

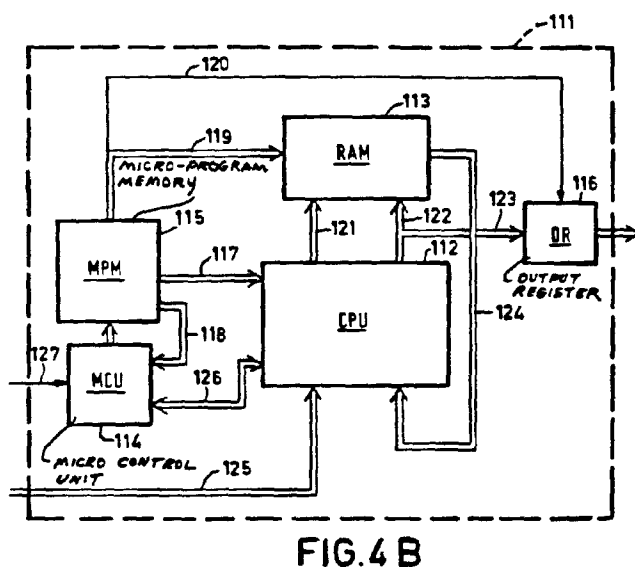
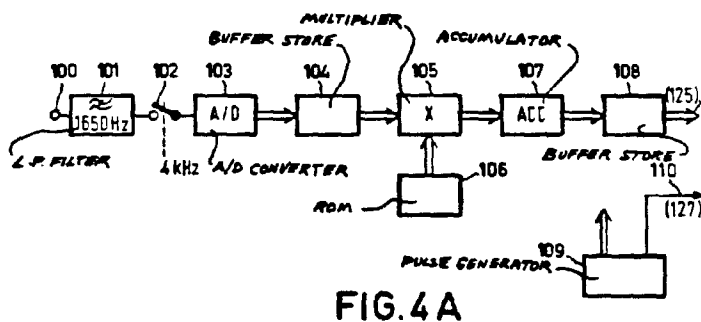
COMMISSIONER'S DECISION

Computer Related Subject Matter: Determining Pitch in Human Speech  
The system provides components for deriving pitch values of signals, for preparing masks for passage of derived values, and for determining from the values passed through the masks a match to enable voice signals to be transmitted. Rejection of application withdrawn.

This decision deals with Applicant's request for review by the Commissioner of Patents of the Final Action on application 341,411 (Class 354-53) filed December 6, 1979. It is assigned to N.V. Philips Gloeilampenfabrieken and is entitled METHOD OF AND SYSTEM FOR DETERMINING THE PITCH IN HUMAN SPEECH. The inventors are H. Duifhuis, L.F. Willems, R.J. Sluyter. The Examiner in charge issued a Final Action on June 15, 1982 refusing to allow the application.

This application relates to a system for identifying whether incoming speech signals, for example originating from telephone lines, match stored predetermined speech signals. Predetermined pitch values are derived for peak positions of the amplitude spectrum of a stored speech signal, as well as for the intervals around the values. Two separate processes are disclosed for comparing the pitch of a transmitted signal with the predetermined values by means of preparing a reference mask. One process forms a mask with apertures in predetermined places, indicative of the value for the pitch and multiples thereof. The other makes a mask which has apertures representing predetermined significant peak portions. Each process acts on incoming signals by computing their particular values, subjecting the values to passage through its mask, ascertaining the values of the signals which pass, and determining whether the values of the signals so passed match the values of the stored signals.

Figures 4A and 4B reproduced below, illustrate apparatus used in the system:



Elements 101 through 107 process an input signal 100 into certain computed values and 108 stores them. A pulse generator 109 via line 127 provides signals to micro-computer 114 while line 125 leads the computed values to central processing unit (CPU) 112. Thereafter, interaction of the elements in block 111 perform the steps of the processes to produce the matched values of the speech signals as output signals at output register 116. Each of the processes is said to be the dual of the other.

In refusing the application for being directed to non-statutory subject matter, the Examiner reasoned in part, as follows:

...

... It is not evident that the claimed process uses apparatus other than general purpose computing apparatus. The apparatus listed on page 2 of the letter of March 8, 1982 appears to be conventional apparatus for preparing speech signals for processing by a data processor (i.e. it is conventional to convert the analog speech signal to digital form to enable processing by a digital computer).

...

... Thus the applicant must show that the claimed process is carried out on novel apparatus wherein a computer may be a component but wherein the novelty lies in a combination of which the computer is only one component. The novelty may not lie in the software in the computer as appears to be the case herein.

. . .

... Applicant further states on page 2 of the letter that a system could be hardwired to carry out the method in accordance with the invention. It would be necessary to disclose such hardware in accordance with Section 36(1) of the Patent Act if this argument were to carry any weight.

It is held that the process of Fig. 1 has only been disclosed as flow charts of a program in Figs. 2, 3, 5 and that the apparatus disclosed to carry out the process shown in Fig. 4 fails to disclose novel apparatus. The apparatus in Fig. 4 is conventional general purpose computing apparatus in combination with expected auxiliary apparatus such as a code converter, buffer, etc.

The Applicant presented his arguments for allowance of the application, in part, as follows:

... The manner in which the known components are used to process the speech signal to a state suitable for input to a general-purpose computer, programmed in a special manner, is a part of the complete system of speech analysis as claimed in the present application. ... line 36 of page 6 clearly indicates that the functions of blocks 25 onward is implemented by the software of a general-purpose computer, the software mentioned herein directing operations additional to those performed by blocks 22-25.

