SYSTEM FOR REAL TIME LONG-TERM RECORDING AND/OR REAL TIME SPECTROSCOPY OF A DISCHARGED URINE AMOUNT FROM A PATIENT

Abstract: System for real time long-term registration of provided urine amount from patients (diuresis) and/or real time spectroscopy of a discharged urine amount, which system includes a registration unit (11); a unit (12) for presentation, communication and user control; and a disposable measuring chamber (13), which measuring chamber (13) has an inlet (14) adapted for receiving urine from a supply hose or similar and an outlet (15) adapted for emptying urine to a collection bag or similar, in which outlet (15) a valve (17) or similar is arranged. The registration unit (11) is adapted for the arrangement and encapsulation of the measuring chamber (13), which registration unit (11) is provided with one or more light sources (19) and one or more sensor means (18) for optical real time reading/registration of urine volume and/or real time spectroscopy of the urine volume.

Fig. 1
System for real time long-term recording and/or real time spectroscopy of a discharged urine amount from a patient

The present invention relates to a system for real time long-term recording of a discharged urine amount (diuresis) for patients and/or real time spectroscopy of the same urine amount, according to the preamble of claim 1.

Background

The measurement of a discharged urine amount from patients, in technical language called diuresis, is an important parameter of that a number of the organs of the body are working satisfactorily. If this changes, or in the worst case stops, it is an early warning of internal malfunction which requires medical care. The diuresis is therefore measured in a large extent, especially at intensive care units and during operations.

The measuring equipment used today is almost exclusively based on a manual reading. The urine is discharged from the bladder of the patient, via a urine catheter, and down into a measuring chamber, which in the principle consists of a graded plastic cassette. The collected volume in the cassette is read off, usually once per hour, and the values are noted manually in a journal or belonging schema. As the cassette is filled up, a valve is opened at the bottom and the cassette is emptied into a collecting bag of plastics.

During the last decades, several instruments for automatic measurement of diuresis have been introduced and patented, without becoming a commercial success. The reason for this is mainly due to three circumstances.

Firstly, the urine flow is very low, so that one gets out of the measuring range of commercially available systems used in the industry. A discharged urine amount of 1 litre a day corresponds, for example, to approximately 0.53 ml per minute.

Secondly, there are strict requirements for sterility. Roughly 1/3 of the hospital infections are urinary tract infections. The largest risk factor is the insertion of urinary track catheters and where the patient lies with these over a longer time period. Bacteria which enter the system often move counter-currently into the urinary system and bladder, and results in infections. One thus aims for closed systems, and it is not desirable to use sensors which contact the urine directly. Sensors like this must in addition be sterilized afterwards, which creates undesired extra work. Possibly a disposable sensor must be used, which results in increased costs.

Thirdly, the urine does not always enter a possible measuring chamber as a smooth flow. Produced urine secreted within a urinary bladder, has a relatively long way to travel via urinary tract catheter, from there via relatively long plastic hose before the measuring chamber. This
results in that it often arises a so-called "water seal", something which results in a burst flow to the measuring instrument, even though the urine production of the patient is steady.

The diuresis is today the only dynamical patient parameter which substantially is read off manually. Paper journals are now rapidly being replaced by electronic journals at the hospitals. One operates with automatic data acquisition, where EKG, blood pressure and other parameters are registered and analyzed automatically. In this environment, manual measurement of diuresis is now a foreign element. It is thus a demand for a simple and reliable automatic system from the users.

There are several patents for measuring diuresis, based on different principle of measurement. US 4 532 936 describes in principle a tube with an optical sensor at the top and one at the bottom. The urine from the patient is guided down the tube from the top. When the tube has been filled up to a level which is registered by the upper sensor, a pump is started which empties the glass until it is registered by the lower sensor. The emptying is performed by a tube pump, and the number of revolutions is registered and will provide a measure of the amount of urine which is removed from the glass. The disadvantages of this system are several. It will not provide exact measurements other than at two points, and no registrations between these. If the urine production, for example, stops at a place between the top and bottom of the glass, this will not be registered, and one loses necessary and critical information. A pump and the further described electronics have also large physical measures and require mains input, which makes it unsuitable for, among others, surgeries.

