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(54) PROBE FLUID ANALYZER SYSTEM

(57) A probe fluid analyzer system includes a lid element for a container. A sensor is mounted or is mountable to the lid element. The sensor is configured to determine measurement data of a probe fluid to be stored in the container. An electronic circuitry electrically connected or connectable to the sensor is configured to generate a radio transmission signal carrying information based on the measurement data for transmission to an external radio receiver. The probe fluid analyzer system includes an antenna for transmitting the radio transmission signal to an external radio receiver.

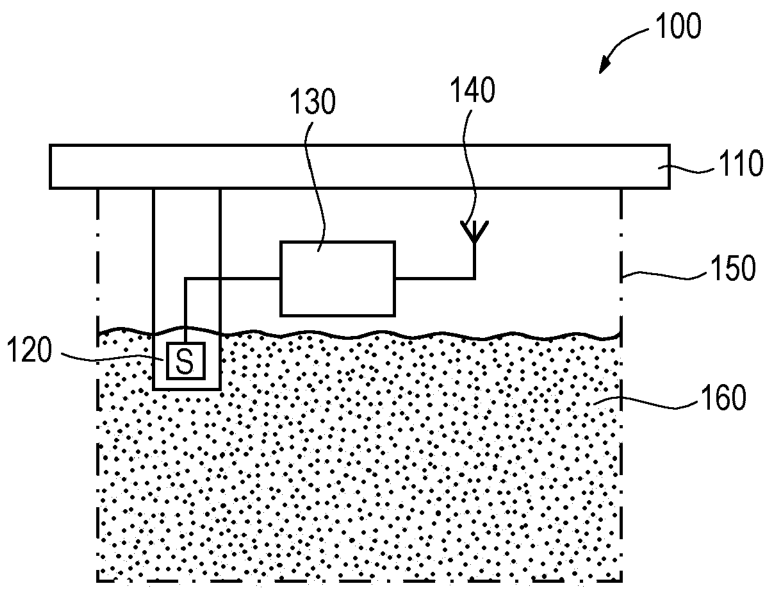

Fig. 1

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Description

Technical Field

[0001] The disclosure relates to the field of analyzing probe fluids, and in particular to determining chemical, biochemical or physical quantities of a probe fluid collected in a container.

Background

[0002] Chemical or biochemical analysis of fluids such as body-fluids, food products, beverages, water etc. is typically carried out in laboratories. This involves collecting the fluid to be analyzed in a container, sealing the container, transferring the container to the laboratory, performing the analysis and communicating the analysis result back to the remitter. This process is well established, mostly avoids any possible risk of contamination and allows highly accurate analysis results. However, it is time consuming and expensive.

[0003] Therefore, on-site testing of fluids has gained increasing importance over the past years. On-site testing allows to obtain analysis results swiftly and in an autonomous manner. However, on-site testing is typically challenged by low accuracy of analysis results, significant risk of contamination and possible hygienic shortcomings. Further, the handling of on-site test kits can be inconvenient or difficult for some people.

Summary

[0004] According to an aspect, a probe fluid analyzer system includes a lid element for a container. A sensor is mounted or is mountable to the lid element. The sensor is configured to determine measurement data of a probe fluid to be stored in the container. An electronic circuitry electrically connected or connectable to the sensor is configured to generate a radio transmission signal carrying information based on the measurement data for transmission to an external radio receiver. The probe fluid analyzer system includes an antenna for transmitting the radio transmission signal to an external radio receiver.

Brief description of the drawings

[0005]

Figure 1 is a schematic illustration of an exemplary probe fluid analyzer system.

Figure 2 is a block diagram of an electronic circuitry coupled to a sensor and an antenna.

Figure 3 is an illustration of an exemplary probe fluid analyzer system.

Figure 4 is a perspective view of an exemplary probe fluid analyzer system.

Figure 5 is a top view on the exemplary probe fluid analyzer system of Figure 4.

Figure 6 is a perspective view of the exemplary probe fluid analyzer system of Figure 4 where the sensor, the electronic circuitry and the antenna are disassembled from the lid element.

Figure 7 is a sectional view of an exemplary probe fluid analyzer system equipped with a measuring chamber.

Figure 8 is a sectional view of the exemplary probe fluid analyzer system of Figure 7 further including a container for the probe fluid.

Figure 9 is a sectional view of the exemplary probe fluid analyzer system of Figure 8 during the process of filling the measuring chamber with probe fluid.

Figure 10 is a sectional view of the exemplary probe fluid analyzer system of Figure 9 after completion of the process of filling the measuring chamber with probe fluid and during transmission of the information based on the measurement data to a radio receiver.

Figure 11 is a sectional view of a further exemplary probe fluid analyzer system including a tool for opening an intake to the measuring chamber for filling the measuring chamber with probe fluid.

Figures 12A-B are sectional views of further exemplary probe fluid analyzer systems equipped with a measuring chamber.

Figure 13 is a sectional view of an exemplary container for the probe fluid after probe fluid collection.

Figure 14 is a sectional view of the exemplary probe fluid analyzer system of Figure 12A combined with the container of Figure 13.

