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File No.: T 0284/92 - 3.5.1  
Application No.: 85 113 092.2  
Publication No.: 0 182 096  
Classification: H04B 3/23  
Title of invention: Method and apparatus for improved control and time sharing of an echo canceller

**D E C I S I O N**  
of 22 September 1993

Applicant: INTERNATIONAL BUSINESS MACHINES CORPORATION  
Proprietor of the patent:  
Opponent:

Headword:

**EPC:** Art. 56

Keyword: "Inventive step (yes)"

**Headnote**  
**Catchwords**



Case Number: T 0284/92 - 3.5.1

**D E C I S I O N**  
**of the Technical Board of Appeal 3.5.1**  
**of 22 September 1993**

**Appellant:**

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Armonk  
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**Representative:**

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**Decision under appeal:**

**Decision of the Examining Division of the European  
Patent Office dated 13 November 1991 refusing  
European patent application No. 85 113 092.2  
pursuant to Article 97(1) EPC.**

**Composition of the Board:**

**Chairman:** P.K.J. van den Berg  
**Members:** A.S. Clelland  
F. Benussi

**Summary of Facts and Submissions**

I. European patent application No. 85 113 092.2, filed on 15 October 1985 claiming a priority of 19 November 1984 and published under No. 0 182 096, was refused by a decision of the Examining Division dated 13 November 1991.

The reason given for the refusal was that the subject-matter of independent Claims 1 and 5 lacked an inventive step having regard to the following prior art documents:

- D1: INTELSAT/IECE/ITE 3rd INTERNATIONAL CONFERENCE ON DIGITAL SATELLITE COMMUNICATIONS, Koyoto, 11 to 13 November 1975, pages 225 to 231; A. CASTANET et al.: "Digital protection devices against echo",
- D2: WO-A-8 203 145, and
- D3: PATENT ABSTRACTS OF JAPAN, Vol. 1, No. 153 (E-77).

II. On 16 January 1992 the Applicant lodged an appeal against this decision and paid the prescribed appeal fee. He requested cancellation of the decision and, implicitly, grant of a patent. On 17 March 1992 a statement setting out the grounds of appeal was filed.

III. Grant of a patent is requested on the basis of Claims 1 to 9 and an amended description as received on 3 August 1991.

IV. Claim 1 reads as follows:

"Method of controlling coefficient (Cs) calculation in an echo canceller having an adaptive filter (8) characterized in that it comprises the steps of:

detecting received signal activity in a first adaptive level detector (19);

providing an output signal (RA) from said first adaptive level detector (19) indicative of detecting received signal activity therein;

detecting combined noise and transmitted signal activity in a second adaptive level detector (20) connected to receive said output signal (RA), having an adaptive threshold level whose adaptive threshold is enabled to adapt by said output signal (RA) from said first adaptive level detector (19); and,

allowing (18) recomputing the coefficients in the adaptive filter (8) when said first adaptive level detector (19) indicates received signal activity (RA = 1) and said second level detector (20) indicates no combined noise and transmitted signal activity (TA = 0)."

Claim 5 reads as follows:

"Apparatus for controlling coefficient recalculation in an echo canceller having an adaptive filter (8) comprising:

a first adaptive level detector means (19) for detecting received signal activity at a communication port and having an output signal line (RA) for indicating detection of received signal activity;

a second adaptive level detector means (20) for detecting combined noise and transmitted signal activity at a communication port and having an internally adjustable threshold level of signal detection, said second adaptive level detector means (20) being

connected to said output signal (RA) of said first adaptive level detector means (19) and being controlled thereby to adaptively adjust its internal threshold detection level only when said first adaptive level detector means detects received signal activity and said second adaptive level detector detects no combined noise and transmitted signal activity; and,

means (18) for allowing recomputing the coefficients (Cs) in said adaptive filter (8) when said first adaptive level detector means (19) indicates received signal activity and said second adaptive level detector means indicates no combined noise and transmitted signal activity."

