EXHIBIT 18

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS:	IRA A. GERSON ET AL.	EXAMINER:	D. KNEPPER
SERIAL NO:	07/888,463	ART GROUP:	2308
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APPLICATION:	DIGITAL SPEECH CODER HAVING OPTIMIZED SIGNAL ENERGY PARAMETERS		

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Date: June 11, 1993

AMENDMENT AND RESPONSE

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

In response to an Office Action dated September 10, 1992 (Paper No. 10), as entered in the above-captioned matter, the Applicants respectfully submit the following Amendment and Response and request further examination.

In the Specification:

On page 5, line 5, please replace the period (.) after the word "invention" with a semicolon (;), then add the following new paragraphs:

Fig. 3 is a flowchart depicting a speech coding methodology in accordance with the present invention;

Fig. 4 is a block diagram of a radio transmitter employing a speech coder;

Fig. 5 illustrates frame and subframe organization of digitized speech samples; and

D1

Fig. 6 is a chart showing portions of a vector quantized signal energy parameter data base.

On page 7, line 9, after the word "choice" please add the following sentences: Fig. 4 illustrates this transmission process in block diagram form. Speech samples are provided to a speech coder (402), such as the one discussed above, through an associated microphone (401). The output of the speech coder (403) is then coupled to a radio transmitter (403), well-known in the art, where the speech coder output signals are used to generate a modulated RF carrier (405) that can be transmitted through a suitable antenna structure (404).

D2

On page 14, line 15, after the word "requirement" please add the following new paragraphs: The flowchart of Fig. 3 provides a concise representation of method steps used to code and transmit a succession of speech samples in the manner taught by the present invention. As discussed previously, a speech sample is provided to a speech coder (block 301) and digitized (302). In the next step (303), the sample is subdivided into selected portions or subframes.

In the subsequent operation (304), a long term energy value $E_q(0)$ is determined for the sample. Then (305), for a selected portion of the sample, a first parameter α is calculated with respect to the long term energy value. As suggested in the discussion above, this first parameter α may be a scale factor that relates the long term energy value to the overall energy in a particular subframe.

D3

In the next step (306), at least one excitation component as corresponds to the speech sample is selected. This excitation component may be the pitch excitation information energy for a particular subframe. After this component is selected, the next operation (307) determines a second parameter

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β by calculating the relative contribution of this selected excitation component (or components) to the overall energy value for that subframe.

The subsequent operation (308) vector quantizes the first and second parameters in order to develop representative information. Vector quantizing, of course, yields a representative code that identifies the information. This results in significant information compression when compared to the first and second parameters themselves. Finally (309), the representative information is transmitted.

On page 12, line 3, after the word "method" please add the following new paragraph: -Fig. 5 illustrates how a complete frame of digitized speech samples, generally depicted by the numeral 500, is divided into subframes. As mentioned previously, each frame is divided into four subframes (501-504). The quantized signal energy value $E_q(0)$ (505), calculated for each complete frame of digitized speech samples, is transmitted once per frame. The α and β parameters, indicated in the figure as part of a gain vector (GV) (506-509) are transmitted for every subframe.

On page 12, line 8, after the word "decoder" please add the following sentences: -Portions of a vector quantized signal energy parameter data base, generally depicted by the numeral 600, are shown in Fig. 6. The data base comprises a set of seven-bit representative codes or vectors (601), and a set of associated signal energy parameters. There are 128 possible vector codes (601) in this example, with each vector code having an associated α, β, and π parameter (602-604). The decimal numbers shown in the figure are for example purposes only, and would have to be selected in practice to compliment all of the particulars of a specific application.

In the Claims:

Please cancel, without prejudice, claims 5, 6, and 12 through 21.

