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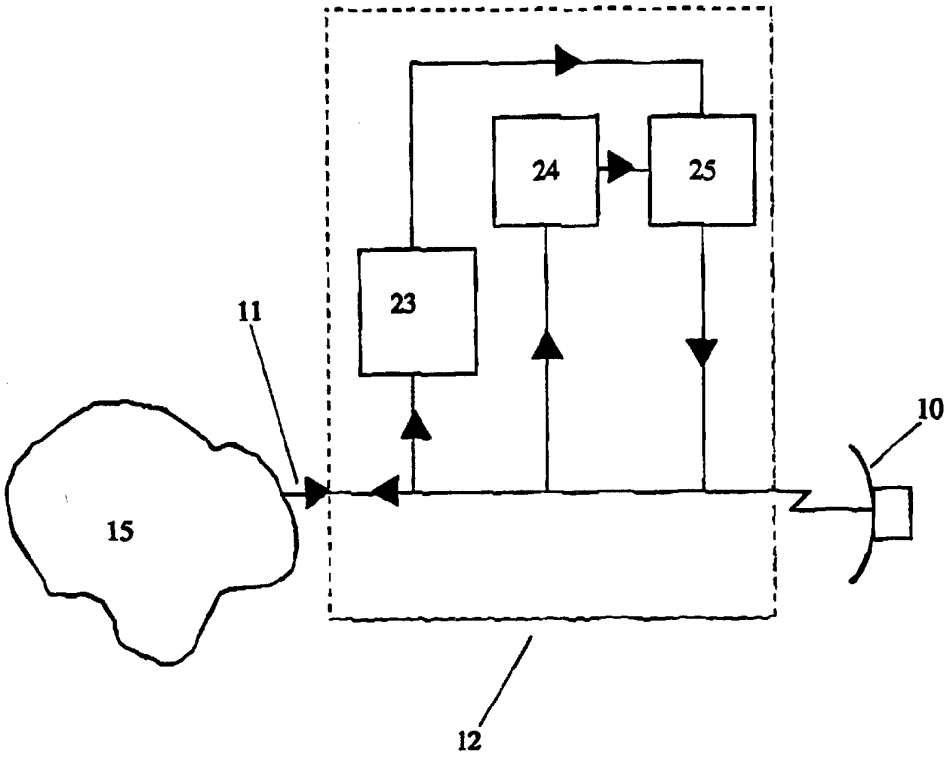
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(54) **Title:** FAR END ECHO CANCELLER



(57) Abstract

A system and device for cancelling far end echo, particularly for echo from a remote network, is disclosed. The system is adapted to cancel echoes from one network (20) from calls from another network (15), from within the other network (15). Preferably, the echo canceller includes a pre-set delay device, which delays an outgoing sample so as to bring the detected echo on the receiver side within range of a conventional echo canceller (24). No ongoing far end echo measurement is required, if the canceller is sited on a link to a particular remote network.

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FAR END ECHO CANCELLER

Technical Field

This invention relates to an improved telecommunications network which cancels echo originating from another network, and to an improved echo canceller.

Background Art

Where communication occurs between telecommunication networks, it is common practice for each network to cancel the echo which it generates. This cancellation usually occurs before the signal is passed to another network.

It is often the case that such echo is not cancelled. This results in the receiving network seeing the echo without the sending network being affected. Thus the situation arises where the receiving network transmission and reception quality is impaired by the failure of the network at the far end of the communications link to cancel the echo generated by that network.

An example of such a situation is on international calls. Particular networks in general have poor echo cancellation and therefore any call to that network will be seen to have echo. It is desirable to improve the quality of service that such regular occurrences of echo be cancelled.

The delay between generating the signal and seeing the echo is proportional to the length of the communications link between the two networks. Referring to Figure 1, echo may result from reflection from the far end of the satellite link, for instance. The size of the delay is much larger than for local echo - for instance, the minimum delay for a signal in geostationary orbit is about 520 mS.

A problem with conventional echo cancellation techniques, particularly on a network basis rather than single circuit link basis, is that the longest delay that can be dealt with is of the order of 64 ms. Cancellation of longer delays requires such a vast amount of signal processing power that it is impractical to implement. By way of example, to cancel a 64ms delay on an 8KHz circuit requires $64 \times 10^{-3} \times 8000 = 512$ co-efficients to effectively model the echo path

in the circuit. Each co-efficient must be updated every sample period and this involves multiply and accumulate type operations for each co-efficient. It can therefore be seen that echo cancellation for a single circuit is mathematically intensive and that echo cancellation of 600ms of delay from an entire network at the far end of a higher frequency communications link will require a prohibitive amount of signal processing power.