Figure 15 is a sectional view of the exemplary probe fluid analyzer system of Figure 14 during the process of filling the measuring chamber with probe fluid by turning the probe fluid analyzer system upside down.

Figure 16 is a sectional view of the exemplary probe fluid analyzer system of Figure 15 after completion of the process of filling the measuring chamber with probe fluid and after turning the probe fluid analyzer system a second time upside down.

Figure 17 is a sectional view of the exemplary probe fluid analyzer system of Figure 16 during transmission of the information based on the measurement data to a radio receiver.

Detailed description

[0006] It is to be understood that the features of the various exemplary embodiments and examples described herein may be combined with each other, unless specifically noted otherwise. Further, identical or similar parts are referenced by the same reference numerals throughout the various embodiments and examples.

[0007] As used in this specification, the terms "attached", "mounted", "connected", "coupled" and/or "electrically connected/electrically coupled" are not meant to mean that the elements or layers must directly be contacted together; intervening elements may be provided between the "attached", "mounted", "connected", "coupled" and/or "electrically connected/electrically coupled" elements, respectively. However, in accordance with the disclosure, the above-mentioned terms may, optionally, also have the specific meaning that the elements are directly contacted together, i.e. that no intervening elements are provided between the "attached", "mounted", "connected", "coupled" and/or "electrically connected/electrically coupled" elements, respectively.

[0008] Referring to Figure 1, an embodiment of a probe fluid analyzer system 100 includes a lid element 110 for a container. The lid element 110 may, e.g., have a plate-shaped design. It can be placed on the container 150, which may but does not need to form a part of the probe fluid analyzer system 110. The container 150 is therefore illustrated by a dashed dotted line in Figure 1.

[0009] The container 150 is configured to store a probe fluid 160 to be analyzed. A variety of probe fluids 160 could be used for the probe fluid analyzer system 110. By way of example, the probe fluid 160 may be a body-fluid such as, e.g., urine or blood. The probe fluid 160 may alternatively be a fluid such as, e.g., water or a liquid extracted from food products such as juice, oils, milk products, baby food, etc.

[0010] Hence, the container 150 may be a special container such as, e.g., a beaker (urine beaker), a test tube (such as, e.g., a blood or urine tube) etc. In this case, the container 150 typically matches with the lid element 110 in some way, e.g. in size, in having a mutually engaging closure mechanics or even in terms of electrical connections between the lid element 110 and the container 150. On the other hand, the container 150 may also be a simple "everyday" container such as, e.g., a drinking glass, a bottle, a plastic cup, a pot (e.g. jam pot a baby food pot), etc. Such containers 150 need not to have any technical or structural relationship to the lid element 110, except, e.g., their size.

[0011] The probe fluid analyzer system 100 further includes a sensor 120. The sensor 120 is mounted or is mountable to the lid element 110. As will be described in more detail further below, this means that the sensor 120 may be permanently fixed at the lid element 110 (possibly by using an intermediate holding structure) or may be an exchangeable sensor 120 which could be detached from the lid element 110 (or from an intermediate holding structure) to be replaced by a new sensor 120. In the latter case, the lid element 110 is typically equipped with a sensor socket or receptacle (not shown in Figure 1), which allows to remove the sensor 120 and allows to attach a new one, if desired.

[0012] Differently put, while the probe fluid analyzer system 100 may be designed only for single use, if the sensor 120 is a non-exchangeable sensor, the probe fluid analyzer system 100 may, e.g., also be designed for multiple use, if, e.g., an exchangeable sensor 120 is provided. In general, however, depending on the type of the sensor 120, it may also be possible that a multiple use probe fluid analyzer system 100 uses the same, non-exchangeable sensor 120 (e.g. if the sensor 120 is an optical sensor or if the sensor could be cleaned and reused after operation).

[0013] A variety of sensors 120 and/or sensing functions could be provided within the scope of this disclosure. By way of example, the sensor 120 may be an electrochemical sensor, a biochemical sensor, a sensor configured to sense one or more physical properties, e.g. a sensor to sense temperature, optical properties such as color, reflectivity, etc. For example, the sensor 120 may determine measurement data of the probe fluid 160 indicative of one or more of a glucose concentration, a ph-value, a salt concentration, a potassium concentration, a concentration of a chemical substance, a concentration of a biochemical substance, or an electrical conductivity value of the probe fluid 160. In particular, the sensor 120 may be configured to determine the concentration of one or more proteins such as, e.g., of the connecting peptide (C-peptide) which is known to be used for the diagnosis of diseases such as, e.g., diabetes or other metabolic disorders. Further, concentrations of antibodies, hormones, or other probe fluid ingredients indicative of the body condition or indicative of the probe fluid quality (e.g. water quality, food product quality) could be sensed by the sensor 120.

[0014] The sensor 120 is configured to determine measurement data of the probe fluid 160. The measurement data is communicated to an electronic circuitry 130. The electronic circuitry 130 is configured to generate a radio transmission signal which carries information based on the measurement data. Further, the probe fluid analyzer system 100 includes an antenna 140, which is configured to transmit the radio transmission signal to an external radio receiver (not shown). As will be described in more detail further below, the external radio receiver (also termed as an external reader) may, e.g., be a cellular phone, a personal computer, a tablet personal computer, or a watch.