Please amend claims 1 through 3 and 7 through 10 as follows:

1. (Once Amended) A method [of] for transmitting information that relates to gain information [for] , which gain information is to be applied to excitation information that corresponds to a [signal] speech sample, wherein the gain information includes:

a first gain value that relates to gain [for] to be applied to a first excitation component, which first excitation component represents a first voice component of the speech sample, which first voice component has a first energy value;

at least a second gain value that relates to gain [for] to be applied to a second excitation component, which second excitation component represents a second voice component of the speech sample, which second voice component has a second energy value;

the method comprising the steps of:

A) providing a speech sample;

B) digitizing the speech sample to provide a digitized speech sample;

C) [processing at least the signal sample to provide:]

determining a long term energy value for the digitized speech sample;

D) selecting at least a portion of the digitized speech sample to provide a selected portion of the digitized speech sample;

E) providing a first parameter that relates to an overall energy value for the selected portion of the [signal] digitized speech sample;

F) providing a second parameter based, at least in part, upon a relative contribution of at least [one of] the first [and second] gain value[s] to the overall energy value for the selected portion of the digitized speech sample;

[B] G) transmitting information related to the long term energy value and the first and second parameters.

2. (Once Amended) The method of claim 1 wherein:

the gain information includes at least a third gain value that relates to gain [for] to be applied to a third excitation component, which third excitation component represents a third voice component of the speech sample, which third voice component has a third energy value;

the method includes the additional step, before step G), of:

F1) [the step of processing includes additionally] providing a third parameter based, at least in part, upon a relative contribution of [a different one of] at least the first[,] and second[, and third] gain values to the overall energy value for the selected portion of the digitized speech sample;

the step of transmitting information includes transmission of information relating to the third [component] parameter.

3. (Once Amended) The method of claim 1 [wherein the step of processing includes] further including the step of vector quantizing at least the first parameter and second parameter information to provide a code.

7. (Once Amended) A method [of] for transmitting information that relates to gain information for a [signal] speech sample, wherein the gain information includes:

a first value that relates to a long term energy value for the [signal] speech sample;

at least a second value, wherein the second value relates to a short term energy value for the speech sample [signal], and comprises a correction factor to be applied with the first value;

comprising the steps of:

A) transmitting, from time to time, information relating to the first value;

B) transmitting, more often than from time to time, information relating to the second value.

8. (Twice Amended) A method [of] for recovering information that relates to gain information for excitation components of a signal, the method comprising the steps of:

A) receiving at least a first parameter that relates to energy for at least one excitation component of the signal;

B) receiving excitation component definition information for the at least one excitation component;

C) processing the excitation component definition information to provide a pre-component, which pre-component has an energy value;

D) using at least the first parameter and the energy value of the pre-component to provide a gain value;

E) applying the gain value to the pre-component, to provide a recovered excitation component of the signal.

9. (Twice Amended) A method [of] for recovering information that relates to gain information for excitation components of a signal, the method comprising the steps of:

A) receiving a radio signal;

B) demodulating the radio signal to provide a recovered signal;

C) extracting from the recovered signal at least a first parameter that relates to energy for at least one excitation component of the signal;

D) extracting from the recovered signal excitation component definition information for the at least one excitation component;

E) processing the excitation component definition information to provide a pre-component, which pre-component has an energy value;

F) using at least the first parameter and the energy value of the pre-component to provide a gain value;

G) applying the gain value to the pre-component[,] to provide a recovered component of the signal.

10. (Twice Amended) A radio that receives speech coded information and that synthesizes speech in response thereto, comprising:

A) RF means for receiving and demodulating a radio signal that includes speech coded information;

B) excitation source means operably coupled to the RF means for receiving the speech coded information and:

1) extracting from the speech coded information at least a first parameter that relates to energy for at least one excitation component of a signal that relates to an original speech [signal] sample;

2) extracting from the speech coded information excitation component definition information for the at least one excitation component;

3) processing the excitation component definition information to provide a pre-component, which pre-component has an energy value;

4) using at least the first parameter and the energy value of the pre-component to provide a gain value;

5) applying the gain value to the pre-component, to provide a recovered component of the signal;

6) providing an excitation signal using the recovered component of the signal;

C) LPC filter means for receiving the excitation signal and for providing a synthesized speech signal in response thereto.