In the past, attempts to deal with echo originating from the far end of a communications link has been restricted to single circuit techniques which have not been implemented on a network scale.

US 4 577 309 is an example of such single circuit echo cancellation technique. It suffers from the problem that it must firstly measure the delay of the echo on the circuit by the auto-correlation of transmitted test data. This requires the received signal to be correlated with the test signal until the delay is measured. To implement this technique at a network level would require the communication link to be periodically fed with test data and for this test data to be auto-correlated, over a period of at least 800ms, with the received data of the entire communications link. The processing power required to do this is clearly prohibitive.

US 4 562 312 addresses a single circuit echo cancellation technique. It suffers a similar problem to US 4 577 309 in that its implementation on a network with international communications would require a cross correlation of the data on the network over a period of some 800ms.

It is accordingly an object of the present invention to provide a technique for cancelling echo resulting from a remote network.

Summary of the invention

According to one aspect the present invention provides a telecommunications network, said network being in communication with remote networks, characterised in that said network includes means for cancelling echoes resulting from said remote networks.

Preferably said remote network is a remote national network.

According to another aspect the present invention provides a far end echo canceller for a communications link, said link having a transmitter output, and a receiver input, wherein said canceller includes means for extracting a signal from said transmitter output, and delaying said signal by a predetermined amount characteristic of the echo delay on said link, and a shorter delay echo canceller arranged to cancel echo present on said receiver input by reference to the output of said delay means.

Preferably said delay means is a bulk delay device.

According to another aspect the present invention provides a method for cancelling far end echoes, comprising

sampling a transmitted signal to produce a reference signal ;

delaying said reference signal by a predetermined period;

receiving an incoming signal including echo;

correlating said incoming signal and said delayed reference signal, and thereby producing an echo cancellation signal; and

substantially cancelling at least part of the echo in said incoming signal.

The present invention therefore allows a network operator to cancel both near and far end echo from a single site. Additionally, the use of a preset delay system to delay the signal for correlation,for a period characteristic of the echo delay on any selected link, allows for a relatively simple solution to the far end echo cancellation problem.

Brief Description of Drawings

The invention will now be described with reference to an illustrative embodiment and the accompanying drawings, in which:

Figure 1 shows schematically a long-delay echo producing system;

Figure 2 illustrates schematically one mode of operation of the present invention; and

Figure 3 illustrates schematically the principle of operation of the present invention.

Description

Referring to Figure 1, a network 15 is communicating with a second network 20 via a satellite 10. Considering a call established between the networks, the customer in network 20 will hear echo originating from network 15, and vice versa. Hence, a calling party is relying in the normal course on adequate echo cancellation on the called party's network. Conventionally, each network must provide adequate echo cancellation for its outgoing signals using cancellers 14, 21. However, this assumes cooperation between the operators of each network.

The present invention allows for cancellation of far end echo by placing a suitable unit 12 on the calling party's network.

Considering Figure 2, a system for far end echo cancellation according to the present invention is located on the relevant communications link - for instance in an international link, preferably on the trunk line beyond the gateway exchange.

Monitoring device 23 is a device adapted to measure quantity and detect echo - for instance a device as described in PCT/AU92/00265 by the present applicant. This is used in initial set up procedures to measure the echo on the link - however, it need not be continually in place during operation. It may be left as a monitoring device, however, it is not required for the operation of the canceller. No on-going calculation of the echo delay is required.

Echo canceller 24 is a conventional device of any suitable type. Such devices are well known and commonly used. Illustratively, it may be an EC 6300 echo canceller form Coherent Communication Systems Corporation, configured for a 64 ms delay tail. The operation and nature of echo cancellers of this type is well known and understood.

Delay box 25 is adapted to delay an incoming signal by a scalable time before output. This is a device of conventional type which is adapted to produce a scalable delay. The device should be capable of a delay of up to one second, if the canceller is to be used for long haul links. It is preferably a 2 M Bit per second device.

In use, monitor 23 identifies a far end echo, and delay box 25 is preset for a delay such that the echo on a given link is brought within the range of the canceller. The delay box typically delays the outgoing cancellation signal by about the round-trip delay on the link. For example, if the measured echo delay is in the range of 580 to 610 ms, then the delay may be set for 580 ms or slightly less, and still bring the echo within the 64 ms delay tail of the canceller. The conventional canceller then sees echoes in the range of 0 to 30 ms. These parameters will of course vary somewhat if different delay tails are used. The present invention is most applicable where echo is largely concentrated within a narrow band, preferably up to a 64 ms delay width.