[0015] Figure 2 illustrates a block diagram of the electronic circuitry 130 coupled to the sensor 120 and to the antenna 140. The electronic circuitry 130 may include a first interface (IF) 130_1 interfacing the electronic circuitry 130 to the sensor 120, and may include a second interface (IF) 130_2 interfacing the electronic circuitry 130 to the antenna 140. Further, the electronic circuitry 130 may include an integrated circuit (IC) such as, e.g., a microprocessor 130_3.

[0016] The electronic circuitry 130 may be realized as a monolithic circuit, e.g. as a single semiconductor chip. It is also possible that the electronic circuitry 130 is realized by two or more semiconductor chips, e.g. by a signal processor or baseband chip, which provides for sensor signal interfacing and which processes and/or evaluates the measurement data, and by a RF (Radio Frequency) chip, which provides for radio transmission signal generation and wireless communication standard protocol interfacing. Further, the sensor 120 may be integrated in the same semiconductor chip in which the electronic circuit 130 or a portion of the electronic circuit 130 is implemented.

[0017] The first interface 130_1 may receive (e.g. analog) measurement data from the sensor 120. The first interface 130_1 may, e.g., be configured to convert the analog measurement data into digital measurement data. The microprocessor 130_3 may process the (analog or digital) measurement data. Data processing may include evaluation of the measurement signals to determine the measurement quantities such as, e.g., concentrations of the various ingredients, temperature, optical or other physical properties, etc. In other words, the microprocessor 130_3 may be configured to evaluate the measurement data received from the sensor 120 via the first interface 130_1 in accordance with the function of the probe fluid analyzer system 100.

[0018] The second interface 130_2 is a wireless communication interface configured to generate a radio transmission signal based on the measurement data (e.g. on the processed measurement data provided by the microprocessor 130_3 as described above). To that end, the second interface 130_2 operates in accordance with a wireless communication standard such as, e.g., the NFC (Near Field Communication) standard, the RFID (Radio Frequency Identification) standard or any other appropriate wireless data communication standard.

[0019] NFC is a short range technology that enables devices to communicate when they are brought into close proximity of only a few centimeters distance. NFC enables two devices to share power and data using magnetic field induction at short range. By way of example, the external radio receiver (reader) may be an active tag (transponder), wherein active means that the device has an own power source (battery). The electronic circuitry 130 may, e.g., be a passive tag (transponder). In this case, the electronic circuitry 130 does not have an own power source (battery). Rather, the energy to operate the electronic circuitry 130 and the sensor 120 is then wirelessly provided by the reader (i.e. the external radio receiver) and is harvested in the electronic circuitry 130 for operation.

[0020] RFID is a wireless communication standard which is similar to NFC. However, in RFID the reader cannot act as tag (transponder), i.e. data exchange is only possible from the electronic circuitry 130 to the external radio receiver

[0021] (reader). Similar to NFC the electronic circuitry 130 (RFID tag) is powered by the reader to harvest the energy for operation if the RFID tag (i.e. the electronic circuitry 130) is a passive tag (i.e. without own power source).

[0022] In general, any wireless data communication technology and/or standard may be used for transmitting the radio transmission signal to the external radio receiver and, optionally, for data exchange between the external radio receiver and the electronic circuitry 130 (as it is, e.g., also possible in NFC).

[0023] Hence, the second interface 130_2 may be a wireless data communication interface 130_2 configured to exchange data between the electronic circuitry 130 via the antenna 140 with the external radio receiver and configured to harvest energy provided by the external radio receiver via the antenna 140 for operating the electronic circuitry 130 (which may represent a passive transponder).

[0024] Figure 3 illustrates an exemplary probe fluid analyzer system 300. The probe fluid analyzer system 300 is similar to the probe fluid analyzer system 100, and reference is made to the description above in order to avoid reiteration. Moreover, in the probe fluid analyzer system 300, the antenna 140 is mounted on the lid element 110. As shown in Figure 3, the antenna 140 may be mounted on an upper surface 110A of the lid element 110. The antenna 140 may be shaped as a coil which runs along the edge of the lid element 110. The electronic circuitry 130 may, e.g., also be mounted on the upper surface 110A of the lid element 110.

[0025] The sensor 120 may comprise a strip-shaped carrier element 122 supporting a plurality of electrodes 120_1, 120_2. The electrodes 120_1, 120_2 may, e.g., be formed out of a structured electrode layer disposed on the carrier element 120. The carrier element 120 may be fixedly or detachably connected to the lid element 110, e.g. directly or via an intermediate member as described in more detail further below. Conducting paths 124_1, 124_2 running on the carrier element 122 may electrically connect the electrodes 120_1, 120_2 to the electronic circuitry 130.

