufficiently disclosed (Article 83 EPC). By contrast, the third auxiliary request underlying the decision under appeal was deemed to fulfil all requirements of the EPC.
- III. Oral proceedings before the board were held on 30 July 2020, based on the following final requests:
- The appellant (opponent) requests that the decision under appeal be set aside and that the patent be revoked.
  - The respondent (proprietor) requests, as a main request, that the appeal be rejected, or, in the alternative, that the patent be maintained in amended form according to an auxiliary request that

was filed with the reply to the statement of grounds of appeal.

At the end of the oral proceedings, the board's decision was announced.

IV. Claim 1 of the **main request** reads as follows:

"A method for producing a combined adaptive directional signal, the method comprising:

deriving from two spaced omni-directional microphones a first signal having an omni-directional polar pattern;

deriving from the two omni-directional microphones a second signal having a bi-directional polar pattern;

constructing the combined adaptive directional signal from a weighted sum of the first signal as scaled by a first weight and the second signal as scaled by a second weight, wherein the first and second signal weights are calculated to give the combined adaptive directional signal a constant gain in a predetermined direction and to minimise the power of the combined adaptive directional signal;

wherein the first and second signal weights are calculated in a non-iterative manner."

V. Claim 1 of the **auxiliary request** comprises all the features of claim 1 of the main request and adds at the end:

"wherein the first and second signal weights are calculated by solving the following equation:

$$a = \frac{\Sigma y^2 - \Sigma xy}{\Sigma x^2 - 2\Sigma xy + \Sigma y^2}$$

Where:

a= first signal weight  
(1-a)= second signal weight  
x=first signal sample  
y=second signal sample."

## Reasons for the Decision

### 1. *Patent in suit*

The opposed patent relates to the adaptive combination of signals from a front and a rear omni-directional microphone in a hearing aid or mobile phone. The adaptive combination starts with deriving a first signal with an omni-directional polar pattern and a second signal with a bi-directional polar pattern from signals of the omni-directional microphones, followed by scaling the first and second signal with a respective signal weight and summing the scaled signals to construct a combined adaptive directional signal. The weights are calculated such as to minimise the power of the combined adaptive directional signal under the constraint that this signal must demonstrate a constant gain in the forward direction, i.e. in the direction indicated by the axis through the front and rear omni-directional microphones.

### 2. *Main request: claim 1 - features*

Claim 1 of the **main request** comprises the following limiting features (with the board's labelling):

- (a) A method for producing a combined adaptive directional signal,
- (b) the method comprising

- (c) deriving from two spaced omni-directional microphones a first signal having an omni-directional polar pattern;
- (d) deriving from two spaced omni-directional microphones a second signal having a bi-directional polar pattern;
- (e) constructing the combined adaptive directional signal from a weighted sum of the first signal as scaled by a first signal weight and the second signal as scaled by a second signal weight,
- (f) wherein the first and second signal weights are calculated to give the combined adaptive directional signal a constant gain in a predetermined direction and to minimise the power of the combined adaptive directional signal,
- (g) wherein the first and second signal weights are calculated in a non-iterative manner.

3. *Main request: claim 1 - added subject-matter*

3.1 The subject-matter of claim 1 of the main request has no direct and unambiguous basis in the present application as published, as regards **features (c) and (d)**.

3.2 The respondent referred to original claims 1 and 13 for such a basis. However, the wording of these original claims is ambiguous in terms of which omni-directional microphones are involved in deriving the first and second signals.

3.3 As to **feature (c)**, the wording "wherein the first and second signals are derived from signals produced by two spaced omni-directional microphones" of original claim 13 is linguistically and technically ambiguous in that the first signal could be derived from a signal of one

of the two spaced omni-directional microphones or from signals of both microphones. The deliberate choice of the plural "signals" in original claim 13, as highlighted by the respondent, is a mere linguistic consequence of the compact way in which original claim 13 is formulated and does not imply that the first signal would be mandatorily derived from signals of both omni-directional microphones. Moreover, the microphones for deriving the first signal as per feature (c) are not necessarily the same as those for deriving the second signal as per feature (d). By contrast, from the underlying application as filed, e.g. original claims 1 and 13 or Figure 3, it is apparent that the first and second signal can only be derived from the same pair of spaced omni-directional microphones.