Monitor 23 is used to verify that the far end echo is concentrated around a central value, and that the system is in fact reducing far end echo.

Operationally, the best way of implementing the improved canceller, to handle both near and far echo (ie in both directions) on international voice circuits, is to use a standard canceller, unaided, to cancel near end echo, a canceller aided with an additional offsetting delay to cancel far end echo, and a monitor 23 to perform setup, configuration and monitoring of the system.

The monitor 23 measures the time delay of the echoes. For transiting traffic, there may be more than two delays at which echo is occurring. In the improved echo cancelling system, one could add a third, standard canceller, with a different delay offset, to cancel another group of clustered echoes.

Thus, in the general case, the enhanced echo canceller consists of several standard, low delay cancellers, some with additional delays adjusted for particular groups of echo associated with particular points along the transmission path.

A single canceller to do the same job would need a very large memory to cover the entire delay range.

It will be appreciated that variations and additions are possible within the spirit and scope of the invention.

CLAIMS

1. A telecommunications network, said network being in communication with remote networks, characterised in that said network includes means for cancelling echoes resulting from said remote networks.

2. A network according to claim 1, wherein said each of said means for cancelling echoes is adapted to cancel echoes having a delay characteristic of the link to said remote network.

3. A far end echo canceller for a communications link, said link having a transmitter output, and a receiver input, wherein said canceller includes means for extracting a signal from said transmitter output, and delaying said signal by a predetermined amount characteristic of the echo delay on said link, and a shorter delay echo canceller arranged to cancel echo present on said receiver input by reference to the output of said delay means.

4. A canceller according to claim 3, wherein said delay means is a bulk delay device.

5. A method for cancelling far end echoes, comprising
sampling a transmitted signal to produce a reference signal ;
delaying said reference signal by a predetermined period;
receiving an incoming signal including echo;
correlating said incoming signal and said delayed reference signal, and thereby producing an echo cancellation signal; and
substantially cancelling at least part of the echo in said incoming signal.

6. A network according to claim 1,wherein said means for cancelling echoes comprises one or more echo cancellers according to claim 3 or claim 4.