[0026] It is to be noted that in the exemplary probe fluid analyzer system 300 shown in Figure 3, the electronic circuitry 130 is arranged at the outside of the probe fluid volume defined by the container 150 and the lid element 110. However, it is also possible that the electronic circuitry 130 is arranged in the interior of this volume. To this end, the electronic circuitry 130 may be mounted on the lower surface 110B of the lid element 110. Further, it is possible that the electronic circuitry 130 is located at a place where it is immersed in the probe fluid during determination of measurement data. This option allows the electronic circuitry 130 to also collect measurement data, e.g. temperature data (since the electronic circuitry 130 is in many cases already equipped with a temperature sensor). And still further, as mentioned earlier, it is possible that the sensor 120 and the electronic circuitry (or a portion of the electronic circuitry 130 such as, e.g., IF 130_1 and/or IC 130_2 and/or IF 130_3) are monolithically integrated in the same semiconductor chip.

[0027] Figures 4, 5 and 6 illustrate various views of a probe fluid analyzer system 400. The probe fluid analyzer system 400 is similar to the probe fluid analyzer system 300, and reference is made to the above disclosure to avoid reiteration.

[0028] As an example and without loss of generality, the probe fluid analyzer system 400 may be a urine beaker. In this and many other cases, the container 150 may be transparent and/or may be provided with a screw closure (not shown) at its upper rim. The lid element 110 can be tightly screwed on the container 150 so as to hermetically seal the lid 110 to the container 150. The circular antenna 140 and the electronic circuitry 130 may be mounted on a support member 420, e.g. a common printed circuit board (PCB), which might be a flexible PCB. The support member 420 (e.g. PCB) may be used as an intermediate holding structure to mount the sensor 120 to the lid element 110. More specifically, the carrier 122 of the sensor 120 may be fixedly or detachably attached to the support member 420, see Figure 6, which may be permanently affixed (e.g. glued, laminated, etc.) to the lid element 110, e.g. the upper surface 110A thereof, see Figures 4 and 5. The sensor 120 may reach into the container 150 through an opening 610 in the lid element 110. The opening 610 may either open into a measuring chamber as will be described in more detail further below or directly into the container 150.

[0029] Figure 7 illustrates an exemplary probe fluid analyzer system 700. The probe fluid analyzer system 700 may be implemented in any of the aforementioned probe fluid analyzer systems 100, 300, 400. Therefore, features of the probe fluid analyzer system 700 described in the following can readily be applied to the probe fluid analyzer systems 100, 300, 400 and vice versa.

[0030] The probe fluid analyzer system 700 is (optionally) provided with a measuring chamber 760. The measuring chamber 760 may be arranged at the lid element 110. In particular, the measuring chamber 760 may be integrally formed with the lid element 110.

[0031] The measuring chamber 760 may be bordered by a chamber wall 710 separating the measuring chamber 760 from the residual interior of the container 150. The chamber wall 710 may, e.g., be integrally formed with the lid element 110, i.e. the lid element 110 and the chamber wall 710 may be formed in one piece, e.g. in one plastic piece. The chamber wall 710 may be shaped as depression of the lid element 110.

[0032] The support member 420 or any other element which might or might not carry the electronic circuitry 130 and/or the antenna 140 may be used to hermetically seal the measuring chamber 760 at its opening 610 in the lid element 110. Further, the lid element 110 may, e.g., have a rim 112, which is, e.g., equipped with a closure mechanics (e.g. screw closure) configured to hermetically connect the lid element 110 to the container 150.

[0033] Optionally, the closure mechanics of the probe fluid analyzer system 700 or any other probe fluid analyzer system disclosed herein may be designed in a manner that it cannot be re-opened without damage. Such protection against reopening the probe fluid analyzer system may be useful in cases of hazardous probe fluids or to prevent unlawful opening (e.g. as in the case of doping tests).

[0034] The measuring chamber 760 is configured to receive probe fluid from the container 150 in order to determine the measurement data from the probe fluid 160 in the measuring chamber 760. An exemplary process to feed the measuring chamber 760 with probe fluid 160 from the container 150 is illustrated in Figures 8 to 10.

[0035] In various examples, the measuring chamber 760 may be configured to be automatically filled by the probe fluid 160 once the lid element 110 is placed on the container 150. Moreover, in various examples, the measuring chamber 760 may be configured to be filled by a predetermined volume of probe fluid 160. In this context, referring to the example of Figure 8, the lid element 110 is placed (e.g. screwed) on the container 150. The chamber wall 710 may have a probe fluid intake 712. The probe fluid intake 712 may be located on a specific height over the bottom of the measuring chamber 760. The height of the probe fluid intake 712 may control the automatic filling process and may accurately determine the amount of probe fluid 160 which enters the measuring chamber 760 during the filling process as, e.g., shown in Figures 8 to 10.

[0036] In one example, the probe fluid intake 712 may simply be a hole in the chamber wall 710. In other examples, the probe fluid intake 712 may be configured to suppress discharge of the probe fluid 160 from the measuring chamber 760 back into the container 150. For instance, the probe fluid intake 712 may be a mechanical filter, a diffusion barrier, a valve or a combination of these elements. A mechanical filter may, e.g., be used to prevent suspended bodies or particles to enter the measuring chamber 760. Suspended bodies or particles could impair the measurement, if they physically engage with the sensor 120 or, in particular, with the electrodes 120_1, 120_2 of the sensor 120. A diffusion barrier and/or a valve could, in particular, be useful if the measuring chamber 760 simultaneously acts as a reaction chamber. For example, one or more reaction substances may be deposited in the measuring chamber 760. In some cases, the sensor 120 and, in particular, the electrodes 120_1, 120_2 of the sensor 120 may be covered with reaction substances such as, e.g., antibodies or enzymes. The operation of the probe fluid analyzer system 700 may then rely on the measurement of the concentration of reaction products generated by the reaction between the reaction substances deposited in the measuring chamber 760 and ingredients of the probe fluid 160. Such measurements may rely both on the exact knowledge of the probe fluid diagnosis volume in the measuring chamber 760 and/or on the prevention of ongoing probe fluid exchange between the measuring chamber 760 and the container 150 during measurement.

