BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS | BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE | CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 26 July 1995

Case Number: T 0686/94 - 3.5.2

Application Number: 88112478.8

Publication Number: 0302434

IPC: H03F 3/45

Language of the proceedings: EN

Title of invention:
System for compensating for offset voltages in comparators

Applicant:
BROOKTREE CORPORATION

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - no"

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0686/94 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 26 July 1995

Appellant: BROOKTREE CORPORATION
9950 Barnes Canyon Road
San Diego
California 92121 (US)

Representative: Patentanwälte
Grünecker, Kinkeldey,
Stockmair & Partner
Maximilianstrasse 58
D-80538 München (DE)

Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 3 March 1994 refusing European patent application No. 88 112 478.8 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: R. G. O'Connell
W. M. Schar

Summary of Facts and Submissions

I. The appellant contests the decision of the Examining Division refusing European patent application No. 88 112 478.8. The reason given for the refusal was that the subject-matter of claim 1 then on file did not involve an inventive step, having regard to US-A-3 988 689 (D1). The decision also mentioned lack of novelty over FR-A-2 543 363 (D2).

II. In reply to a communication of the board, the appellant filed new claims 1 to 22 on 26 June 1995. Oral proceedings were held on 26 July 1995.

III. Claim 1 is now worded as follows:

"1. Apparatus for providing a correction in an amplifier (10) to compensate for an offset voltage produced in the amplifier:

said amplifier (50,52) having a first input for a reference voltage, a second input for a variable voltage and an output, and having characteristics to produce the offset voltage, said apparatus comprising:

means (106) for introducing the reference voltage to the first input,

means (104) for introducing the variable voltage to the second input to obtain the production of the offset voltage at the output (65,69) of the amplifier and a voltage representative at the output (65,69) of the amplifier of the difference between the variable and reference voltages,

means (110,116) for periodically shorting the first and second inputs to provide for the introduction of the reference voltage to both inputs, and

characterized in that

means (Figure 4) are provided for sensing the offset voltage periodically produced at the output (65, 69) of the amplifier when the first and second inputs are periodically shorted,

means (26,67,70,96,92,84) are provided for storing a correction voltage related to the offset voltage periodically sensed at the output of the amplifier and

means (62,66) are provided for introducing the stored correction voltage to the output (65,69) of the amplifier (50,52), when the reference voltage is introduced to the first input (106) of the amplifier and the variable voltage is introduced to the second input (104) of the amplifier, in a polarity for compensating for the offset voltage sensed at the output of the amplifier."

Claims 2 to 22 are dependent on claim 1.

IV. The appellant argued essentially that:

D1, the closest prior art, taught the offset compensation of an operational amplifier as a complete unit, indicated by the dotted outline in Figure 2, comprising cascaded amplifiers 10 and 12 (column 3, lines 45 to 46); the output of this unit was the output of amplifier 12. Since in D1 the stored correction voltage was not introduced to the output of the operational amplifier i.e. the output of amplifier 12, but instead to the input of the latter the feature

specified in the last paragraph of claim 1 - "means for introducing the stored correction voltage to the output of the amplifier" - was not disclosed or suggested in D1. On an alternative interpretation of D1 - which in the appellant's view amounted to a misreading of the document, - the offset of amplifier 10 alone was compensated, but on this view the first characterising feature of claim 1, "means for sensing the offset voltage periodically produced at the output of the amplifier when the first and second inputs are periodically shorted" was not disclosed or suggested by D1, since the offset at the output of amplifier 10 was sensed only indirectly via amplifier 12. Either way there was a significant difference.

The appellant emphasised however that it was not legitimate to "tear the operational amplifier apart" to interpret D1. There were altogether three separate amplifiers 10, 12, 24 in the D1 arrangement each having its respective offset but the teaching of D1 was directed to compensating the offset of the composite unit 10, 12 forming the operational amplifier. He argued that such an interpretation would be analogous to regarding the compensation point G'1 in D2, which is internal to the operational amplifier AO to be compensated, as being the notional output of a first part of the operational amplifier AO. Although the unreasonableness of such an interpretation might be easier to see in the case of D2, the principle was the same for both D1 and D2.

V. The appellant requested that the decision under appeal be set aside and a patent granted on the basis of claims 1 to 22 filed 26 June 1995, a description to be adapted and drawings as originally filed.

Reasons for the Decision

1. The appeal is admissible.

2. The main issue to be decided in this appeal is whether the subject-matter of claim 1 involves an inventive step within the meaning of Article 56 EPC.

3. The present application addresses the problem of compensating offset voltage in an amplifier, i.e. the spurious voltage present at the amplifier output in the absence of an input signal; cf. column 2, line 1 to column 3, line 31 of the published application, noting that the comparators referred to there are to be understood as comprising amplifiers as is clear from the remainder of the application. Both cited documents D1 and D2 relate to this problem but D1 is regarded as closest prior art for the present claim 1 since both in D1 and in the arrangement in accordance with claim 1 compensation is effected by summing signals at the amplifier output whereas in D2 the compensation is effected internally in the amplifier.

