

[54] **PROCESS AND APPARATUS FOR
DETERMINING THE DEGREE OF
NASALITY OF HUMAN SPEECH**

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128/2 R, 2.1 R; 324/77 J

[56] **References Cited**

UNITED STATES PATENTS

3,281,534	10/1966	Dersch	128/2.1 R
3,383,466	5/1968	Hillix	179/1 SA
3,316,353	4/1967	Dersch	179/1 SA
3,410,264	11/1968	Frederik	128/2 R

2,416,353 2/1947 Shipman 179/1 VS

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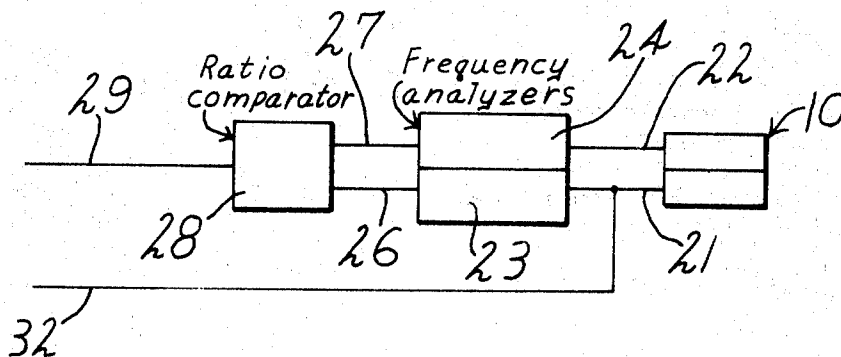
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[57]

ABSTRACT

A process and apparatus is described in which electric signals representative of the sounds emitted from the nose and mouth are utilized to determine the degree of nasality of speech. Separate electric signals are derived from sounds emitted from the nose and mouth and these are compared one to the other and then the resultant signal is compared with a signal representative of a known degree of nasality. A form of apparatus suitable for carrying out the process is disclosed, including means separately to impress the nasal and oral signals onto separately functioning microphones.