[0037] Figure 9 illustrates a stage during the automatic filling of the measuring chamber 760 shortly before the sensor 120 is immersed in the probe fluid 160.

[0038] Figure 10 illustrates a final state of the filling process. A predetermined filling level is obtained because the probe fluid 160 in the measuring chamber 760 traps the air above the probe fluid 160 once the filling level exceeds the probe fluid intake 712. The residual air trapped over the probe fluid in the measuring chamber 760 may also serve to keep the carrier element 122 and/or the conducting paths 124_1, 124_2 dry and clean.

[0039] It is also possible that a concentration of an ingredient of the probe fluid 160 (i.e. not a reaction product) is directly determined by the sensor 120 and/or that a quantity of the probe fluid 160 is determined which does not rely on a certain dosage volume and/or the prevention of fluid exchange between the measuring chamber 760 and the container 150. In these and other cases, a simple through hole or a mechanical filter may be sufficient to serve as the probe fluid intake 712 to the measuring chamber 760, or the measuring chamber 760 may completely be avoided.

[0040] Other solutions to fill the measuring chamber 760 with a predefined volume of probe fluid 160 are also feasible. By way of example, the measuring chamber 760 may be applied with a vacuum which controls the filling process. Referring to Figure 11, a puncturing device such as, e.g., a hollow needle 1012 may be provided in the container 150, e.g. mounted at the bottom of the container 150. The puncturing device may cause the measuring chamber 760 to be punctured once the lid element 110 is placed (e.g. screwed or otherwise fixedly closed) on the container 150.

[0041] By virtue of the vacuum, the probe fluid 160 may then be sucked into the measuring chamber 760. The amount of probe fluid 160 sucked into the measuring chamber 760 may be controlled by the pressure of the vacuum and/or by the size of the measuring chamber 760 (e.g. if the measuring chamber 760 is completely filled with probe fluid 160).

[0042] As illustrated in Figures 10 and 11, an external radio receiver 1050 such as, e.g., a cellular phone or a smartphone or any other reader device may be brought into proximity to the lid element 110 of the probe fluid analyzer system 700. For instance, the external radio receiver may simply be put down on the lid element 110. As already described above, the external radio receiver 1050 may then power the electronic circuitry 130 and the sensor 120 via the antenna 140 and may read out the information based on the measurement data. A software application program running on the external radio receiver 1050 may be used to control the communication with the electronic circuitry 130 and to display, manage and/or store the received information data.

[0043] Figures 12A and 12B illustrate further examples of a probe fluid analyzer system 1200. Referring to Figure 12A, a measuring chamber 1260 may be provided in a space directly below the lower surface 110B of the lid element 110. The measuring chamber 1260 may be formed as an integral part of the lid element 110.

[0044] The measurement chamber 1260 may be defined by a chamber wall 1210 which may form a part of the lid element 110. The vertical dimension of the measurement chamber 1260 may in this example be relatively small, e.g. equal to or less than a few (say 2, 3, 4, 5 or 10) millimeters. The chamber wall 1210 may be provided with a probe fluid intake 1212, which may be designed similar as the probe fluid intake 712, and reference is made to the above disclosure in order to avoid reiteration.

[0045] In the example of Figure 12A the electronic circuitry 130 may be located outside of the measuring chamber 1260, while in the example of Figure 12B the electronic circuitry 130 is located in the interior of the measuring chamber 1260 together with the sensor 120. In the latter case, as mentioned before, the electronic circuitry 130 can contribute to the determining of measurement data such as, e.g., temperature data.

[0046] Moreover, the measuring chamber 1260 may be completely filled by probe fluid 160. Therefore, the probe fluid analyzer system 1200 can also provide for a predetermined volume of probe fluid 160 to be analyzed as required in some applications.

[0047] Figures 13 to 17 illustrate exemplary operation stages of a probe fluid analyzer system 1200.

[0048] Referring to Figure 13, probe fluid 160 has been collected in the container 150. Again, all kinds of probe fluid 160 and/or containers 150 may be used.

[0049] The container 150 is then closed by the lid assembly as, e.g., illustrated in Figures 12A or 12B. As noted previously, the term probe fluid analyzer system 1200 may again either relate only to the lid assembly, as for instance illustrated in Figures 12A and 12B, or to the combination of the container 150 and the lid assembly as shown in Figure 14.