3.1 D1 (Figures 1 to 2 and associated description) discloses:

an apparatus for providing a correction in a transconductance amplifier (10; 32,34) to compensate for an offset current produced in the amplifier:

said amplifier (32,34) having a first input (gate of JFET 34) for a reference voltage, a second input (gate of JFET 32) for a variable voltage and an output (48,50), and having characteristics to produce the offset current, said apparatus comprising:

means (20) for introducing the reference voltage to the first input,

means (18) for introducing the variable voltage to the second input to obtain the production of the offset current at the output (48,50) of the amplifier and a current representative at the output (48,50) of the amplifier of the difference between the variable and reference voltages,

means (22) for periodically shorting the first and second inputs to provide for the introduction of the reference voltage to both inputs, and

wherein

means (12) are provided for sensing the offset current periodically produced at the output (48, 50) of the amplifier when the first and second inputs are periodically shorted,

means (26) are provided for storing a correction voltage related to the offset current periodically sensed at the output of the amplifier and

means (42,54,58,44,52,56) are provided for introducing a current corresponding to the stored correction voltage to the output (48, 50) of the amplifier (10; 32, 34), when the reference voltage is introduced to the first input (gate of JFET 34) of the amplifier and the variable voltage is introduced to the second input (gate of JFET 32) of the amplifier, in a polarity for compensating for the offset current sensed at the output of the amplifier.

3.2 It can be seen that the amplifier offset correction apparatus specified in claim 1 differs from that known from D1 solely in the fact that the claim specifies an apparatus for correcting an output **voltage** offset in a **voltage** amplifier whereas D1 discloses an apparatus for correcting an output **current** offset in a **transconductance** amplifier. It is well known to those skilled in the art that all amplifiers, whether producing an output current or an output voltage, suffer from offset problems, as exemplified in D1, where, in addition to two transconductance amplifiers 10 and 24 having output current offsets, an amplifier 12 having an output voltage offset is also discussed. In fact the composite operational amplifier illustrated within the dotted line block in Figure 2 of D1 is itself a voltage amplifier whose output voltage offset is to be compensated. It follows that there is no contribution to inventive step involved in formulating the problem in terms of output voltage offset as opposed to output current offset. For the person skilled in the art, the teaching of D1 in relation to the compensation of the output current offset of amplifier 10 by introducing a correction current at its output would be understood as being generally applicable in terms of output signal offset compensation by introduction of a correction signal at the output, so that if the problem is one of compensating an output voltage, the current summing at the output of the amplifier 10 in D1 would be replaced by voltage summing at the output of the amplifier whose offset is to be corrected. The appellant does not dispute that such a substitution is a matter of routine circuit design for the person skilled in the amplifier art. It follows that the subject-matter of claim 1 does not involve an inventive step over the prior art known from D1.

4. Appellant's argument that the feature "means for sensing the offset voltage periodically produced at the output of the amplifier when the first and second inputs are periodically shorted" was to be interpreted as excluding indirect sensing means such as amplifier 12 in D1, is not convincing since the embodiment in the present application has a bistable latch (121,123,124,126) between the amplifier output (65, 69) and the means for storing a correction voltage, so that the sensing means in the embodiment - which the claim can reasonably be interpreted to cover - is less direct than in D1.

4.1 Appellant's further argument that it was not legitimate to "tear the operational amplifier apart" to interpret D1 is also not cogent since the amplifier 10 is not a notional portion of the operational amplifier but a real subunit with its own operating characteristics and offset and is indeed presented as such in the drawings, description and claims: see D1, claim 1 where the "signal amplifier" whose offset is to be cancelled is identifiable only with amplifier 10 and description, column 5, lines 29 to 34, where it is stated that: "when a signal source is connected to the terminals 18 and 20, that component of the output of the amplifier 10 which is contributed by the offset voltage of the amplifier 10 will be cancelled by a current supplied at the output of the amplifier 24." The fact that D1 refers at times to compensating the offset of the differential amplifier as a whole and at other times to compensating the offset of the transconductance amplifier 10 reflects the fact that the overall offset is due almost entirely to the offset of amplifier 10; see D1, column 4, lines 10 to 18.

5. It is also noted that claim 1 is effectively a claim to the broad principle of offset voltage compensation at an amplifier output as distinct from compensation at the amplifier input, notwithstanding the fact that the

present application itself at column 2, lines 18 to 50, indicates that both these general approaches were known in the prior art.

6. For the above reasons the board finds that the subject-matter of claim 1 does not involve an inventive step within the meaning of Article 56 EPC. Consequently a patent cannot be granted on the basis of the appellant's request.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl W. J. L. Wheeler