2 Claims, 4 Drawing Figures



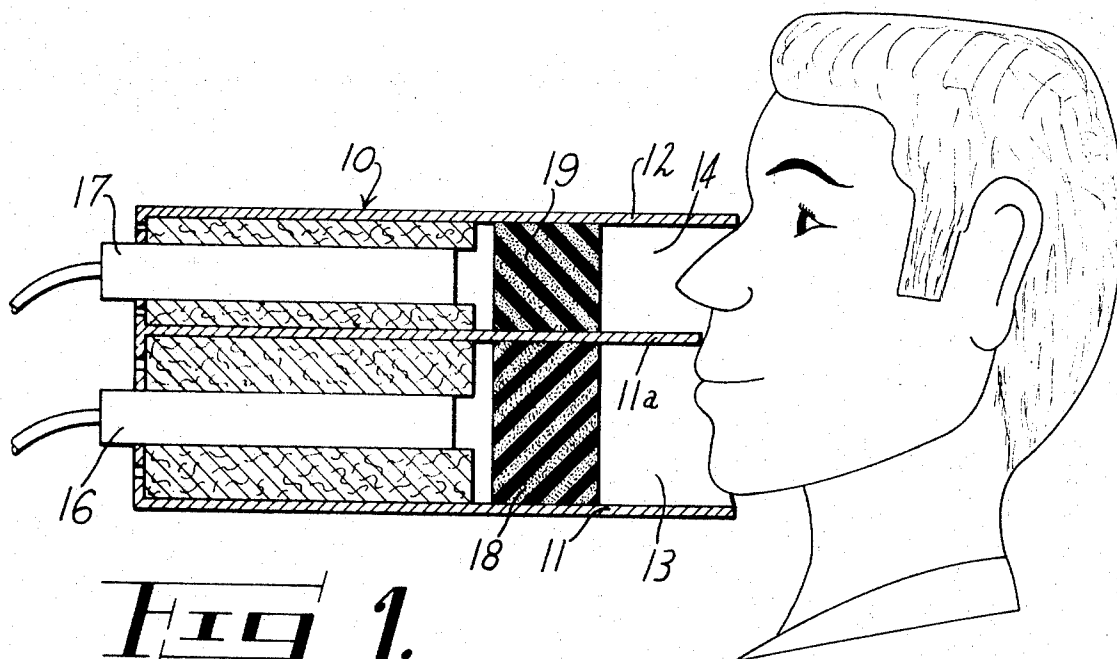


FIG 1

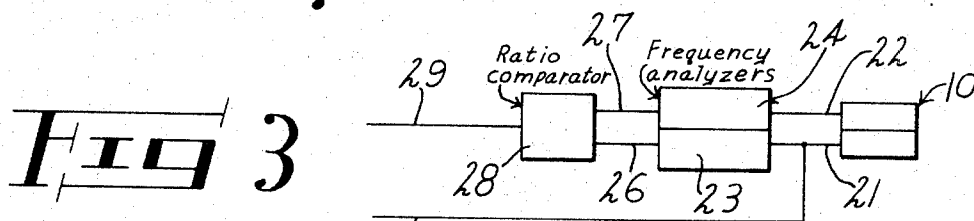


FIG 3

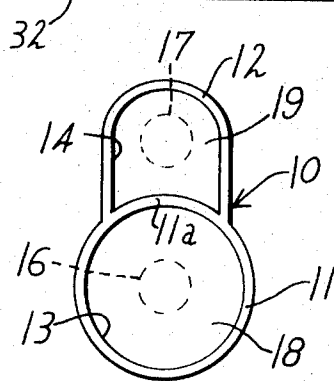
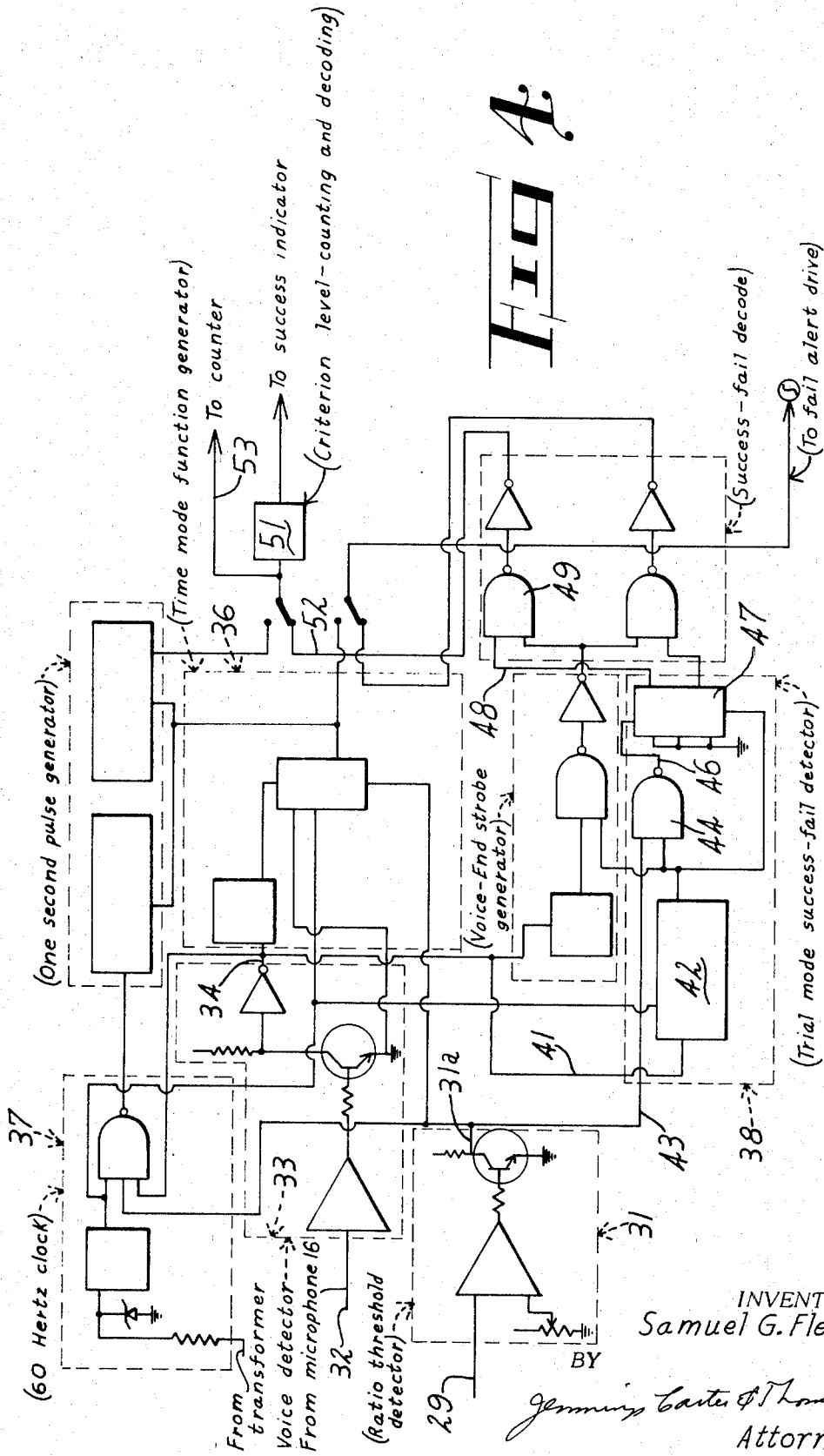


FIG 2

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PROCESS AND APPARATUS FOR DETERMINING THE DEGREE OF NASALITY OF HUMAN SPEECH

This invention relates to a process and apparatus for determining the nasality, or degree of nasality, of human speech.

