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(54) Titre : METHODE DE SORTIE SONORE D'UN ELEMENT D'INFORMATION DANS UN SYSTEME D'ANALYSE
(54) Title: METHOD FOR THE AUDIBLE OUTPUT OF A PIECE OF INFORMATION IN AN ANALYSIS SYSTEM

(57) Abrégé/Abstract:
The invention relates to a method for the audible output of a piece of information by an audible signal generator, where the signal generator is arranged in an analysis system and the analysis system analyses a fluid sample using a test element, where analysis results are generated and are processed by a data processing unit, and where a control unit in the analysis system actuates the signal generator, so that the signal generator audibly outputs a piece of information, the signal generator sending an audible test signal in order to test the operability of the signal generator.

Abstract

The invention relates to a method for the audible output of a piece of information by an audible signal generator, where the signal generator is arranged in an analysis system and the analysis system analyses a fluid sample using a test element, where analysis results are generated and are processed by a data processing unit, and where a control unit in the analysis system actuates the signal generator, so that the signal generator audibly outputs a piece of information, the signal generator sending an audible test signal in order to test the operability of the signal generator.

Method for the audible output of a piece of information in an analysis system

The invention relates to a method for the audible output of a piece of information by an audible signal generator, where the signal generator is arranged in an analysis system for analysing a sample using a test element, and relates to an analysis system having an audible signal generator.

To analyse samples, for example body fluids such as blood or urine, analysis systems are frequently used in which the samples to be analysed are placed on a test element and possibly react with one or more reagents in a test array on the test element before they are analysed. Optical, particularly photometric, and electrochemical evaluation of test elements are the most common methods for quickly determining the concentration of analytes in samples. Photometric and electrochemical evaluations are generally used in the field of chemical analysis, environmental analysis and in particular in the field of medical diagnosis. Especially in the field of blood glucose diagnosis from capillary blood, test elements which are evaluated photometrically or electrochemically carry a great weight.

In recent years, portable meters for determining blood sugar have become significant. They allow an easy-to-use meter, a piercing aid optimized for piercing pain and a single-use test element to be used at any time to determine blood sugar measured values and hence to effect more accurate insulin dosage for the patient in order to stabilize his blood sugar value.

There are various forms of test elements. By way of example, essentially square lamellae, also called slides, are known, in the centre of which there is a multilayer test array. Diagnostic test elements in strip form are called test strips. For the purpose of three-dimensional separation of a detection zone and a sample application point on a test element, capillary test elements are known from the prior art, e.g. from WO 99/29429.

Sample analysis performed using a test element in an analysis system produces an analysis result, e.g. an ascertained blood sugar concentration value. This analysis result is usually indicated on a visual display panel in the analysis system, e.g. on a liquid crystal display. For users who suffer from visual impairment or blindness, an audible output is additionally provided.

WO 03/039362 A1 relates to a reagentless whole-blood glucose meter in which a processor communicates measured concentration results and/or other information to a controller. The controller operates a visual display panel for presenting the information to a user. In addition or as an alternative to the visual display panel, an audible output for the information may be provided.

WO 02/062212 A1 relates to a management system for personal health which comprises an output apparatus which communicates a treatment recommendation to a patient. The output apparatus can transmit the treatment recommendation using audible, visible or tactile means, for example using a warning tone generator or a system indicator.

A piece of information is audibly output usually using an audible signal generator or a loudspeaker.

US 4,014,016 relates to an output system for blind people in which information is transmitted by audible signals. This is an output system in a pocket calculator, for example, in which the digits of a calculation result are output using uniformly spaced tone sequences with a different number of tones at the same frequency.

DE 25 50 614 relates to a method for audible output through the production of an encoded electrical output signal which denotes a recoverable piece of information. This encoded electrical output signal is used to produce a predetermined number of audible tones at essentially the same frequency, the number of these tones denoting the recoverable piece of information. The recoverable piece of information may be at least one decimal number, for example, with the number of audible tones being equal to the decimal number.

Audible output in an analysis system for analysing a sample using a test element needs to meet particular demands on the operability thereof. The health or even the life of the user may depend on the result of the analysis being output correctly in audible form. By way of example, a measured blood glucose value governs the insulin dose which is administered to a diabetic.

It is therefore an object of the present invention to avoid incorrect audible outputs by an audible signal generator in an analysis system for analysing a sample using a test element or to allow them to be identified by the user.