US 6 640 649 describes an optical measuring system where the urine firstly is collected in a measuring chamber. It works as a reservoir and has a filter which the urine must pass through before it enters a chamber below in the form of drops. Here the number of drops is registered either optically or based on an electrical measurement of conductivity. The problem with registrations based on drop counting, is that the drops will have different sizes and a count will therefore necessarily not provide the correct volume, which is the parameter which is desired to measure. The size of the drops varies, among others, with the viscosity of the fluid, temperature and pressure conditions. Urine from two patients are not directly comparable fluids. One has therefore in US 6 640 649 attempted to correct for this by a "weighing" of the measuring results from certain curves stored in a microprocessor. It is not known how accurate this is, but in any case this is an indirect measuring method for measuring discharged volume, which is the desired parameter.

Another weakness with systems based on drop sensors is that one is dependent on the measuring being aligned approximately vertically. A mechanical angling, which will be the case
during use, will result in that the drops fall outside the light beam, alternatively the sensor, and thus not become registered.

GB 2 328 157 A describes in principle a drop counter which merely is a simplified edition of US 6 640 649, as mentioned above. This has the same weaknesses as are described above, as regards drop-based registration.

JP 02027264 describes a simple form of light absorption measurement in a so-called "Measuring Toilet Chair". This is not measuring equipment for diuresis, i.e. long-term registration of urine, but equipment which to a large extent is used for diagnosing urine functions for patients. The patients urinate and the urine is guided via a catheter and down into a wash basin where a load cell measures the weight of the urine, and other parameters are registered, such as pressure and flow. The publication neither describes how the measurement itself is to be performed.

Object

The main object of the invention is to provide a closed system, based on light, something which makes it possible to acquire information without entering the fluid flow, to avoid/solve the above described problems, among others, with risk of infection. It is further an object that the system should be able to measure fluid volume even though the system no longer hangs in a vertical position.

The invention

A system according to the invention is described in claim 1. Advantageous features of the system are described in claim 2-20.

The present system is an optoelectronic system. The system includes a multi-use measuring instrument, which preferably includes two main parts, a registration unit and a unit for presentation and user control, respectively. The system includes further a disposable measuring chamber, preferably in plastics or similar materials. The registration unit is adapted for arrangement and encapsulation of the measuring chamber therein. Urine from a patient is usually guided via a urinary tract catheter and via a supply hose and into the measuring chamber, where an optical reading by means of light is performed. As the measuring chamber is filled up, the system is arranged to empty the measuring chamber automatically. The measuring chamber preferably consists of entirely or partly transparent plastics or other suitable materials. By sending light in against the measuring chamber, one will due to light refraction at the transition between plastics and fluid, and different absorption properties for light versus air, get a highly visual presentation of the surface of the fluid amount, which at any time is present in the measuring
chamber. The system preferably includes sensor means for registering light, (grey scale - colours), preferably a linear CCD-array or similar means, which sensor means are integrated in the electronic measuring instrument, i.e. the registration unit, and arranged against the measuring chamber. This is in practice a video camera which makes readings in one plane only. The resolution of the sensor unit can vary, but an example has 836 elements - pixels distributed on a length of 10.5 cm. If a measuring chamber with a similar length and a volume of 30 ml is used, one will get a system with a resolution of 0.04 ml, something which is very good.

The output from the sensor unit is a video signal which form will vary dependent of the at any time present fluid amount in the measuring chamber. The video signal from the sensor unit is transferred to a processor unit, preferably a microcontroller, where it is digitized and processed. The basal area in the measuring chamber will be constant and known. The height of the fluid surface in the measuring chamber is continuously registered as described, and one can then at any time quantify the fluid amount in the measuring chamber. From the changes in fluid amount between readings at known time, a discharged urine amount can be calculated for the actual time period. Continuous registrations can be presented in different forms, as instantaneous values, average values during an hour (hour diuresis) or during a day. These data can next be the basis for analyses, trend curves and similar, and be presented on a display or be transmitted to an external unit for further processing.