Please add new claims 22 through 24 as follows:

22. (New) The method of claim 1, wherein the digitized speech sample comprises a frame of information and the selected portion of the digitized speech sample comprises a subframe.

23. (New) The method of claim 22, wherein the first parameter is a scale factor that relates the long term energy value for the frame of information to the overall energy value for the subframe.

24. (New) The method of claim 22, wherein the second parameter is a ratio that relates pitch excitation energy for the subframe to the overall energy value for the subframe.

REMARKS

1. Pursuant to the above-noted Office Action, the drawings have been objected to under 37 C.F.R. 1.83(a) on the ground that the drawings fail to show every feature of the invention specified in the claims. The Specification

has been objected to under 35 U.S.C. 112, first paragraph, as failing to provide an enabling disclosure and failing to provide an adequate written description of the invention, and claims 1 through 21 have been rejected under the same paragraph of the above-cited section for the reasons set forth in the objection to the Specification. Claims 1 through 16 have also been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as the invention.

Further, claims 1 through 8 and 11 through 21 have been rejected under 35 U.S.C. 101 on the ground that the claimed invention is directed toward non-statutory subject matter. Claims 1 through 21 have also been rejected under 35 U.S.C. 103 as being unpatentable over Davidson et al. (U.S. Patent No. 4,868,867). These rejections are respectfully traversed.

2. In response to the Examiner's objection to the drawings, four proposed drawing sheets including six drawing figures are attached hereto for the Examiner's approval. Sheet 1 is essentially a duplicate of original Fig. 1, except that the label "PRE-COMPONENT" has been added to the outputs of the PITCH FILTER STATE (102), CODEBOOK NO. 1 (103), and CODEBOOK NO. 2 (104). Also, the LONG TERM ENERGY input to the GAIN CONTROL block (101) has been labelled $E_q(0)$, while the GAIN VECTOR input had been labelled $GV(\alpha,\beta,\pi)$. The use of the term "pre-component" to describe the excitation signals that are output from the pitch excitation filter state and the codebooks is well-supported in the Specification (See, for example, page 7, lines 25-29). Also, the Specification recites that the gain control function (101) provides gain information "as a function of . . . the long term energy value as provided by the coder [Eq(0)], and a gain vector (GV) provided by the coder that supplies a

short term correction value for the long term energy value." (Page 7, lines 16-24). The long term energy value is defined as $E_q(0)$ on page 9 of the Specification [Lines 1-2], while the parameters α, β, and π are identified as gain vector parameters on page 12 [Lines 4-8]. For these reasons, the Applicants submit that the additional markings on Fig. 1 do not constitute new matter, and should therefore be permitted.

Proposed drawing sheet number 2 includes a duplicate of old Fig. 2 and proposed Fig. 4. Fig. 4 shows, in block diagram form, a transmitter employing a speech coder. The Specification recites that "[i]n one embodiment of the invention, the first and second parameters . . . are vector quantized to provide a code. This code then comprises the information that is transmitted to the decoder." [Page 3, line 30 to page 4, line 2]. The Specification also suggests that "the speech coder/decoder platform is located in a radio." [Page 4, lines 28-29]. Also, "[t]he pitch and codebook information will then be coded and transmitted to the decoder by a transmission medium of choice." [Page 7, lines 7-9]. Since the concept of locating the speech coder in a radio is also claimed, the Applicants respectfully submit that proposed drawing figure 4, and the associated descriptive text added pursuant to this Amendment, do not constitute new matter, and should therefore be entered.

Proposed drawing sheet 3 includes proposed Fig. 3, which is a flowchart that closely tracks the method steps of claim 1, as amended. The first steps depicted in the flowchart, those of providing a speech sample and digitizing, are common to any speech coder implementation, and are illustrated in Gerson (U.S. Patent No. 4,817,157), which patent is incorporated by reference into the instant Application. In addition, the Specification describes the process as follows:

> For purposes of this description, it will be presumed that an original speech sample (or at least a portion thereof) is digitized, and that the resultant digital information is divided as necessary into frames and subframes of data, all in accordance with well understood prior art technique. In this description, it will also be presumed that each frame is comprised of four subframes.