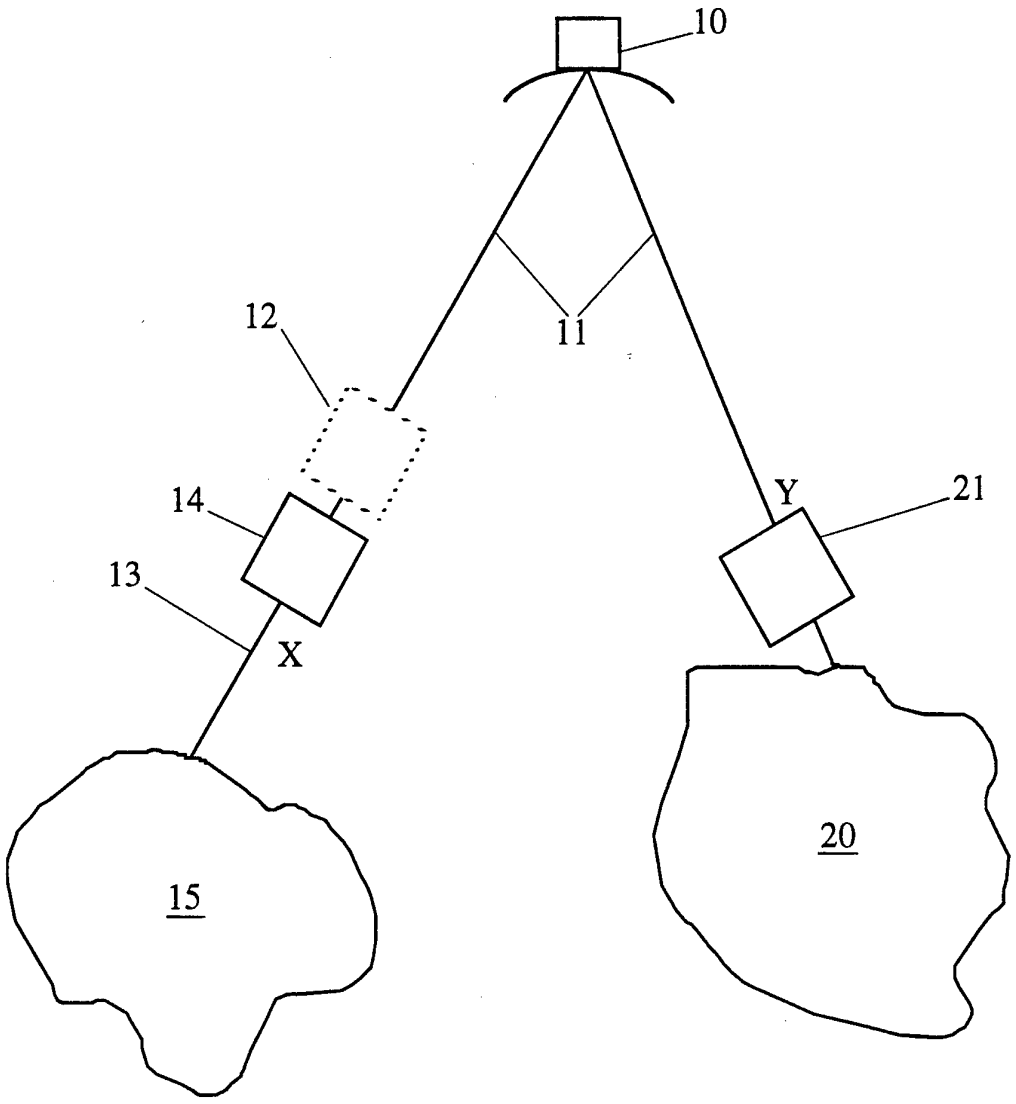


Fig 1.