When the measuring chamber is filled up, the system is arranged for, preferably in that the processor unit actuates a valve at the bottom of the measuring chamber and the content is emptied down into a collecting bag of plastics or other suitable means, whereupon a new registration cycle can start. Data from several measuring cycles can be added, so that one at any time has an overview of the total discharged volume for a registered patient.

At present, there are two types of CCD-arrays which can be used. One edition has the necessary light source integrated, a so-called "Contact Image Sensor (CIS)", while the other requires an external light source. Both types can be used in the system according to the invention. The CIS type has constructional advantages, but can only register colours, possibly grey scale. This is fully acceptable if the system only is to be used for volumetric measurements.

The system can further include means for spectrometry, as an additional function for the measuring instrument.

For patients where the diuresis is measured, it is often also of interest to analyse the consistency of the urine. Today, samples are taken and sent to laboratories. Here are special sticks inserted into a measuring glass with urine, and one gets a colour reagent for a number of substances which are arranged on the stick. The colours are read by spectrometry in an analyser instrument and provide numerical values of a number of substances in the urine. By means of the
system according to the invention, the measuring instrument by use of light in the first place, can be used for real time spectrometric measurements of some substances, for example blood in the urine. This requires an illumination of the urine. The system includes for this preferably one or more separate light sources which are arranged at the opposite side of the CCD-array. Detection of different substances requires different colours - wavelengths of light. This can be achieved by using light sources with different colours, alternatively a combination of several light sources, alternatively filters or light sources with properties to change wavelength/colour.

As mentioned, the system includes a unit for the presentation and user control, which unit preferably includes a display or a monitor for presenting results, and a control panel for the setting of the system. The monitor and the control panel can of course be integrated in the one and same unit, as a touch sensitive monitor. The unit includes further preferably the processor unit of the system, which preferably is provided with software for performing measurements and the setting of the system, for example, alarms and similar. The system further includes an internal or external memory for storing of values. The system preferably also includes communication means for wireless or wired communication with an external unit, such as a computer, PDA or other external units. The system is provided with opportunities for setting alarms and transferring information to external units, for example for registering in the journal of the patients.

The system includes naturally power supply means, rechargeable batteries and other necessary electronics, which is obvious for a skilled person to implement and will not be described further herein.

By means of the system according to the present invention, real time volume measurements can be performed, as opposed to the most other described as prior art, which actually measures flow and must perform integration overtime to calculate volume.

According to the present invention, urine is collected in a measuring chamber. The level in the measuring chamber is read off optically with a high degree of accuracy. In addition the same CCD-array which is used for volume measurements, also register drops. By counting drops and comparing this with the discharged volume, one can tell something about the size of the drops. This can provide information about the consistence of the urine, which can be useful from a medical point of view.

Further advantageous features and details of the invention will appear from the following example description.

**Example**

The invention will in the following be described in detail with references to the attached drawing, where:
Figure 1 shows a system according to the invention,
Figure 2 shows an example of an output video signal from a CCD-array,
Figure 3 shows an example of a CCD-array with integrated light sources, and
Figure 4 shows an example of a CCD-array with external light sources.

Reference is first made to Figure 1, which shows an embodiment of a system according to the invention. A system according to a first embodiment of the invention includes a multi-use measuring instrument, which includes two main parts, a registration unit 11 and a unit 12 for presentation and user control, respectively. The system includes further a disposable measuring chamber 13 which is arranged in the registration unit 11, which registration unit 11 is adapted for the arrangement and encapsulation of the measuring chamber 13. The measuring chamber 13 preferably consists of entirely or partly transparent plastics or similar, and is preferably a disposable equipment. The measuring chamber 13 has preferably either a circular or rectangular cross-section and includes an inlet 14 at the top and an outlet 15 at the bottom. The lower part of the inlet 14 is preferably bias-cut (not shown) so that it provides the largest possible surface to counteract the inlet from being clogged due to crystallization of the urine. The measuring chamber 13 further preferably includes an integrated bacterial filter (not shown), for example a Hepa filter integrated at the top of the measuring chamber 13. This is to provide airing of the measuring chamber 13, and to avoid bacteria from entering in connection with the airing of the measuring chamber 13. When the outlet 15 is closed and measuring chamber 13 is filled up of urine, air must be transported out, while air must be transported in at the emptying of the measuring chamber 13. To avoid the supply of bacteria, this is performed via a Hepa filter.