3.3.1 In that regard, Figure 3 of the underlying patent application as filed has to be pointed at:

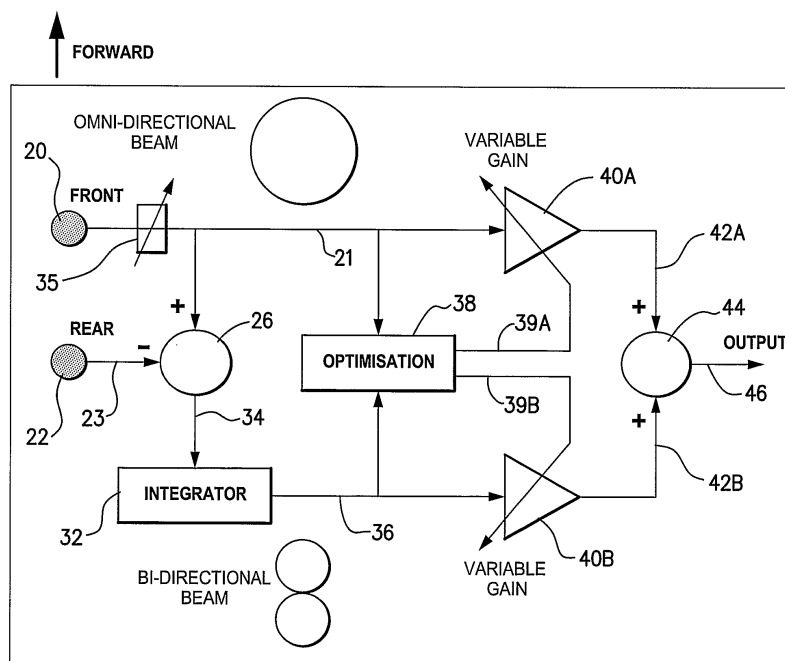


Fig. 3

3.3.2 This diagram illustratively shows two omni-directional signals, namely "front signal 21", which is derived solely from the signal of "front microphone 20", and "weighted signal 42A", which is obtained by scaling signal 21 with a weight calculated by optimiser 38 based on signals from "front microphone 20" and "rear microphone 22". Thus, the main question is how a skilled reader would map the features of claim 1 with the circuit elements shown in Figure 3.

The board agrees with the appellant that the skilled reader would map these features such that the "first signal" as claimed corresponds to "front signal 21" while the "second signal" corresponds to "bipolar signal 34". Conversely, the "first signal as scaled by a first signal weight" is illustrated by "signal 42A" and the "second signal as scaled by a second signal weight" by "signal 42B". As a result, the first and second signals represent the signals before scaling and differ from the first and second signal "as scaled" referred to in feature (e). As a consequence, the first signal is derived from a single omni-directional microphone, namely from front microphone 20, rather than from two omni-directional microphones as claimed.

3.3.3 The respondent's assessment of Figure 3 consists of equating the "first signal" with "signal 42A" and the "second signal" with "signal 42B", i.e. the first and second signal would, in the respondent's view, rather refer to the signals after scaling.

However, the wording "as scaled" in feature (e) might simply impose an additional operation on the associated signal: it need not necessarily be an inherent characteristic of that signal, as implied by the respondent's argument that "signal 42A" constituted the



only omni-directional signal in Figure 3 that had been scaled by a first weight as per feature (e). The respondent's assessment is also not apparent from the exemplifying combinations of omni-directional signal 42A and bi-directional signal 42B, illustrated in Figure 5, taken together with the phrase "[t]hus it will be realised that the polar pattern of the combined signal will vary in response to changes in the first and second signals" (emphasis by the board) on page 4, lines 22-24 of the underlying description as filed. Rather, as brought forward by the appellant, this phrase means, within the context of Figure 3, that changes in signals 21 and 34 will unequivocally cause changes in weights 39A and 39B as determined by the optimisation circuit 38, leading to the different combinations shown in Figure 5.

Moreover, apart from lacking a direct and unambiguous basis in the present application as filed, the respondent's appraisal is not plausible in several regards:

- First, the skilled reader would immediately understand that the "first signal" of feature (c) differs from the "first signal as scaled by a first signal weight" as per feature (e) already from the basic fact that a different wording is used.
  
- Even if one assumed that the wording "as scaled by a first signal weight" was erroneously omitted from feature (c), the respondent's mapping would not be plausible to a skilled reader in that it *artificially* skips the branch relating to signal 21 to focus *entirely* on the right side of Figure 3, starting from gain element 40A. There is no direct and unambiguous basis in the application as filed

for the skilled reader to deviate from the "normal", i.e. *balanced*, way of mapping the method steps of claim 1 with consecutive operations in the circuit of Figure 3.