[Specification, page 8, lines 14-21]. The remaining steps of calculating the first and second parameters and vector quantizing are discussed at some length on pages 11 through 14. Therefore, the Applicants submit that Fig. 3 does not encompass new matter and should, consequently, be entered.

Sheet 4 includes proposed new drawing figures 5 and 6. Fig. 5 illustrates the frame and subframe organization of digitized speech samples. As described above, the Specification includes a discussion of the frame and subframe nature of the digitized speech information with which the present invention is concerned. The Specification also recites that "the quantized signal energy value $E_q(0)$ can be calculated for a complete frame of digitized speech samples (and) transmitted from the coder to the decoder from time to time." [Page 10, lines 21-24]. Modification of long term energy information to derive appropriate parameters for each subframe is treated in detail on pages 11 through 14. Fig. 6 illustrates portions of a data base of vector quantized signal energy parameters as they relate to a set of vector codes. This concept of vector quantizing the subframe signal energy parameters is described starting with page 12, line 4, and ending on page 14, line 15. For these reasons, the Applicants respectfully submit that proposed drawing figures 5 and 6, along with associated explanatory text, do not constitute new matter and are suitable for entry.

3. The specification has been objected to under 35 U.S.C. 112, first paragraph, for failing to provide an enabling disclosure and failing to provide

an adequate written description of the invention. The Examiner asserts, among other objections, that, while claims 1-7 seem directed toward "a method of transmitting information," the Specification and drawings only show reconstructing speech from transmitted parameters and do not explain how the information sent is coded for transmission. Pursuant to this Amendment, new drawing figures 4 and 5, with attendant descriptive matter, are submitted for the Examiner's review. For the reasons set forth above with respect to entry of these new figures and descriptions, the Applicants respectfully submit that the Specification now avoids the Examiner's objections relating to a method of transmitting information.

The Examiner also maintains that no specifics related to gain values are taught in the Specification or illustrated in the drawings. A thorough discussion of the inputs used in calculation of the excitation source is included in the Gerson patent ('157) incorporated by reference into the instant disclosure. As to the claimed "first parameter" and "second parameter," the flowchart of proposed Fig. 3 and the associated description clearly articulate the relationship between these terms and the voice signal. Contrary to the Examiner's impression, the first and second parameters are actually corrections to the long-term energy that relate to energy within a subframe. As discussed above, this relationship was covered in detail in the Specification even before the proposed introduction of the additional explanatory matter included in this Amendment. Thus, the Applicants believe the Specification makes an adequate disclosure of material related to gain values, and avoids the Examiner's objections as to this issue.

In the present Office Action, the Examiner also raises an issue of vagueness as to the differences between a frame and a subframe, as well as what the inventors might consider a "component" to be. In addition, the

meaning of the term "pre-component" is alleged to be unknown. As discussed above with relation to the introduction of proposed drawing figure 5, the difference between a frame and a subframe is articulated in the Specification, and, with the addition of Fig. 5, should be more than clear. The term "component" should be given its ordinary meaning: "a constituent part." Webster's Ninth New Collegiate Dictionary 270 (1988). "Pre-components" are introduced on page 7 of the Specification as outputs from the pitch excitation filter state and the codebooks [Lines 25-28]. The additional labelling proposed pursuant to this Amendment for drawing figure 1 should help to make this even more clear.

Vector quantizing, as discussed previously with reference to new drawing figure 6, is introduced on page 12 of the Specification, lines 4 through 8. In addition, Gerson ('157) refers to the concept frequently. [See, for example, column 1, lines 38-42]. Vector quantizing as it applies to parameters α, β, and π is illustrated in Fig. 6.

