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Ruether et al.(54) **METHOD AND DEVICE FOR MEASURING
BLOOD GAS PARAMETERS****Publication Classification**(76) Inventors: **Horst Ruether, Hart/Graz (AT);
Herfried Huemer, Feldbach (AT)**(51) **Int. Cl.⁷** **A61B 5/00**
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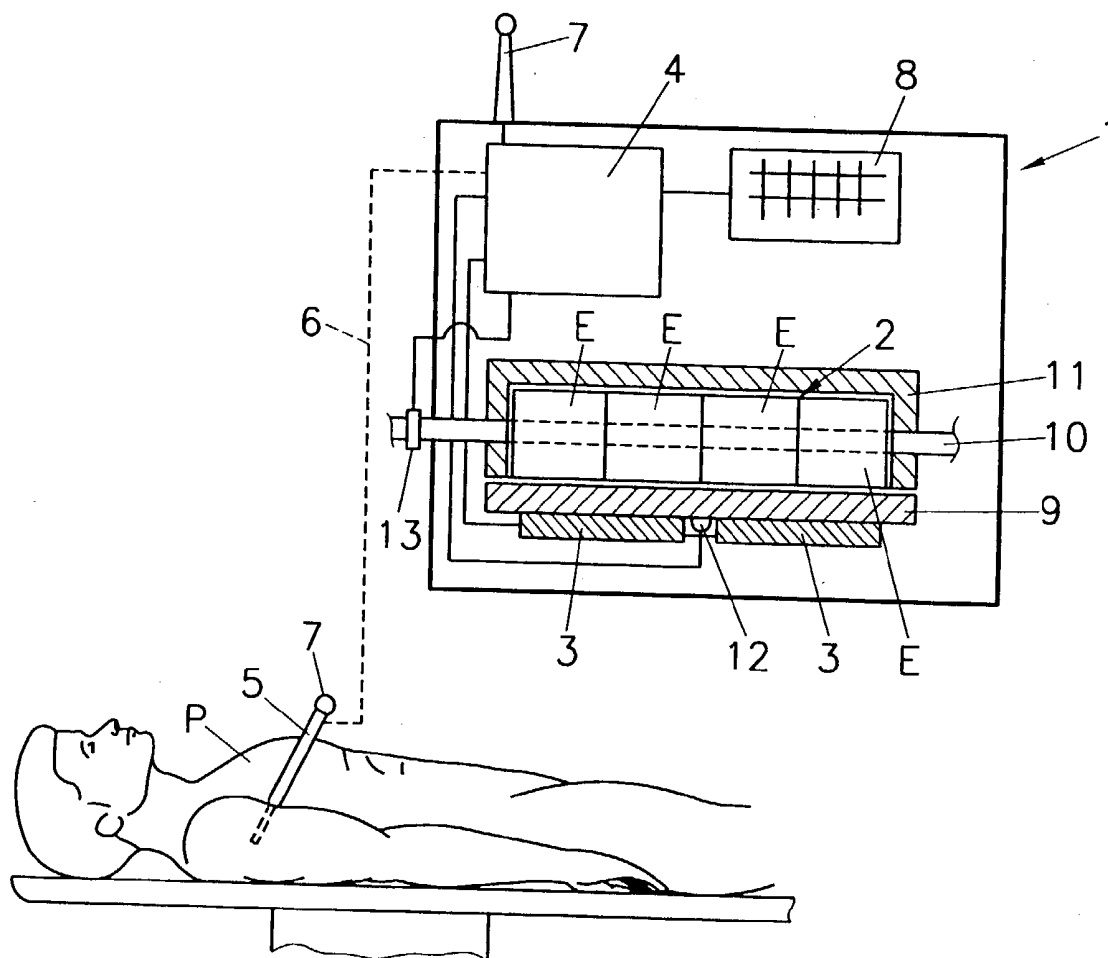
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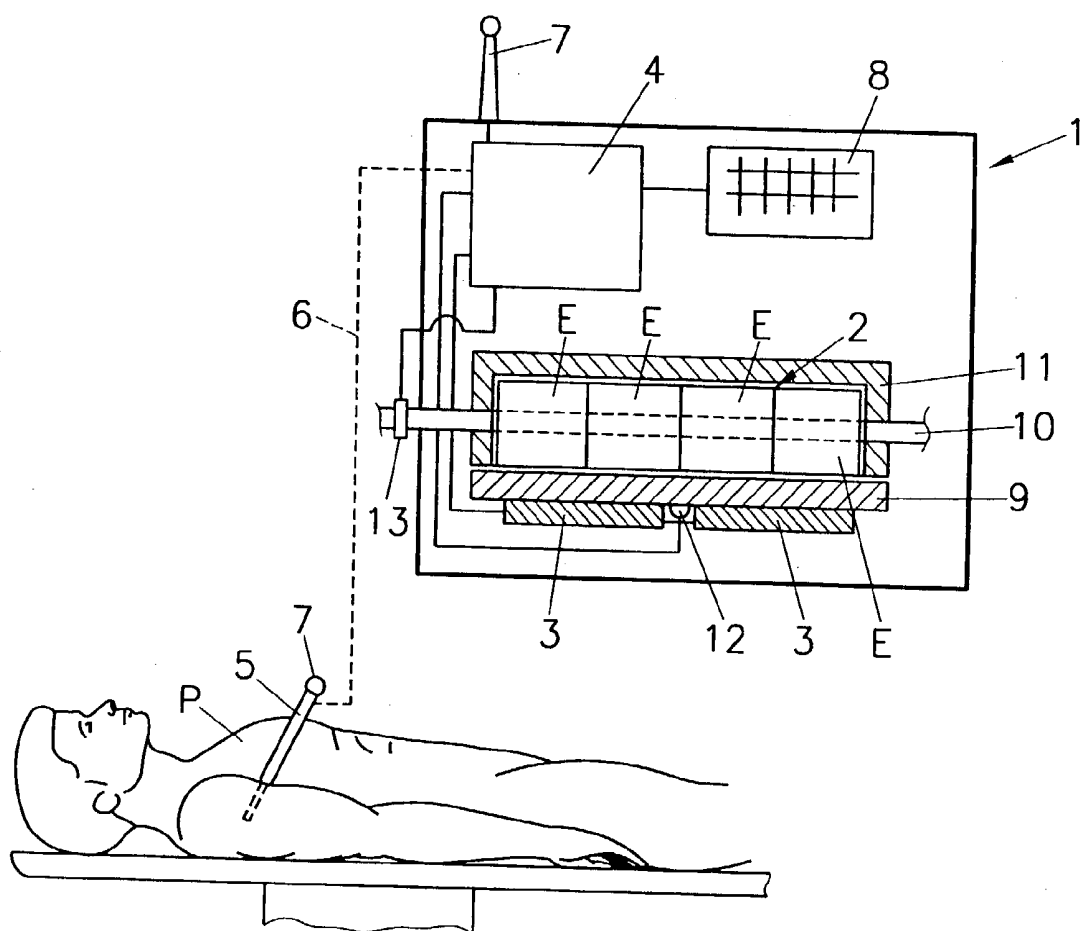
Brent A. Harris
Roche Diagnostics Corporation
9115 Hague Road, Bldg. D
Indianapolis, IN 46250-0457 (US)(21) Appl. No.: **10/449,420**(22) Filed: **May 30, 2003**(30) **Foreign Application Priority Data**