Urine is usually supplied via a urinary tract catheter (not shown) via a supply hose (not shown) which is arranged to the inlet 14 of the top of the measuring chamber 13. The inner diameter of the inlet 14 is preferably adapted so that the fluid, i.e. the urine, enters the measuring chamber 13 drop-shaped 16. At the bottom of the measuring chamber 13 it is preferably arranged a valve 17 or similar to the outlet 15. In practice this is, for example, a silicone hose which during filling of the measuring chamber 13 is kept closed by a pressure force applied to the hose by an electromagnetic solenoid. The measuring chamber 13 is preferably also provided with a visual scale (not shown), so that there also are opportunities to perform manual monitoring of the fluid amount via a slit (not shown) in the registration unit 11. Naturally the entire registration unit 11 can be of a transparent material, so that a slit is not necessary.

At the one side of the measuring chamber 13 it is arranged sensor means 18, preferably in the form of a linear CCD-array. A CCD-array consists of a number of pixels (836 in standard edition), i.e. light sensitive elements. At the other side of the measuring chamber 13 it is preferably arranged...
one or more light sources 19 (light diodes) which provides light. As light is sent in against the measuring chamber 13 from the light source(s) 19 one gets, partly due to refraction between plastics and fluid (urine) versus plastics and air, partly due to different light absorption from urine and air, a highly visual and clearly defined fluid surface 20. The fluid surface 20 can be registered by the CCD-array 18, to produce a video signal, as shown in Figure 2. By knowing the geometric form of the measuring chamber 13, as the basal area, and reading the surface 20 of the urine as a measure of the height, an integrated processor unit (not shown), such as a microprocessor arranged in the unit 12, at any time will be able to calculate urine volume in the measuring chamber 13. The difference between two readings at time point T1 and T2 will then represent registered volume in this time period. The microprocessor can then continuously present measured data in a desired form on an integrated display 21 of the unit 12.

The unit 12 includes further a control panel 22 for user control of the system and setting of the system. The control panel 22 and display can be an integrated unit, such as a contact sensitive monitor. The processor unit is further provided with software for controlling the system.

Communication between the registration unit 11 and the unit 12 can be wired or wireless, and the units 11 and 12 can be two separate units or be integrated into one unit. The measuring data can further be transferred to an external unit, such as a computer, PDA or similar, via communication means 23, either via wires or wirelessly. As the measuring chamber 13 filled up, the system is arranged to actuate the valve 17 at the bottom, and the measuring chamber 13 is emptied into a suitable unit for emptying, such as a collection bag, and a new registration cycle can be started. Data from several measuring cycles can be added, so that one at all time has an overview of total discharged volume for a registered patient. The system is preferably provided with internal or external memory for storing values.

The system according to the invention can be used for two types of CCD-arrays, as shown in Figures 3 and 4. According to a first example, as shown in Figure 3, the CCD-array 18 is a so-called contact array where the light sources 19 are built into the same physical unit as the array 18.

Another embodiment is also conceivable, as shown in Figures 1 and 3, where one or more light sources 19 are arranged at the opposite side of the measuring chamber 13. The light from the light sources 19, such as light diodes, is then sent via a tube (not shown) with shiny reflecting inside, with an opening against the measuring chamber 13. It is thus achieved a homogenous illumination over the entire measuring chamber 13, even with only one light point. If the light diodes 19 have different colours, for example red - green - blue, a combination of these lights can result in a light with any colour within the visible area. One will thus not only get information about urine amount, but also be able to do simple spectrometry, and acquire other information on substances in the urine, as for example blood.
The system is preferably arranged for being power saving, so that measurements are only performed at definable time intervals. The system is preferably arranged to perform more frequent measurements as the measuring chamber is close to being filled up.