The Applicants submit that the Specification and claims are now consistent with the characterization of α as a first parameter that relates to an overall energy value, while β is based upon a relative contribution of the first gain value to the overall energy value. The term "vector" can mean an ordered sequence, as in a sequence of excitation samples [See Gerson ('157), column 1, lines 40-42]. Thus, the term "vector code" is applied to the representative code that identifies the result of vector quantizing the parameters α, β, and π.

The Examiner asserts that the Specification and drawings only show reconstructed speech and that nothing is shown to explain how the information that is sent is coded for transmission. First, the essential elements of a speech decoder, as shown in Fig. 1, are identical to the essential elements

of a compatible coder. Further, the Specification describes a coder embodiment in detail from page 10, line 19 to page 13, line 22. Based upon these reasons, and the reasons set forth above, the Applicants submit that the Specification is enabling with respect to coding a signal for transmission, particularly in light of the proposed new drawing figures and additional explanatory text including with this Amendment.

Explanation of the difference between "component" and "pre-component" has been offered above, and the claim language has been modified pursuant to this Amendment in an effort to minimize confusion that may result from the use of these terms. And a new drawing figure has been submitted showing the claimed frame and subframe relationship.

The Applicants respectfully disagree with the Examiner's assertion that the terms "gain information," "components", and "energy" have not been adequately distinguished from each other in the Specification and claims. The Specification indicates that the energy in the pitch excitation and codebook excitation signals (called pre-components) is necessary in order to determine the amount of energy correction that will be required. Energy correction is accomplished through adjustment of GAIN values on a subframe by subframe basis. [See, page 7, line 25 through page 8, line 6].

4. Claims 1-21 have been rejected under 35 U.S.C. 112, first paragraph, for the same reasons set forth in the objection to the Specification. For the same reasons set forth in response to the Examiner's objections to the Specification, the Applicants respectfully submit that the claims avoid the Examiner's objections under the first paragraph of section 112.

5. Claims 1-21 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as the invention. Once again, the Examiner raises an objection to the terms "gain information," components," and "energy." For the reasons set forth above, the Applicants submit that these terms are adequately distinguished from one another.

Claim 1 has been amended so it no longer contains "processing" steps. The method steps of claim 1 now carefully follow the process outlined in the Specification, and proposed drawing figure 3 flowcharts the steps of the claim to illustrate their interrelationship.

The language of claims 8-11 is not directed toward using a "component" to form a "pre-component." It should be especially clear in view of the modified claim language (pursuant to this Amendment) that the claims recite a method for recovering information that *relates* to *gain information* for *excitation components* of a signal. The method generally requires that a first parameter relating to energy be received, followed by excitation component definition information. This information is processed to provide a pre-component, and an associated energy value. From the data acquired above, a gain value is determined that can be applied to the pre-component to yield the desired recovered excitation component of the signal.

Even allowing the term "pre-component" to be interpreted in light of the commonly understood meaning of its prefix, there is no contradiction; pre-component information is used to arrive at the excitation component. However, in this instance the Specification provides a definition for the term "pre-component," as discussed previously, and this definition should be

applied when interpreting the language of the claims. Claims 13 through 19 have been cancelled pursuant to this Amendment.

The Examiner has objected to the "pitch excitation filter state" of claim 21. Claim 21 has also been cancelled.

6. Claims 1 through 8 and 11 through 21 have been rejected under 35 U.S.C. 101 on the ground that the claimed invention is directed toward non-statutory subject matter. (The Applicants assume that the Examiner meant to reject claims 12 through 21, since claim 11 is a dependent claim). While the Applicants are not prepared to dispute, at this time, the Examiner's contention that a mathematical algorithm is present, the Applicants do take exception to the Examiner's interpretation of the second element of the "two-part test" adopted by the Examiner.