Heretofore in the diagnosis and treatment of hypernasality, such condition generally has been diagnosed merely by having the patient speak to a human listener, the latter of whom then, perceptually, judges the degree of nasality. Such judgment obviously is directly related not only to the acuity of hearing of the listener, but also to background noise, the amount of contact which the listener previously had had with the subject and with other similar subjects, as well as other various physical and psychological factors. Therefore, the concept of determining nasality, and prescribing treatment for the same, by patient to listener methods has been found to be inaccurate and ineffective and has lead to a gross waste of effort both on the part of the patient and the clinician.

Prior efforts have been made to measure hypernasality by electronic means. However, so far as I am aware such prior efforts have consisted in attempts to utilize the overall sound output from the patient, namely, the sounds emitted from the nasal and oral passages, without attempting in any effective way to segregate these two sounds, analyze the same as they relate to their respective frequencies and then compare them.

In view of the foregoing an object of my invention is to provide a process for determining the degree of nasality in human speech which comprises developing separate electric signals representative of the sounds emitted from the nasal and oral passages of a patient being tested, said signals also being representative of the nasal resonance frequency, and then, utilizing said separate signals, to relate the same to a signal which is representative of a known degree of nasality, thus to obtain an indication of the overall performance of speech, in the sense of nasality.

Another object is to provide a process of the character indicated which comprises carrying out the operation during continuous speech of the person being tested and further, as an aid in speech improvement, continuously to indicate to the person being tested the degree of performance during the entire therapy period.

A further object is to provide apparatus which is capable of carrying out my improved process and which embodies, in particular, a pair of sound isolated microphones carried by a housing and so relatively arranged that when the housing is brought into place about the face of a person the separate sounds from the nasal and oral cavities are impressed upon the respective microphones, thus initiating and making possible the production of the electrical signals with which I start my improved process.

My invention also is characterized by the provision of apparatus which is reliable in operation and which is responsive to substantially the entire critical range of resonant frequencies encountered in human nasality.

Apparatus illustrating the constructional features of my invention and which may also be used in carrying out my improved process is shown in the accompanying drawings forming a part of this application in which:

FIG. 1 is a vertical sectional view, somewhat diagrammatic, and illustrating an internally baffled housing having separate microphones therein and which are adapted to produce signals representative of sounds

emitted from the nasal and oral passages of a person being tested;

FIG. 2 is a front elevational view of the apparatus shown in FIG. 1;

FIG. 3 is a wholly diagrammatic partial wiring diagram of a portion of my improved apparatus; and,

FIG. 4 is a wholly diagrammatic, schematic wiring diagram of the remainder of my improved apparatus.

Referring to the drawings it will first be understood that my improved process starts with and is predicated upon the concept of producing separate electrical signals which are representative of the sounds emitted from the nasal and oral passages of a person being tested. To this end I indicate in FIG. 1 at 10 a housing which may have a circular lower part 11 and an upper, somewhat vertically elongated part 12. As illustrated in the drawings the lower part 11 provides a chamber 13 while the upper part 12 provides a chamber 14. It will be seen, in effect, that the wall 11a of the device 10, when the device is brought into position relative to a human face as shown, separates the acoustic output of the nose from the mouth.

Associated with the chamber 13 is a microphone 16 while associated with the chamber 14 is a microphone 17. Sound pervious pads 18 and 19 of foam rubber or the like may be used, if desired.

It will be seen that with the housing 10 in place adjacent the face and with the baffle 11a contacting the upper lip of the person, sounds emanating from the nasal cavities are impressed upon the microphone 17 whereas sounds from the oral cavity are impressed upon the microphone 16.

Referring particularly to FIG. 3 signals from the microphones 16 and 17 are lead through circuits 21 and 22 to the respective frequency analyzers 23 and 24. The analyzer 24 is tuned to nasal resonance frequency while the analyzer 23 scans the same frequency band in the oral signal.

From the frequency analyzers 23 and 24 the signals are sent through the respective circuits 26 and 27 to the ratio computer, indicated diagrammatically at 28. In the computer 28 the nasal signal is divided by the oral signal thus to obtain a quotient signal which is sent through appropriate circuits 29 to a ratio threshold detector, the mechanism of which is enclosed within the dotted outline 31, FIG. 4.