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(57) **ABSTRACT**

The invention relates to a method and device for measuring blood gas parameters, preferably pH, pCO₂, and pO₂, in a blood sample, where the blood sample of a patient is fed into at least one measuring cell of an analyzer. In order to obtain accurate values for the blood gas parameters even in cases where the temperature of the patient deviates from normal temperature, the temperature of the patient or blood sample is measured upon sample withdrawal, and the measured temperature is transmitted to the analyzer or is recorded by the analyzer, and the temperature of the measuring cell of the analyzer is adjusted to the measured temperature by cooling or heating.





METHOD AND DEVICE FOR MEASURING BLOOD GAS PARAMETERS

BACKGROUND OF THE INVENTION

[0001] The invention relates to a method and device for measuring blood gas parameters, preferably pH, pCO₂, and pO₂, in a blood sample, where the blood sample of a patient is fed into at least one measuring cell of an analyzer.

[0002] In the blood gas multi-analyzers described in the literature and commercially available the measuring cells are thermo-stabilized at body temperature, i.e., at 37.0° C. Besides measuring the blood gas parameters pH, pCO₂ and pO₂, these analyzers are used to measure electrolytes, metabolic parameters and Hb-derivatives. For this reason the maximum operating temperature of such analyzers should always be somewhat lower than the temperature of the measuring cell and lies between 31° C. and 33° C. in commercially available devices.