The invention achieves this object by means of a method for the audible output of a piece of information by an audible signal generator, where the signal generator is arranged in an analysis system and the analysis system analyses a fluid sample using a test element, where analysis results are generated and are processed by a data processing unit, and where a control unit in the analysis system actuates the signal generator, so that the signal generator audibly outputs a piece of information, the signal generator sending an audible test signal in order to test the operability of the signal generator.

An analysis system in this context is a system for analysing a fluid sample, for example for analysing blood, urine or interstitial fluid, particularly a blood sugar meter. The data processing unit in the analysis system receives the analysis results generated in the analysis of a fluid sample arranged on the test element and processes them. By way of example, it takes the analysis results measured (e.g. photometrically or electrochemically) and calculates the concentration of an analyte in the fluid sample. The control unit contained in the analysis system actuates the signal generator, inter alia, for example when the signal generator is intended to be used to output the information about which analysis result processed by the data processing unit has been obtained from the analysis of a fluid sample.

The audible signal generator provided in the analysis system may be any audible signal generator with which a person skilled in the art is familiar, e.g. a buzzer, a loudspeaker or a piezoelectric signal generator.

The information which is output may be a piece of information relating to the operating status of the analysis system or to an analysis result, for example.

In line with the invention, the signal generator in the analysis system sends an audible test signal in order to test the operability of the signal generator. The user of the analysis system is then able to identify whether or not the audible test signal is correct. If the audible test signal is not sent correctly by the signal generator, it can be assumed that a piece of information which has been output by the audible signal generator might likewise be incorrect.

The invention also relates to an analysis system for analysing a fluid sample using a test element, containing an audible signal generator for audibly outputting a piece of information, an analysing for generating analysis results, a data processing unit

for processing the analysis results and a control unit, the control unit being designed such that it actuates the signal generator to send an audible test signal in order to test the operability of the signal generator.

In line with one preferred embodiment of the inventive analysis system, the analysis system contains a switch which is tripped by a test element's being pushed or inserted into the analysis system, the switch being coupled to the controller such that the controller actuates the signal generator to send an audible test signal when the switch is tripped. In this case, a test element needs to be pushed or inserted into the analysis system manually or automatically before a fluid sample is analysed, into a sample holding position for holding the fluid sample on the test element and/or a measuring position for performing a measurement and generating analysis results.

However, the audible test signal may also be sent as soon as the user of the analysis system pushes a particular button on the analysis system (e.g. the button for turning on the analysis system) or automatically at at least one particular instant during operation of the analysis system.

In line with one preferred embodiment of the present invention, the signal generator sends an audible test signal which comprises a tone or a sequence of tones, the tone or the sequence of tones essentially having a constant frequency or the tone or the sequence of tones having a changing frequency. The sequence of tones may be sent such that the individual tones merge into one another or are at least to some extent interrupted by pauses between the tones.

In addition, the signal generator in the inventive method may send an audible test signal which comprises a sequence of tones, at least some of the tones having different tone lengths or the tones having essentially the same tone length.

In line with the invention, the audible signal generator may also send an audible test signal which comprises a tone or a sequence of tones, the volume of the tone or of the sequence of tones changing or the tone or the sequence of tones having essentially the same volume.

Particularly with regard to tone frequencies, tone lengths, tone volumes, and changes of frequencies and volume, the audible test signal should have as many of the features as possible which an audible signal sent by the signal generator during

normal operation of the analysis system for the purpose of outputting a piece of information can have. If an audible signal of this kind for outputting a piece of information comprises merely a sequence of tones having essentially the same frequency, tone length and volume, with the individual tones being interrupted by pauses, then the test signal should have at least the same features to be able to detect a malfunction reliably. In addition, the test signal should be designed as far as possible such that a user can easily identify the correct test signal and any deviations therefrom.

In line with one preferred embodiment of the present invention, the signal generator sends the test signal at the start of the analysis system's being started up. Alternatively, the signal generator can send the or at least one additional test signal at any other instant during operation of the analysis system. The advantage of sending the test signal at the start of the analysis system's being started up is that the user can refrain from performing an analysis if he detects a malfunction in the audible signal generator in the analysis system right at the start. This means that it is possible to avoid, by way of example, taking useless painful blood samples or wasting test elements for analyses using the analysis system which are not able to be used on account of the malfunction in the audible signal generator. Alternatively, upon identifying an incorrect test signal, the user can ask a supervisor whose vision is not impaired to read off the information from a visual indicator if a visual indicator of this kind is available.