The system is also preferably designed so that the components emit as little heat as possible during use, something which also is emphasized in that the system is only active at defined time intervals.

**Modifications**

Even if the system preferably includes several light sources, the system can also work even if only one light source is used, but one will then use suitable means for scattering the light, and filters or similar to change colour (wavelength) of the light source.

Even if the system is described by examples involving the use of light diodes, it is clear that one also can consider other means, as for example one or more semiconductor lasers, i.e. for example tuneable lasers which can change wavelength. The system must of course then include means for detecting the light from the laser, and possible prisms, mirrors or other means for the scattering of the light must be arranged.

One can also consider the use of a diffractive optical element, where broad banded light is emitted from a light source against an optical element and wherefrom it is transferred to at least one detector to perform spectroscopy.

One can further consider the use of an ultrasound source at the top of the measuring chamber and a sensor at the bottom to measure volume.

Another alternative can be cast-in fiber-optics.

The measuring chamber can be provided with an overflow tube at the inside. If the drain function for some reason should fail, the urine in the measuring chamber will never come so high that it gets into physical contact with the incoming urine flow. This is also for infection considerations.
Claims

1. System for real time long-term registration of discharged urine amount from patients (diuresis) and/or real time spectroscopy of a discharged urine amount, which system includes a registration unit (11); a unit (12) for presentation, communication and user control; and a disposable measuring chamber (13), which measuring chamber (13) has an inlet (14) adapted for receiving urine from a supply hose or similar and an outlet (15) adapted for emptying urine to a collection bag or similar, in which outlet (15) a valve (17) or similar is arranged, characterized in that the registration unit (11) is adapted for the arrangement and encapsulation of the measuring chamber (13), which registration unit (11) is provided with one or more light sources (19) and one or more sensor means (18) for optical real time reading/registration of urine volume and/or real time spectroscopy of the urine volume.

2. System according to claim 1, characterized in that the light source(s) (19) is/are arranged at one side of the measuring chamber (13) and one or more sensor means (18) are arranged at the opposite side of the measuring chamber (13).

3. System according to claim 1, characterized in that one or more sensor means (18) having integrated light sources (19) are arranged at the one side of the measuring chamber (13).

4. System according to claim 1, characterized in that the measuring chamber (13) entirely or partly consists of a transparent material, and that the measuring chamber (13) exhibits a circular or rectangular cross-section.

5. System according to claim 1, characterized in that the inlet (14) in the measuring chamber (13) is bias-cut at its lower end.

6. System according to claim 1, characterized in that the sensor means (18) extends along the entire length of the measuring chamber (13).

7. System according to claim 2, characterized in that the sensor means (18) is a linear CCD-array.

8. System according to claim 3, characterized in that the sensor means (18) is a linear CCD-array including integrated light sources (19).
9. System according to claim 1, characterized in that the system further includes a processor unit, preferably a microcontroller, which is provided with software for controlling the system.

10. System according to claim 1, characterized in that the light source(s) (19) has/have different wavelength/colour and/or has/have the property to change wavelength/colour.

11. System according to any of the preceding claims, characterized in that the system is arranged for illuminating the measuring chamber (13) by means of the light source(s) (19) and optical reading of the volume level by means of the sensor means (18).

12. System according to any of the preceding claims, characterized in that the system is arranged to perform spectroscopy of the provided urine amount by illuminating the measuring chamber (13) by means of the light source(s) (19) with different colours/wavelengths and optical reading of the measuring chamber (13) by means of the sensor means (18).

13. System according to any of the preceding claims, characterized in that the system is arranged to count the number of drops (16).