Claims 1, 7, and 8 are the only independent claims remaining for consideration as to rejections under the above-cited section, since claims 12, 13, and 19 through 21 have been cancelled pursuant to the instant Amendment. Claim 1 in particular (as amended) includes essential limitations that are arguably distinguishable from data gathering steps "which merely determine values for the variables used in the mathematical formulae used in making the calculations." The method steps of claim 1 include the following:

> A) providing a speech sample;
> B) digitizing the speech sample to provide a digitized speech sample;
> C) determining a long term energy value for the digitized speech sample;
> D) selecting at least a portion of the digitized speech sample to provide a selected portion of the digitized speech sample;

[Applicants' claim 1, as amended]. These steps do not represent mere acquisition and substitution of values. Provision of the speech sample

requires that an analog speech signal be input via an appropriate transducer (such as a microphone), and digitizing requires an analog-to-digital conversion operation. Establishment of the long term energy value and arrangement of the digitized speech sample into subframes, while they may be characterized as preparatory steps, do not merely act to provide values for variables used in mathematical computation. For these reasons, the Applicants believe that claim 1 avoids the Examiners objections under section 101.

The Court of Customs and Patent Appeals has suggested that a claim drawn to a process which merely uses equation solutions as one step in achieving some result other than solution of the equations would be drawn to statutory subject matter. In re de Castelet, 195 U.S.P.Q. 439, 446 (1977). The Applicants maintain that that is the case here. In claim 7, for example, the method steps are directed toward transmission of first and second values. The first value relates to long term energy for the speech sample, while the second value relates to short term energy. The first value is transmitted periodically, while the second value need be transmitted less frequently because of the design of the Applicants' system. Similarly, the method steps of claim 8 lead to application of a gain value to the pre-component in order to yield a recovered excitation component of the signal. For the reasons set forth above, the Applicants respectfully submit that the claims cited above are directed toward patentable subject matter.

7. Claims 1 through 21 have been rejected under 35 U.S.C 103 as being unpatentable over Davidson et al. (U.S. Patent No. 4,868,867). The Examiner suggests that LPC information contains energy information. In actuality, however, the LPC parameters are just filter coefficients. He is

correct, however, that block 66 computes gain factor Gj, which relates to an overall energy value.

In attempting to draw an analogy between the "second parameter" of the Applicants' claim 1 and the long-term LPC analysis of Davidson, the Examiner is again confusing LPC parameters with gain values; they are actually filter coefficients. If one were to draw a block diagram of an LPC filter, one might be tempted to call the coefficients gain terms, since they are used to multiply signals. This, however, is not what someone "skilled in the art" would consider gain values.

The Examiner theorizes that Davidson teaches analysis of the spectral envelope and performs calculations from a frame of vectors which contain gain values for each of ten frequencies. Again, the Examiner seems confused about LPC analysis. The notion that LPC coefficients "contain gain values for each of ten frequencies" is clearly incorrect. LPC information provides filter coefficients for an all-pole filter.

The Examiner asserts that the "long-term analysis uses the energy located at the pitch frequency and is, therefore, also related to overall energy." While energy terms are typically used in LPC analysis, the overall energy is factored out, so that the resulting LPC parameters are independent of the overall signal energy.

With respect to claim 7, the Examiner maintains that "since there are more short-term coefficients than long-term coefficients, the short term coefficients would have to be sent "more often" than the long term coefficients." Claim 7 is not directed toward sending more parameters, but sending the same parameters more often. The Examiner may also be confusing the Applicants' "long-term energy" with Davidson's "long-term coefficients."

There is no relation since, in Davidson, "long-term" refers to a pitch prediction filter, and the Applicants' claim is related to energy.

As to claim 8's recitation of "receiving at least a first parameter," the a_i's and b_i's are not related to energy. What the Examiner may have meant is Gj, from block 35a. In any event, what Davidson does not provide for is element D of claim 8. Davidson does not teach using "the energy value of the pre-component to provide a gain value" at the receiver. Energy values may be computed at the encoder (transmitter) to compute the transmitted gain term, Gj, but Davidson certainly does not compute the energy at the receiver to generate the gain term to be utilized. For these reasons, the Applicants respectfully submit that the remaining claims are distinguishable over the prior art of record.

8. For the reasons set forth above, allowance of claims 1 through 4, 7 through 11, and 22 through 24 is hereby respectfully solicited.

Respectfully submitted,

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