- Furthermore, identifying the "second signal" with "signal 42B" conflicts with original claim 15 specifying that the second signal is processed by an "integrator element". In Figure 3, it is signal 34 (not signal 42B) that is processed by "integrator 32".

3.3.5 Consequently, Figure 3 cannot provide a direct and unambiguous basis for feature (c) either, given that this figure clearly teaches to derive "signal 21" solely from a signal of one of the two omni-directional microphones.

3.4 As to **feature (d)**, the respondent emphasised that this feature was disclosed at the same level of generality in original claim 13.

However, unlike the situation prevalent for the omni-directional polar pattern as in feature (c), the board agrees with the appellant that, within the context of a bi-directional polar pattern as in feature (d), the labels "front" and "rear" of original claim 13 cannot be omitted without resulting in an unallowable intermediate generalisation. In fact, original claims 1 and 13 define an inextricable link between the "predetermined direction", the labels "front" and "rear" for the microphones, the "forward direction along the microphone axis" and the axis of the "bi-directional polar pattern".

This inextricable link is particularly manifest from

the underlying description as filed in the passage on page 2, line 32 to page 3, line 4, where it is explained that the labels "front" and "rear" define the "forward direction" as the direction of arrival of a sound wave reaching the front microphone *first* and the rear microphone *later*. Whilst this passage describes Figure 2 relating to a prior-art system, it would be immediately apparent to the skilled reader that the same teaching applies to Figure 3 and that this "forward direction" is identical to the "forward direction along the microphone axis" of original claim 13.

Moreover, the passage on page 10, line 4 of the description as filed confirms that, within the context of Figure 3, the "forward direction" is the direction along the axis of the front and rear microphones. Therefore, the choice as to which microphone is the front microphone and which one is the rear microphone determines the forward direction. In the application as filed, the bi-directional polar pattern is formed by making a difference between signals from the omni-directional microphones, which means that the axis of the resulting bi-directional polar pattern is determined by the axis through the microphones.

Furthermore, the order in which the difference is made determines the sign of the phase of the resulting bi-directional signal: as shown in Figure 3, subtractor 26 makes a difference between *front* microphone 20 and *rear* microphone 22. The same order in deriving the difference between the microphone signals is also apparent from original claim 14. Consequently, the labels "front" and "rear" are instrumental in defining the "forward direction along the microphone axis" and limit, by virtue of original claim 13, the

axis of the "bi-directional polar pattern" and the "predetermined direction" of original claims 1 and 13. This impacts the value of the weights used for scaling the first and second signals as in original claim 1.

Conversely, the spaced omni-directional microphones and the bi-directional polar pattern derived from their signals as per feature (d) in no way limit the "predetermined direction" of feature (f) or *vice versa*. Correspondingly, the value of the weights used for scaling is not limited as in the application as filed. Whilst, as brought forward by the respondent, the "predetermined direction" is, by virtue of page 10, lines 10-12 of the description as filed, indeed not limited to the "forward direction" but can be a "selected other direction", it would be immediately apparent for the skilled reader that this "selected other direction" is at least limited to the plane defined by the bi-directional polar pattern, given that the underlying application as filed exclusively concerns two-dimensional characteristics.

The skilled reader would know that, in practice, an omni-directional microphone only possesses an omni-directional characteristic *in a given plane* and, as a result, would realise without difficulty that it is implicitly assumed in the original application that the plane of the omni-directional characteristic of the front microphone is the same as for the rear microphone, thereby defining the plane of the bi-directional polar pattern. In the case where the front and rear omni-directional microphones are part of a hearing aid, the "selected other direction" would be, as suggested by the respondent, in the horizontal plane through the ear canal of a user. The "predetermined direction" of feature (f) is, however, not limited in

any way.

3.5 In sum, the original application does not provide a direct and unambiguous basis for features (c) and (d) and claim 1 of the main request does not comply with Article 123(2) EPC.

4. *Auxiliary request: claim 1 - added subject-matter*

4.1 Features (c) and (d) are also included in claim 1 of the present **auxiliary request**. The objections raised for claim 1 of the main request are, consequently, not remedied by any of the additional features of claim 1 of the auxiliary request and therefore apply equally to the latter claim.

4.2 Claim 1 of the auxiliary request therefore does not comply with the provisions of Article 123(2) EPC either.

5. Given that there is no allowable claim request on file, the opposed patent is to be revoked.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chair:



B. Brückner

K. Bengi-Akyürek

Decision electronically authenticated