[0050] The measuring chamber 1260 may then be completely filled. Various options are available. For instance, referring for example to Figure 15, the fluid analyzer system 1200 may be turned upside down to completely fill the measuring chamber 1260 with probe fluid 160. Other possibilities to completely fill the measuring chamber 1260 with probe fluid 160 may rely on applying the measuring chamber 1260 with a vacuum and puncturing the measuring chamber 1260, e.g. by a hollow needle (see Figure 11). In this and other cases, the measuring chamber 1260 may be completely filled by probe fluid 160 without the need of turning the probe fluid analyzer system 1200 upside down.

[0051] Returning to the example of Figure 14, the measuring chamber 1260 may be completely filled by gravity. Then, as illustrated in Figure 16, the probe fluid analyzer system 1200 is a second time turned upside down. The probe fluid 160 remains in the measuring chamber 1260. This may be achieved either due to the effect of capillary forces and the small amount of probe fluid pressuring against the probe fluid intake 1212 (even if the probe fluid intake 1212 is merely a hole) or may be supported by additional features such as a specific design (e.g. filter, diffusion barrier, valve, etc.) of the probe fluid intake 1212 as already mentioned. The probe fluid analyzer system 1200 completely excludes any possibility of fluid exchange between the measuring chamber 1260 and the container 150 after completion of the filling process.

[0052] In all embodiments, the probe fluid measuring chamber 760, 1260 may be a sterile volume which might be filled with a protective gas or vacuum.

[0053] Figure 17 corresponds to the wireless data communication process of Figures 10 and 11, and reference is made to the above description for the sake of brevity.

[0054] Waste disposal of the probe fluid analyzer systems described herein may depend on the specific application (in particular the kind of probe fluid 160) and the specific design of the probe fluid analyzer system. However, it is believed that existing waste disposal management processes may at least partly be applicable to the probe fluid analyzer systems disclosed herein.

[0055] A further aspect of the disclosure involves the return of the filled probe fluid analyzer systems to the producer. The producer may then use laboratory analytics to verify the measurement data and/or the information based on the measurement data as computed by the electronic circuitry 130. These quantities may be stored in a non-volatile memory of the electronic circuitry 130 and could be used to develop and refine the acquisition, evaluation and/or interpretation of the measurement data for product advancements.

[0056] In conclusion, the probe fluid analyzer system disclosed herein allows for a simple and inexpensive probe fluid analysis on the ground. There is not much the user can do wrong and the user does not need to come into contact with the probe fluid sample.

[0057] The following examples pertain to further aspects of the disclosure:

[0058] Example 1 is a probe fluid analyzer system, comprising a lid element for a container; a sensor mounted or mountable to the lid element, the sensor being configured to determine measurement data of a probe fluid to be stored in the container; an electronic circuitry electrically connected or connectable to the sensor and configured to generate a radio transmission signal carrying information based on the measurement data; and an antenna for transmitting the radio transmission signal to an external radio receiver.

[0059] In Example 2, the subject matter of Example 1 can optionally include wherein the antenna is mounted on the lid element.

[0060] In Example 3, the subject matter of Example 1 or 2 can optionally include a closure element configured to hermetically seal the lid to the container.

[0061] In Example 4, the subject matter of any of the preceding Examples can optionally include a measuring chamber provided at the lid element and configured to receive probe fluid from the container, wherein the sensor is configured to determine measurement data from the probe fluid in the measuring chamber.

[0062] In Example 5, the subject matter of any of the preceding Examples can optionally include wherein the measuring chamber is configured to be automatically filled by the probe fluid once the lid element is placed on the container.

[0063] In Example 6, the subject matter of any of the Examples 1 to 4 can optionally include wherein the measuring chamber is configured to be filled by the probe fluid once the lid element is placed on the container and turned upside down.

[0064] In Example 7, the subject matter of any of the Examples 4 to 6c an optionally include wherein the measuring chamber has a probe fluid intake, the probe fluid intake is configured to suppress discharge of the probe fluid from the measuring chamber back into the container.

[0065] In Example 8, the subject matter of any of the Examples 4 to 7 can optionally include wherein the measuring chamber is applied with a vacuum, a protective gas or an air dehumidifier agent.

[0066] In Example 9, the subject matter of any of the Examples 4 to 8 can optionally include wherein the measuring chamber accommodates a reaction agent.

[0067] In Example 10, the subject matter of any of the Examples 4 to 9 can optionally include wherein the measuring chamber is configured to receive a predetermined volume of probe fluid.

[0068] In Example 11, the subject matter of any of the Examples 4 to 10 can optionally include wherein the measuring chamber is configured to be completely filled by the probe fluid.

[0069] In Example 12, the subject matter of any of the Examples 4 to 10 can optionally include wherein the measuring chamber is configured to be partly filled by the probe fluid.

[0070] In Example 13, the subject matter of any of the preceding Examples can optionally include wherein the sensor is an electrochemical and/or biochemical sensor and/or a sensor configured to sense a physical property, in particular a temperature sensor and/or an optical sensor.

[0071] In Example 14, the subject matter of any of the preceding Examples can optionally include wherein the sensor comprises a strip-shaped carrier element supporting a plurality of electrodes.

[0072] In Example 15, the subject matter of any of the preceding Examples can optionally include wherein the sensor is an exchangeable sensor detachably mounted on the lid element.

[0073] In Example 16, the subject matter of any of the preceding Examples can optionally include wherein the electronic circuitry is located at a place where it is immersed in the probe fluid during determination of measurement data.