The sending of the test signal right at the start of the analysis system's being started up can be triggered by the analysis system's being turned on or by a test element's being pushed into the analysis system automatically or by the user, for example. The operability of the signal generator can be checked using the audible test signal at the same time as the operability of a visual indicator in the analysis system, e.g. a liquid crystal display, is checked, which means that there is no need to accept any additional delay until the analysis system is ready for use.

In line with one preferred embodiment of the present invention, the audible signal generator audibly encodes a piece of information which can be represented as a number with at least one digit. By way of example, the number may be a concentration (ascertained using the analysis system) for an analyte in a sample analysed on a test element, particularly the glucose concentration in blood. The number may comprise one or more digits and may possibly have places after a decimal point.

In addition or as an alternative thereto, the piece of information encoded by the audible signal generator may comprise a piece of information regarding the operational readiness of the analysis system (e.g. the fact that the analysis system has been turned on) or a piece of information about the instant for a particular action to be performed by the user (e.g. the instant for applying his finger to a piercing aid integrated in the analysis system or the instant for transferring a sample for analysis to a test element. The signal generator may also audibly output a piece of information regarding the need to replace or refill a consumable used in the analysis system (e.g. test element, test element magazine, battery, lancet or disposable).

In line with one preferred embodiment of the present invention, the audible signal generator audibly encodes a piece of information as a sequence of tones, the number of tones denoting the piece of information. By way of example, a number can be audibly output such that a number of audible output tones respectively corresponds to a digit value for each digit in the number, with the output of a respective new digit being indicated by a longer pause or another audible signal, for example. In addition, a particular audible signal may be provided for a decimal point and/or an arithmetic sign.

The invention also relates to the use of an audible signal generator, which, for the purpose of audibly outputting a piece of information, is arranged in an analysis system for analysing a sample using a test element, for checking the operability of the signal generator by sending an audible test signal.

CLAIMS:

1. Method for the audible output of a piece of information by an audible signal generator, the audible signal generator is arranged in an analysis system and the analysis system analyses a fluid sample using a test element, where analysis results are generated and are processed by a data processing unit, and where a control unit in the analysis system actuates the signal generator, so that the signal generator audibly outputs a piece of information, the method comprising the audible signal generator sending an audible test signal in order to test the operability of the signal generator, the audible test signal including audible features that allow for identification of any deviation of the generated audible test signal from a correctly generated audible test signal.

2. The method according to claim 1, wherein the audible test signal comprises a tone or a sequence of tones, the tone or the sequence of tones essentially having a constant frequency or the tone or the sequence of tones having a changing frequency.

3. The method according to claim 1 or claim 2, wherein the audible test signal comprises a sequence of tones, at least some of the tones having different tone lengths or the tones having essentially the same tone length.

4. The method according to any one of claims 1 to 3, wherein the audible test signal comprises a tone or a sequence of tones, the volume of the tone or of the sequence of tones changing or the tone or the sequence of tones having essentially the same volume.

5. The method according to any one of claims 1 to 4, wherein sending the audible test signal occurs at the start of the analysis system's being started up.

6. The method according to any one of claims 1 to 5, further comprising the step of the audible signal generator audibly encoding a piece of information which can be represented as a number with at least one digit.

7. The method according to any one of claims 1 to 6, further comprising the step of audibly encoding a piece of information as a sequence of tones, the number of tones denoting

the piece of information.

8. An analysis system for analysing a fluid sample using a test element, containing an audible signal generator for audibly outputting a piece of information, an analyser for generating analysis results, a data processing unit for processing the analysis results and a control unit, wherein the control unit is designed such that it actuates the signal generator to send an audible test signal in order to test the operability of the signal generator, the audible test signal including audible features that allow for identification of any deviation of the generated audible test signal from a correctly generated audible test signal.

9. The analysis system according to claim 8, wherein the analysis system contains a switch which is tripped by a test element's being pushed into the analysis system, the switch being coupled to the controller such that the controller actuates the signal generator to send an audible test signal when the switch is tripped.

10. Use of an audible signal generator, which, for the purpose of audibly outputting a piece of information, is arranged in an analysis system for analysing a sample using a test element, for checking the operability of the signal generator by sending an audible test signal, the audible test signal including audible features that allow for identification of any deviation of the generated audible test signal from a correctly generated audible test signal.