DESCRIPTION OF PRIOR ART

[0003] In U.S. Pat. No. 4,548,259 A a measuring cell is described in the context of a chemical analyzer for photometric measurement of a liquid sample, which is thermo-stabilized by being provided on opposing walls with thermoelements, e.g., Peltier elements, the side walls of the measuring cell furthermore being provided with temperature sensors for measuring the cell temperature. After a sample has been fed into the measuring cell, the cell may be heated or cooled by means of the Peltier elements—depending on the output signal of the temperature sensors—until a predetermined working temperature in the range of 37° C.±0.2° C. is attained. The device described is suitable for the photometric measurement of blood samples, for instance, during which temperature must be kept constant.

[0004] From DE 26 51 356 A1 a measuring device for the photometry of liquid samples is known, in which a Peltier element is proposed as a heat-source or heat-sink for the thermo-stabilization of small measuring vessels (and thus small measurement samples). This permits rapid and highly accurate adjustment of the working temperature (preferably 30° C.) of the measuring device.

[0005] Finally, a blood gas analyzer is described in U.S. Pat. No. 4,717,548, which determines blood gas parameters, such as pH, pCO₂, pO₂ and temperature, in an extracorporeal blood flow situation, for instance during open-heart surgery, and which records the individual signals in real time. The signals are used for parameter monitoring and may activate alarm and switching functions when preset values are exceeded.

[0006] If conventional blood gas multi-analyzers are used for blood gas analysis with patients whose body temperature deviates from the normal temperature (37° C.), for instance in special surgery cases during which body temperature is artificially lowered, it is standard practice to correct the values for pH, pCO₂ and pO₂ obtained from the measuring device with the use of mathematical models, in order to find the medically relevant values at the actual body temperature of the patient. Such corrections are rather imprecise, however, and errors of up to 50% may occur.

SUMMARY OF THE INVENTION

[0007] It is the object of the present invention to propose a method for measuring blood gas parameters, preferably

pH, pCO₂ and pO₂, of a blood sample, and an analyzing device for application of the method, which permits the determining of accurate values for the blood gas parameters even in cases where the temperature of the patient deviates from normal temperature.

[0008] This object is achieved by the invention by providing that the temperature of the patient or blood sample is measured upon sample withdrawal, and that the measured temperature is transmitted to the analyzer or recorded by the analyzer, and that for measuring blood gas parameters the measuring cell of the analyzer is adjusted to the measured temperature by heating or cooling.

[0009] The advantage of the method according to the invention lies in the fact that the partial pressures (pCO₂, pO₂) and the pH-value are measured at the actual temperature of the patient, thus giving values which are of immediate physiological relevance, and rendering superfluous any error-prone subsequent mathematical correction of the measured values. The values obtained permit rapid medical action and provide a basis for emergency measures.

[0010] An analyzing device implementing the method of the invention is characterized by a regulating and control unit, which permits regulating the temperature of the measuring cell in the range from 22° C. to 40° C. depending on the temperature of the blood or the patient measured at the time of sampling.

[0011] The method according to the invention will permit a stable temperature regimen for the measuring cell even at operating or ambient temperatures which are higher than the temperature of the measuring cell.

[0012] It is of particular advantage if the measuring cell is cooled or heated to the measured temperature before the blood sample is entered into the analyzer and if sample entry is enabled only after this temperature is reached. During an operation the anesthetist or internist is assisted by this arrangement since the analyzer will automatically signal when sample entry may take place from the point of view of measurement accuracy.

[0013] In the most basic variant of the invention the blood temperature or the temperature of the patient may be measured in the conventional way by means of a thermometer or measuring probe and entered manually into the analyzer via an entry device (keyboard or touchscreen). Measurement of the temperature, data entry into the analyzer, withdrawal of the blood sample and sample entry into the analyzer should all be effected within a time period of a few minutes, preferably.

[0014] It is of particular advantage if the process is automated in such a way that the blood or patient temperature is measured by a temperature probe placed inside or on the patient, and that the temperature data are transmitted automatically to the analyzer. In this case a special advantage is obtained by continually adjusting the temperature of the measuring cell synchronously with the actual temperature measured. For this purpose the patient temperature may be measured on various parts of the body by means of thermometers, temperature sensors or infrared measuring cells. For accurately determining the basal temperature the placing of a sensor in the anal region is indicated.

[0015] It is of advantage if the measurement signal is amplified directly in the measuring probe, and is converted

in an A/D-converter, and is transmitted noise-free over a distance of a few meters to the analyzer interface as an IF or RF signal. Transmission via cable would also be possible.

DETAILED DESCRIPTION OF THE DRAWING

[0016] The invention will be further described below, with reference to the schematic representation in FIG. 1.