14. System according to claim 1, characterized in that the unit (12) includes a display (21) and a control panel (22), which can be separate units or integrated units, such as a contact sensitive monitor, communication means (23) for communication with an external unit, and internal or external memory for storing measured data.

15. System according to claim 1, characterized in that the system is arranged to provide a visual presentation of the fluid content and the fluid surface of the measuring chamber.

16. System according to any of the preceding claims, characterized in that the system is arranged to digitize measured data, process the measured data and store measured data by means of the processor unit.

17. System according to claim 2, characterized in that a tube having a shiny interior surface for transport of light is arranged between two light sources (19), arranged close to the top of the registration unit (11) and close to the bottom of the registration unit (11), respectively, which tube has a longitudinal opening towards the measuring chamber (13).
18. System according to claim 1, characterized in that the measuring chamber (13) is provided with a visual scale for manual control of the measuring chamber (13).

19. System according to claim 1, characterized in that the measuring chamber (13) is provided with a filter, such as a Hepa filter, to prevent bacteria from entering at airing/supplying of air in connection with the supply of urine and emptying of the measuring chamber (13).

20. System according to claim 1, characterized in that the measuring chamber (13) is provided with an overflow tube.
INTERNATIONAL SEARCH REPORT

INTERNATIONAL application No. PCT/NO2009/000190

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: GO1F, GO1N, A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>DE 10221823 A1 (OUT OPTOTRANSMITTER-UMWELTSCHUTZ-TECHNOLOGIE), 27 November 2003 (27.11.2003), column 4, line 3 - line 5, figure 2, abstract</td>
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<td>X</td>
<td>US 20030010396 A1 (JURSICH ET AL), 16 January 2003 (16.01.2003), figure 2</td>
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<td>X</td>
<td>US 4343316 A (JESPERSEN CA.), 10 August 1982 (10.08.1982), column 4, line 18 - line 21, figure 1, abstract</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
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  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search 24 August 2009

Date of mailing of the international search report 25-08-2009

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Form "PCT/ISA/210" (second sheet) (July 2008)
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<td>WO 9920983 kZ (ARGONAUT TECHNOLOGIES, INC.), 29 April 1999 (29.04.1999), figures 1.3B</td>
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## INTERNATIONAL SEARCH REPORT

### Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [ ] Claims Nos.:  
   because they relate to subject matter not required to be searched by this Authority, namely:

2. [ ] Claims Nos.:  
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [ ] Claims Nos.:  
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

### Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See additional sheet

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2008)
Continuation of Box III

The present application has been considered to contain at least two inventions which, a priori, are not linked such that they form a single general inventive concept, as required by Rule 13 PCT for the following reasons:

Claim 1 relates in one embodiment to the problem of measuring flow and a spectroscopic property.

As the problems are technically different, no single general concept can be formulated based on the technical features of the inventions. Consequently, the requirements of Rule 13.1 PCT are not met.

It was investigated under Rule 13.2 if any further feature, either in the claims or derivable from the description, could be considered as a same or corresponding feature, and could be considered a special technical feature establishing a technical link between the two groups of inventions.

One such feature is a simultaneous measurement of flow and a spectroscopic property by means of at least one light source and a light sensor.

However, in view of for instance each of US 2003/0010396 and DE 10221823 the present application has, a posteriori, been considered to contain a large number of inventions stated by the dependent claims, which are not linked such that they form a single general inventive concept, as required by Rule 13 PCT for the following reasons:

The single general concept of the present application is the teaching of simultaneous measurement of volume and a spectroscopic property. The cited documents each disclose such systems.

The invention differs from the cited documents by stating the liquid as being urine.

It is considered that urine is an obvious selection.

Thus, the single general concept is obvious and cannot be considered as a single general inventive concept in the sense of Rule 13.1 PCT.

No other features can be distinguished which can be considered as the same or corresponding special technical features in the sense of Rule 13.2 PCT.

Thus, the application lacks unity of invention.
International patent classification (IPC)

A61B 5/20 (2006.01)
GOIF 23/292 (2006.01)
GOIN 21/27 (2006.01)

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Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.
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