[0074] In Example 17, the subject matter of any of the preceding Examples can optionally include wherein the electronic circuitry comprises a non-volatile memory for storing the measurement data and/or the information based on the measurement data.

[0075] In Example 18, the subject matter of any of the preceding Examples can optionally include wherein the electronic circuitry is wirelessly powered by the external radio receiver.

[0076] In Example 19, the subject matter of any of the preceding Examples can optionally include the container for the probe fluid.

[0077] While this invention has been described with reference to illustrative embodiments, this description is not intended to be construed in a limiting sense. Various modifications and combinations of the illustrative embodiments, as well as other embodiments of the invention, will be apparent to persons skilled in the art upon reference to the description. It is therefore intended that the appended claims encompass any such modifications or embodiments.

Claims

1. A probe fluid analyzer system, comprising:

a lid element for a container;
a sensor mounted or mountable to the lid element, the sensor being configured to determine measurement data of a probe fluid to be stored in the container;
an electronic circuitry electrically connected or connectable to the sensor and configured to generate a radio transmission signal carrying information based on the measurement data; and
an antenna for transmitting the radio transmission signal to an external radio receiver.

2. The probe fluid analyzer system of claim 1, wherein the antenna is mounted on the lid element.

3. The probe fluid analyzer system of claim 1 or 2, further comprising:
a closure element configured to hermetically seal the lid to the container.

4. The probe fluid analyzer system of any of the preceding claims, further comprising:
a measuring chamber provided at the lid element and configured to receive probe fluid from the container, wherein the sensor is configured to determine measurement data from the probe fluid in the measuring chamber.

5. The probe fluid analyzer system of claim 4, wherein the measuring chamber is configured to be automatically filled by the probe fluid once the lid element is placed on the container.

6. The probe fluid analyzer system of claim 4, wherein the measuring chamber is configured to be filled by the probe fluid once the lid element is placed on the container and turned upside down.

7. The probe fluid analyzer system of one of claims 4 to 6, wherein the measuring chamber has a probe fluid intake, the probe fluid intake is configured to suppress discharge of the probe fluid from the measuring chamber back into the container.

8. The probe fluid analyzer system of one of claims 4 to 7, wherein the measuring chamber is applied with a vacuum, a protective gas or an air dehumidifier agent.

9. The probe fluid analyzer system of one of claims 4 to 8, wherein the measuring chamber accommodates a reaction agent.

10. The probe fluid analyzer system of one of claims 4 to 8, wherein the measuring chamber is configured to receive a predetermined volume of probe fluid.

11. The probe fluid analyzer system of any of the preceding claims, wherein the sensor is an electrochemical and/or biochemical sensor and/or a sensor configured to sense a physical property, in particular a temperature sensor and/or an optical sensor.

12. The probe fluid analyzer system of any of the preceding claims, wherein the sensor comprises a strip-shaped carrier element supporting a plurality of electrodes.

13. The probe fluid analyzer system of any of the preceding claims, wherein the sensor is an exchangeable sensor detachably mounted on the lid element.

14. The probe fluid analyzer system of any of the preceding claims, wherein the electronic circuitry is located at a place where it is immersed in the probe fluid during determination of measurement data.

15. The probe fluid analyzer system of any of the preceding claims, wherein the electronic circuitry comprises a non-volatile memory for storing the measurement data and/or the information based on the measurement data.

16. The probe fluid analyzer system of any of the preceding claims, wherein the electronic circuitry is wirelessly powered by the external radio receiver.

17. The probe fluid analyzer system of any of the preceding claims, further comprising:
the container for the probe fluid.