- V. The Appellant's arguments in support of the patentability of the subject-matter of Claims 1 and 5 can be summarised as follows:

The invention is concerned with control of coefficient calculation in an echo canceller as used in long-distance telephone lines and satellite channels. Two categories of device have been used in the past for echo control: on the one hand echo suppressors, in which attenuation is inserted into the line to attenuate the return echo; and on the other hand echo cancellers, in which an auxiliary signal is generated and combined with the echo so as to effectively cancel it out. In the situation in which both stations are transmitting and receiving simultaneously, so-called "double talk", echo suppressors cannot operate effectively since in addition to suppressing the echo one of the transmitted signals will also be suppressed. Echo cancellers also give rise to difficulty in the case of double talk in that the transmitted signal to the echo canceller at the far end of a path will include both an echo signal and a near end speech signal, the calculation of filter

coefficients thereby being disturbed by the speech signal, which the canceller treats as noise. This is overcome in the invention by providing detectors which respectively detect received signal activity and combined noise and transmitted signal activity. When there is no receive signal activity, or transmission signal activity is present, adaptive updating of the canceller is inhibited.

D1 discloses both an echo suppressor and an echo canceller. These two devices are described completely separately as alternative solutions to a common problem and there is no teaching in D1 which would lead the skilled person to combine features of the echo suppressor with features of the echo canceller. Nor would the skilled person be led to combine any of the subject-matter of D1 with any other prior art document.

### **Reasons for the Decision**

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. Claims 1 and 5 contain all the features of original Claims 1 and 8 respectively. The claims at present on file do not therefore contravene Article 123(2) EPC and are, therefore, admissible.
3. *Novelty*
  - 3.1 Although novelty was not explicitly discussed in the decision under appeal, the Board considers it appropriate to consider novelty with respect to D1 before going on to inventive step.

3.2 Under the introductory heading "1. GENERAL", D1 refers to the problem of echo suppression in telecommunication lines; existing analog equipment is said to give rise to difficulties in respect of the double talking detector and to be expensive and bulky. Reference is then made to a study undertaken of:

"... two new equipments which remedy each some of the weaknesses of the analog echo suppressor:

- study of a digital echo suppression process ...
- study of an echo canceller ...".

3.3 Part 2 of D1 is headed "DIGITAL ECHO SUPPRESSION PROCESS" and describes an echo suppressor, i.e. a device in which attenuation is dynamically inserted in the echo return path so as to cut down the echo whilst ensuring little or no net loss in the receive path. The device described contains logic to distinguish four situations:-

- "inactive state
- speech of the distant customer only
- speech of the local customer only
- double talking".

3.4 Part 3 is headed "ECHO CANCELLER" and describes a device in which, by means of an adaptive filter, a transfer function corresponding to the echo return path is derived and used to generate a signal which is subtracted from the return path signal to cancel the echo. No blocking attenuation is therefore necessary. Such devices were at the priority date of the present application well known in the art. Reference is made to the problem of double talking: it is stated that

"The echo transfer function is supposed to be constant during the double talking period: the

feedback loop can then be opened ... the echo return loss will be constant during that period which is generally small."

There is no indication as to how this is achieved, but it is clear from the art that the adaptive filter or filters can interpret a superimposed speech signal as noise and change the filter characteristics accordingly; it is therefore imperative that the filter be stopped from adaptation when double talking is detected.

3.5 The summary in part 4, "PERSPECTIVES", states that

"each one of these both equipments brings some improvements compared with the analog echo suppressor"

3.6 Thus, consistently throughout the document, the echo suppressor of part 2 and echo canceller of part 3 are described separately; nowhere is any relationship drawn between them or indication given that a functional component of one could be juxtaposed with components of the other. The Board therefore concludes that the skilled person, reading D1, would understand that two entirely separate devices are disclosed and would read the document accordingly.

3.7 Considering each device of D1 separately, the echo suppressor of part 2 is clearly not an echo canceller in the sense of the claims. The echo canceller of part 3 is a standard adaptive canceller which does not provide an adaptive threshold level for combined noise and transmitted signal activity. The subject-matter of Claim 1 is accordingly novel having regard to the disclosure of D1.