[0017] Reference numeral 1 denotes an analyzer for the measurement of blood gas parameters, preferably pH, pCO₂ and pO₂, in a blood sample, where the analyzer 1 has at least one thermostabilized measuring cell 2 with electrochemical measurement electrodes E, for instance flow sensors. The measuring cell 2 and measurement electrodes E, respectively, can be heated or cooled, for instance by means of Peltier elements 3, via a distributor element 9, which is a good heat conductor, depending on the output signal of a regulating and control device 4, which is connected to a temperature probe 5 placed in or on the patient P. The current temperature of the measuring cell 2, through which a sample capillary 10 runs and which is provided with thermal insulation 11, is recorded by a temperature sensor 12 whose measurement signal is fed to the regulating unit 4.

[0018] For data transmission to the regulating and control device 4 a cable 6 (dashed line) or a wireless link 7 is provided. Depending on the patient temperature measured by the temperature probe 5 the temperature of the measuring cell 2 can be regulated over a range of 22° C. to 40° C., the temperature of the measuring cell 2 preferably being continually and synchronously adjusted to the currently measured temperature of the patient P.

[0019] The patient temperature determined by measurement probe 5 may also be read off and entered into the analyzer 1 by means of an input device 8, for instance a keyboard.

[0020] Furthermore the analyzer 1 may be provided with a locking device 13 on the sample input element, which is controlled by the regulating and control device 4 and enables sample input only when the temperature of the measuring cell 2 is equal to the blood or patient temperature measured.

What is claimed is:

1. A method for measuring blood gas parameters, in a blood sample, comprising the steps of:

measuring the temperature of a patient or the temperature of the blood sample upon sample withdrawal,

feeding the blood sample of the patient into at least one measuring cell of an analyzer,

transmitting the measured temperature to the analyzer, and

for measuring said blood gas parameters adjusting the at least one measuring cell of the analyzer to the measured temperature by heating or cooling said measuring cell.

2. A method according to claim 1, wherein the measuring cell is cooled or heated to the measured temperature before the blood sample is entered into the analyzer, and wherein sample entry is enabled only after said measured temperature is reached.

3. A method according to claim 1, wherein the blood or patient temperature is measured by a temperature probe placed in or on the patient and the temperature data are transmitted automatically to the analyzer.

4. A method according to claim 1, wherein the temperature of the measuring cell is continually adjusted synchronously with the actual temperature measured.

5. A method according to claim 1, wherein the temperature of the measuring cell of the analyzer is regulated in a range from 22° C. to 40° C., depending on the temperature measured.

6. A method according to claim 5, wherein the transmission of the measured temperature to the analyzer is performed via cable, via IF signal, or via RF signal.

7. A method according to claim 1, wherein at least one blood gas parameter of a group consisting of pH, pCO₂, and pO₂ is measured.

8. An analyzer for measuring blood gas parameters in a blood sample, with at least one thermostabilized measuring cell, wherein a regulating and control unit is provided, which permits the temperature of the measuring cell to be regulated in a range from 22° C. to 40° C., depending on blood sample temperature or a patient temperature measured upon sample withdrawal.

9. An analyzer according to claim 8, wherein the analyzer is provided with a locking device on a sample input element, which is controlled by the regulating and control device and enables sample input only when measuring cell temperature is equal to the blood sample temperature or patient temperature measured.

10. An analyzer according to claim 8, wherein the regulating and control unit is connected to a temperature probe placed in or on the patient, and wherein a cable or wireless link is provided for data transmission to the regulating and control unit.

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专利名称(译)	用于测量血气参数的方法和装置		
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[标]申请(专利权)人(译)	RUETHER HORST HUEMER赫尔弗里德		
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当前申请(专利权)人(译)	RUETHER HORST HUEMER赫尔弗里德		
[标]发明人	RUETHER HORST HUEMER HERFRIED		
发明人	RUETHER, HORST HUEMER, HERFRIED		
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其他公开文献	US7491175		
外部链接	Espacenet USPTO		

摘要(译)

本发明涉及一种用于测量血液样品中的血气参数，优选pH，pCO₂和pO₂的方法和装置，其中将患者的血液样品送入分析仪的至少一个测量池中。为了获得血气参数的准确值，即使在患者的温度偏离正常温度的情况下，在取样时测量患者或血液样本的温度，并且将测量的温度传输到分析仪或者是由分析仪记录，并通过冷却或加热将分析仪的测量池的温度调节到测量的温度。