Circuit 32 leads from the microphone 16 to a voice detector, the mechanism of which is included within the dotted outline 33, FIG. 4.

When sound is impressed on microphone 16 the section of the apparatus indicated by numeral 33 generates a signal which may be denominated logic 1 and this is impressed through circuits 34 onto a time mode function generator indicated within the box 36. In addition, the signal from the voice detector goes to a sixty cycle clock 37 and to a trial mode success-fail detector 38.

From what has been so far described it will be seen that the enumerated mechanism takes the signals from the nasal and oral passages, converts them into electric signals, analyzes the same for respective intensity and frequencies and divides the signal representative of the oral sound into the signal representative of the nasal sound. This resultant signal is sent through the circuits 29 into the ratio threshold detector 31 and operates the system either in time or trial mode, depending upon its elected function. The signal from microphone 16 is also

brought to the voice detector 33 to activate the comparative function.

In the ratio threshold detector 31 the signal from circuits 29 is sent to an amplifying circuit which conditions it to proper voltages, by way of example, from 0 to 2.4 volts. Also in the section 31 the signal which has been thus conditioned is compared with a signal representative of a known degree of nasality, which by way of example may be 1.8 volts. The comparison signal is lead through circuits 31a to the 60 cycle clock 37, the time mode function generator 36 and to the trial mode success-fail detector 38.

Simultaneously with the foregoing the signal through the circuits 32 coming from microphone 16 are fed to the voice detector 33 which includes an isolation amplifier and sensitivity control therefor, a rectifier, a filter and a threshold detector. The signal coming through circuits 32 from microphone 16 is generally on the order of about 0 to 0.8 volts AC, peak. As before stated, the output through circuits 34 from section 33 go to the clock 37, the time mode function generator 36 and trial mode success-fail detector 38.

From what has been so far described it will be seen that the apparatus provides means to determine during the trial period, (namely, during the time the person is speaking) whether the degree of nasality has decreased below the selected level to which the ratio signal in circuits 29 are being compared.

The trail mode success-fail detector 38 receives the signal from the voice detector 33 and the ratio threshold detector 31 through circuits 41 to an eight bit shift register indicated at 42. The ratio signal is delivered through circuits 43 to a two input NAND gate 44 and a circuit 46 leads from the gate 44 to the input of a J-K flipflop 47. Thus, when the signal in circuits 29 indicate a degree of nasality below the comparison level, the unit 47 sends a signal through circuits 48 to another two input NAND gate 49. When a person stops speaking, for instance at the end of a word, the device 49 gates out a signal which is sent to the success counting devices indicated in part by the numeral 51 and circuits 52. The unit 51 may indicate success in the form of a succession of lights, and so forth. In addition, a circuit 53 may lead to a counter or counters to totalize the number of successes.

In view of the foregoing it will be seen also that various ancillary equipment may be associated with my apparatus. By way of example one may display to the person being tested a succession of lights, or other indicia, indicating to him his repeated success or repeated failure, with each attempt to speak a given sentence, phrase, word or the like.

In actual practice my improved process and apparatus have proven to be extremely beneficial in the scientific diagnosis and treatment of hypernasality. By my improved process people of all ages, that is, children as well as adults have been enabled to reduce their hypernasality to acceptable levels within a very short time as compared to months and even years through traditional observation and treatment. I have thus reduced the science of determining and treating hypernasality from an individual appraisal basis to that of an objective, accurately determinable basis. My invention provides a fixed standard against which a person afflicted with hypernasality may be advised, continuously, as he speaks, of the degree of the same and the improvement which he makes while undergoing observation and testing.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various other changes and modifications without departing from the spirit thereof.

What I claim is:

1. In apparatus for analyzing continuous human speech to indicate the degree of nasality thereof comprising:

- a. means to produce separate electric signals directly from the sounds emitted from the nasal and oral passages of a person being tested,
- b. means to which said signals are separately fed and effective to emit separate signals representative of the proportionate intensity of each signal within a predetermined frequency range,
- c. means to which the signals from the means set forth in (b) above are fed and effective to generate another signal which represents the ratio of said signals which ratio is representative of a known degree of nasality
- d. means to compare said ratio signal to a signal representing a known degree of nasality, and
- e. indicating means responsive to the signal obtained from the means of (d) above.

2. Apparatus as defined in claim 1 in which the means set forth in (a) of claim 1 comprises an internally baffled housing disposed when placed adjacent the face of a person to provide a pair of sound chambers, one of which chambers communicates with the nasal passages and the other of which communicates with the oral passage, and microphones in each of said chambers by which the sounds emitted from the nose and mouth are caused to produce separate electric signals.

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