... the first paragraph of the disclosure on page 7 ... states "By way of input data the computer receives the components  $AF(r)$ ,  $r = 1, \dots, 128$  of the amplitude spectrum as represented by block 26". This paragraph ... clearly indicates that the complete system of speech analysis requires more than a specifically programmed general-purpose computer in order to produce the data input for such computer.

. . .

The processing of the speech to data, suitable for input to the computer, is necessarily carried out by apparatus or hardware which may be that according to Figure 4 as described beginning at line 18 of page 13.

The hardware of Figure 4 comprises a low-pass filter 101, a sampling switch 102, an analog-to-digital converter 103, a buffer store 104, a multiplier 105 for discrete Fourier transformation based on coefficients supplied by ROM 106 producing "frequency points" and a buffer store 108.

It should be readily apparent that a low-pass filter, such as 101, is not a component part of a general-purpose computer, nor is it possible to feed other than so-called data signal (pulse signals) to a general-purpose computer. In the present system, the input to filter 101 is an analog speech signal.

Furthermore, for the Fourier transform operation of block 105, a ROM 106 is specially provided with the coefficients necessary for the particular operation desired.

The output of accumulator 108 is clocked as input to the general-purpose computer, block 111 of Fig. 4B again giving clear indication that the general-purpose computer is concerned only with the final mathematical manipulations of the data resulting from the processing of the analog speech signal.

. . .

It is only possible to select the time segments and determine Fourier transforms when the analog speech signal is processed to a form of selected time segments exhibiting a Fourier transform characteristic. This part of the system or method of speech analysis is performed by apparatus other than a general-purpose computer and hence the complete system, as claimed, including the selecting, Fourier transformation and final mathematical analysis, the last part of which may be performed by a general-purpose computer.

The issue before the Board is whether or not the application is directed to statutory subject matter in view of Section 2 of the Patent Act. Claim 1 reads:

In a system of speech analysis wherein the amplitude spectrum of a speech signal is analyzed by regularly selecting time segments of the speech signal, by determining from each time segment a sequence of spectrum components which constitute the discrete Fourier transform of samples of the speech signal and by deriving in each time segment the positions of the significant peaks in the spectrum from the sequence of spectrum components, the method comprising the steps:

the selection of a value for the pitch and the determination of a sequence of consecutive integral multiples of this value and the determination of intervals around this value and the multiples thereof, these intervals defining a mask having apertures in situ of an interval, harmonic number corresponding to the multiplication factors in the said multiples being associated with the apertures;

the determination of the significant peak positions coinciding with a mask aperture;

the computation of a quality figure in accordance with a criterion indicating the degree to which the significant peak positions and the mask apertures match;

the repetition of the preceding steps for consecutive higher values of the pitch until a predetermined highest value, resulting in a sequence of quality figures associated with these pitch values;

the selection of the value of the pitch having the highest quality figure, of which the associated mask constitutes a reference mask;

the association of the harmonic numbers of the apertures of the reference mask with the significant peak positions coinciding with the apertures, these harmonic numbers characterizing the locations of these peak positions in a sequence of harmonics of a same fundamental tone; and

the determination of a probable value for the pitch, thus that the deviations between the last-mentioned significant peak positions and the corresponding multiples of the probable value having the same harmonic numbers are as small as possible.

We look to the decision in Schlumberger Canada Ltd. v. The Commissioner of Patents (1981) 56 CPR (2d) at 204 in determining whether the application is directed to statutory subject matter, and in particular to the following passages of Pratte, J.:

In order to determine whether the application discloses a patentable invention, it is first necessary to determine what, according to the application, has been discovered.

and

I am of opinion that the fact a computer is or should be used to implement discovery does not change the nature of that discovery. What the appellant claims as an invention here is merely the discovery that by making certain calculations according to certain formulae, useful information could be extracted from certain measurements. This is not, in my view, an invention within the meaning of Section 2.

Applicant has described an arrangement which identifies transmitted speech signals by determining pitch values of those signals and comparing them with stored predetermined pitch values of speech signals. The system provides various means for deriving pitch values of received signals, preparing masks for passage of the derived values, and determining from the values passed whether or not a match of pitch values is present. In our view, the system provides a useful end result in matching acceptable voice signals that are transmitted from one place to another, for example, in telephone communication. We consider the matching of the signals is directed to more than merely making calculations. We are satisfied therefore that the application is directed to patentable subject matter.

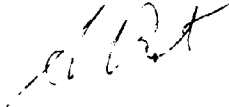
We note the claims define a system to analyse speech signals by regularly selected time segments, and by determining from each segment a sequence of spectrum components. We see that they set forth the various steps which determine the pitch values of speech signals, provide appropriate reference mask means, and determine the correspondence of incoming signals to stored values. In our view, they are directed to the invention disclosed.

In summary, we are satisfied the application discloses and claims features that present more than calculations to convert a set of values into another set of values. We are persuaded that the application and claims are directed to allowable subject matter, and in the absence of any cited art, may be allow-

We recommend that the rejection of the application for being directed to non-statutory subject matter, be withdrawn.



M.G. Brown  
Acting Chairman  
Patent Appeal Board



S.D. Kot  
Member

I concur with the findings and recommendations of the Patent Appeal Board.  
Accordingly, I withdraw the Final Action, and I am remanding the application to the Examiner for prosecution consistent with the recommendation.



J.H.A. Gariépy  
Commissioner of Patents

Dated at Hull, Quebec  
this 14th day of August 1986.

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