4. *Inventive Step*

- 4.1 The application is directed to solving the problem of double talking in an echo canceller and in particular to preventing the adaptive filter from interpreting the near end speech signal as a noise signal, causing it to update.
- 4.2 The Board considers that for the reasons given below the skilled man seeking to solve the double talking problem would not, given the disclosure of the two devices of D1 considered individually, be led without the exercise of inventive skill to the subject-matter of Claims 1 and 5.
- 4.3 The first device is an echo suppressor and is not concerned with the control of coefficient calculation in an adaptive filter. Echo suppressors are commonly used in the telephone art but assume that only one party or the other is transmitting; they give rise to difficulties during "double talking", i.e. when both parties speak simultaneously. The difficulty is that speech can be interpreted as an echo and consequently blocked. The D1 echo suppressor provides *inter alia* for the double talking condition although the description does not make clear what kind of provision is made; presumably no attenuation is effected, i.e. the logic unit provides no output. The description at page 226 indicates that the speech detector SDR "allows the SDS (speech detector on the send path) to select its operation mode". This speech detector SDS is described in terms which suggest that it constitutes an adaptive level detector, the description stating that, "The detection algorithm is based on a sum of partial grades compiled on each speech sample and depending on preceding memorized informations". From the further statement that "The speech detector on the send path works with two integration time values which depend on the information given by the speech detector on the receive path", it is clear that the mode of operation of

SDS is dependent on a signal from the detector SDR. This detector however has a fixed threshold and "starts working when the sample entering has an amplitude bigger than -31dBmO" The operation of detector SDS is also dependent on speech power indicator SPI, which "elaborates a code translating the signal peak level which is present on the receive path when the SDI is working", i.e. passes an indication of peak received signal power to detector SDS. The outputs of SDS and SDR are used to operate a logic unit which determines whether attenuation is inserted in a line.

4.4 The D1 echo suppressor therefore detects combined noise and transmitted signal activity in an adaptive level detector, the threshold of which is dependent on the output of a received signal level detector; the latter is not however adaptive. The skilled person, seeking to solve the double talking problem in an echo canceller, would - even if he were to take the first device disclosed in D1 into account - not be led to the claimed invention.

4.5 The D1 echo canceller is, as noted at paragraphs 3.4 and 3.7 above, of conventional design. Although page 231 specifically refers to stopping convergence "during any silent period" and to maintaining the echo transfer function constant during double talking, i.e. to controlling coefficient calculation, there is no disclosure of how this is done. The skilled person would not therefore derive the claimed invention from this disclosure.

4.6 Having considered the two D1 devices separately, it is now necessary to consider whether the skilled person would understand echo suppression and echo cancellation to be such closely related fields that, whatever the manner in which the two devices are disclosed in D1, it

would be obvious to apply developments in one field to the other. This does not however appear to be the case. "Digital Telephony" by J. Bellamy, John Wiley & Sons, 1982, one of the standard texts in the field, discusses known forms of echo suppression and then at page 38 states:

"Recent developments in electronics technology have paved the way for a new form of echo control ... echo cancellers ... The complex electronics ... have only recently become economically feasible.

Bellamy thus sees echo cancellation as a break with the past. Similarly, the article cited at page 1 of the application, "Echo Canceller with Two Echo Path Models", Ochiai et al., IEEE Transactions on Communications, Vol. COM-25, No. 6, June 1977, starts by discussing the problem of double-talking in echo cancellers and states at page 589, right-hand column:

"A simple and most direct approach for this would be to use a double-talking detector ... As yet, no detector adequate for the present purpose has been designed."

This suggests that the skilled person would have considered the known double-talking detectors as used in echo suppressors to be inadequate for echo cancellers. The skilled person would not have expected a double talking detector designed for an echo suppressor to be of use in an echo canceller.

4.7 Accordingly, the Board takes the view that the subject-matter of each of Claims 1 and 5 involves an inventive step having regard to the disclosure of D1.

5. It remains only to be considered whether the skilled person, faced with the Applicants' problem of double talking in the context of a conventional echo cancellation system, would be led by any of the other cited prior art to the claimed invention. The Board considers that this is not the case. D2 discloses an adaptive filter in which updating is dependent on the presence of a received signal with a predetermined energy spectrum; the problem of double talking is not addressed. D3 does disclose a double talking detector in which updating of an adaptive filter is stopped when double talking is detected; there are no adaptive level detectors. Neither of these documents, nor any of the other documents to be found in the application file taken singly or in combination, would lead the skilled man, faced with the problem of double talking in an echo canceller, to the claimed solution.

**Order**

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

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent on the basis of the Appellants' request (paragraph III above).

The Registrar:

The Chairman:

M. Kiehl

P.K.J. van den Berg