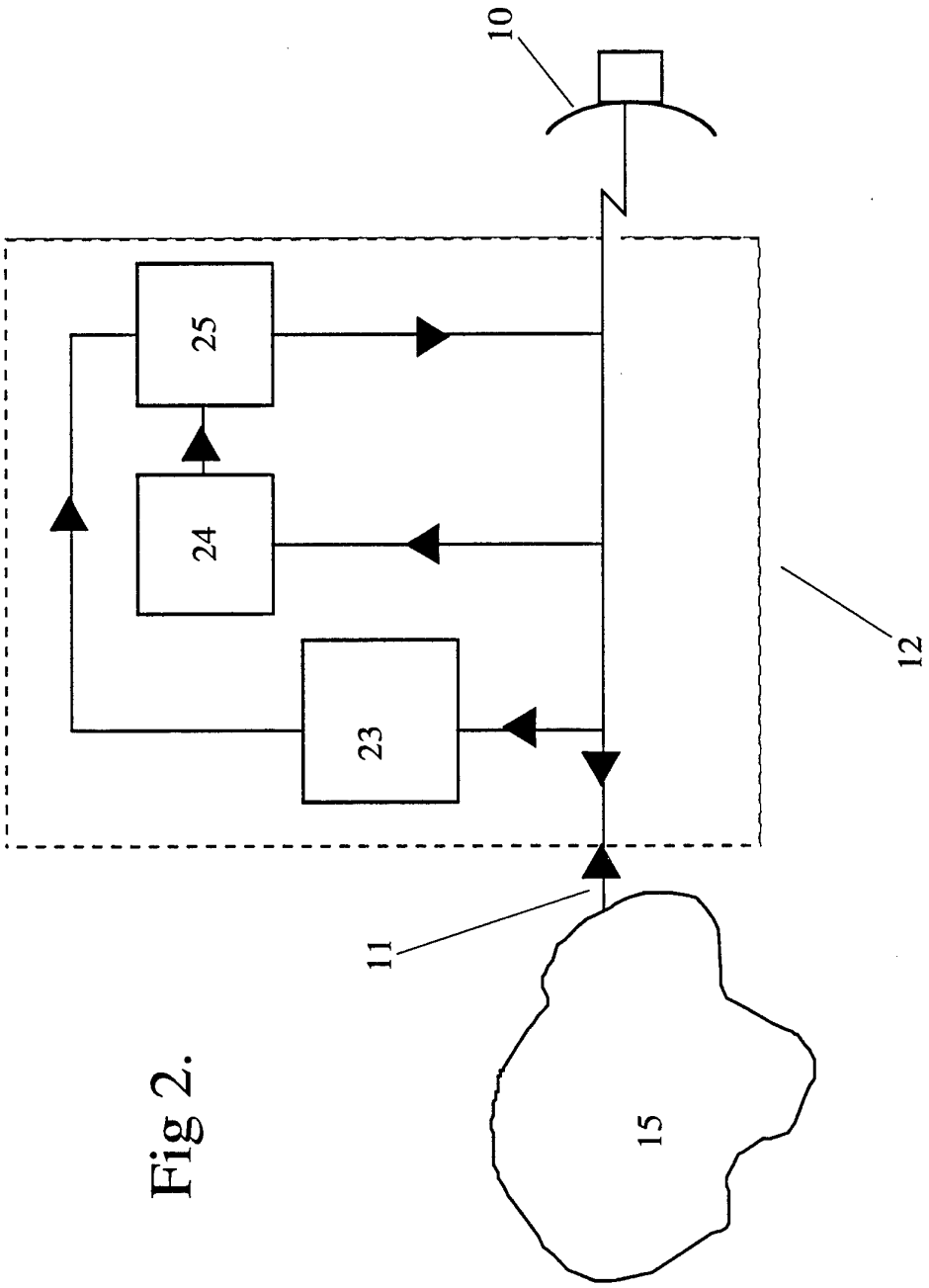


Fig 2.

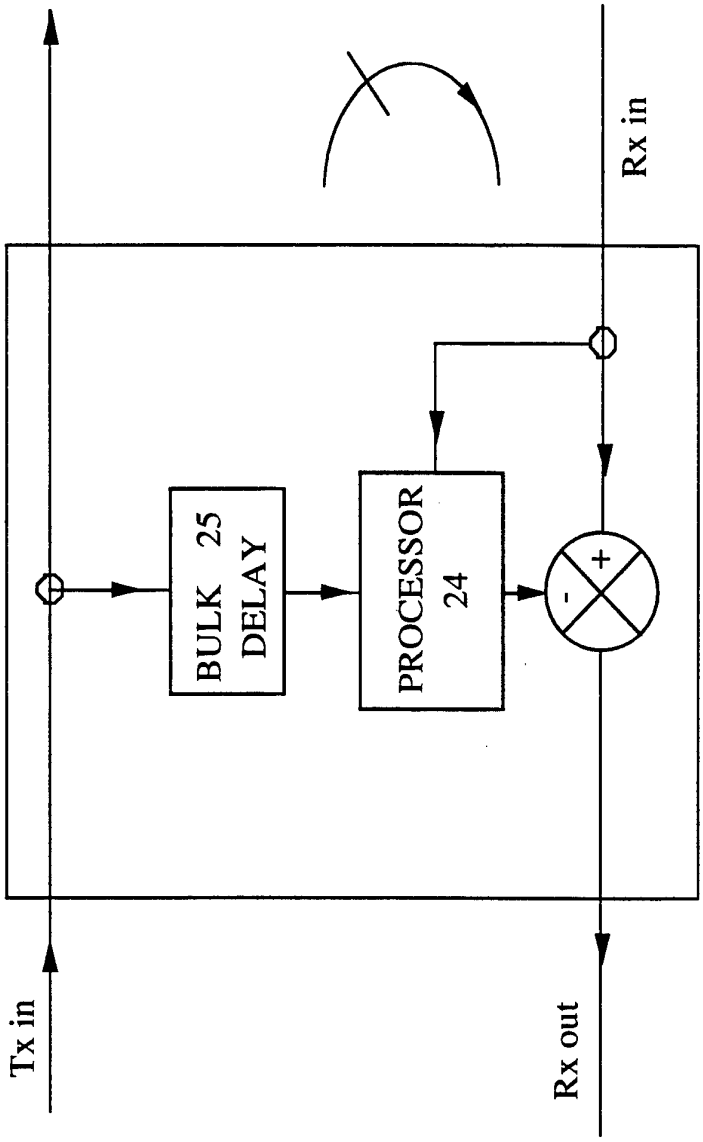


Fig 3.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 93/00626

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl.[5] H04B 3/23, 7/015

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC H04B 3/20, 3/21, 3/23, 7/01, 7/015

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	AU,B, 22859/83 (561776) (TELECOMMUNICATIONS RADIOELECTRIQUES ET TELEPHONIQUES T.R.T.) 5 July 1984 (05.07.84) page 5 line 34-page 9 line 34, figures 1 and 2	1-6
X	AU,B, 23850/84 (570668) (TELECOMMUNICATIONS RADIOELECTRIQUES ET TELEPHONIQUES T.R.T) 2 August 1984 (02.08.84) page 5 line 29-page 7 line 9	1-6
	EP,A, 221221 (INTERNATIONAL BUSINESS MACHINES) 13 May 1987 (13.05.87)	

[X] Further documents are listed in the continuation of Box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	claims 1 and 2, figures 5	5
X	EP,A, 260678 (NEC CORPORATION) 16 September 1987 (16.09.87) column 2 line 37-column 3 line 20	1-6
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This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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