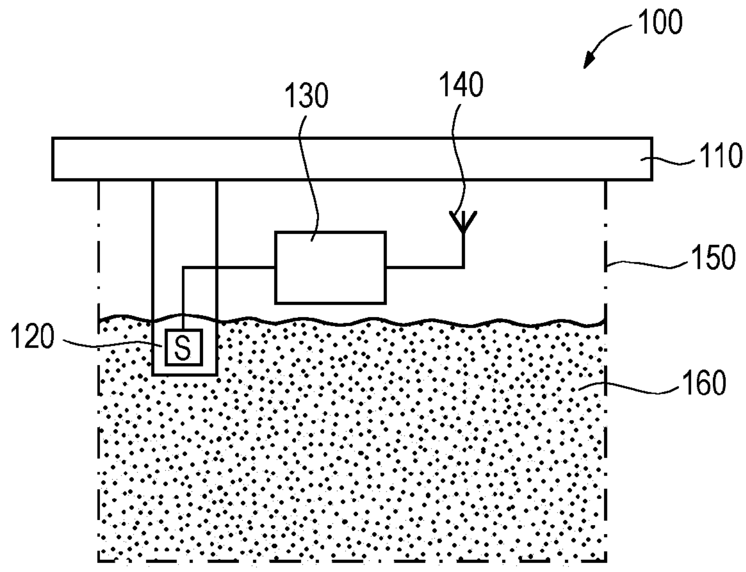


Fig. 1

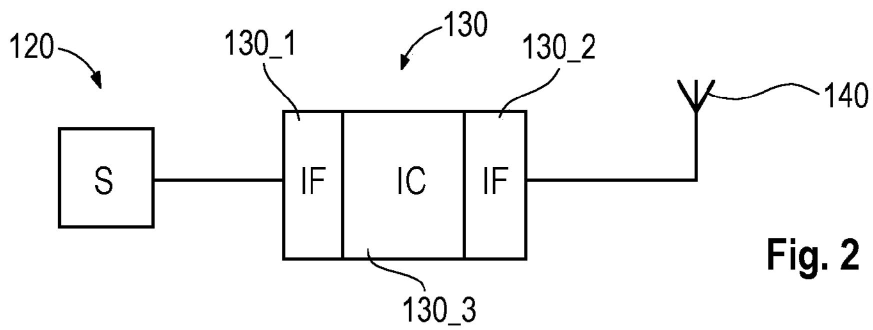


Fig. 2

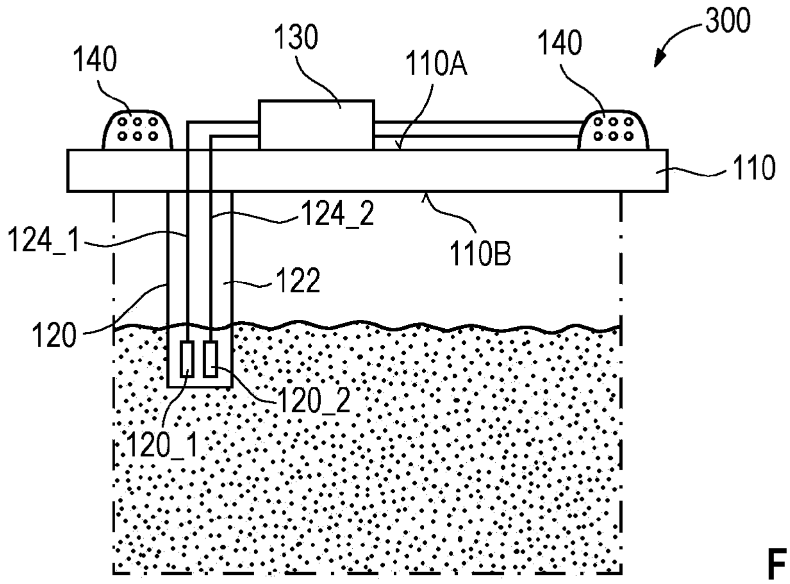
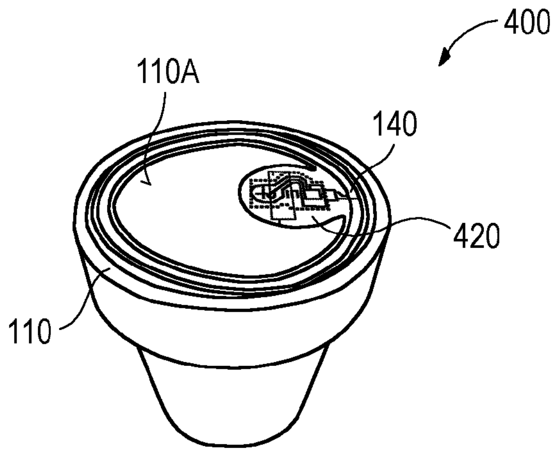


Fig. 3



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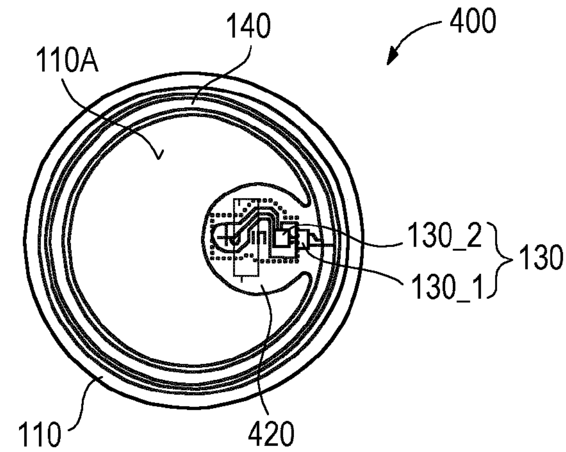
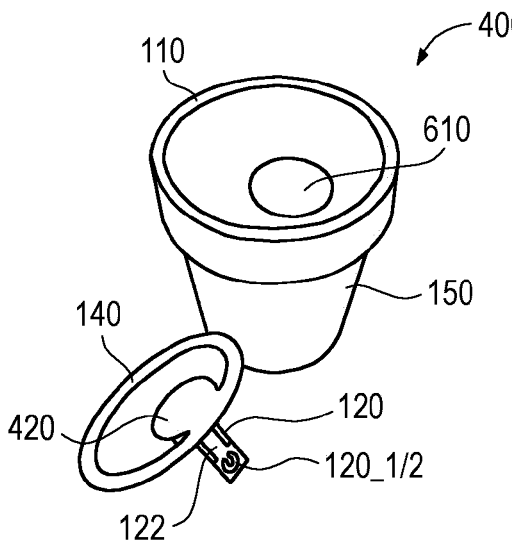


Fig. 5



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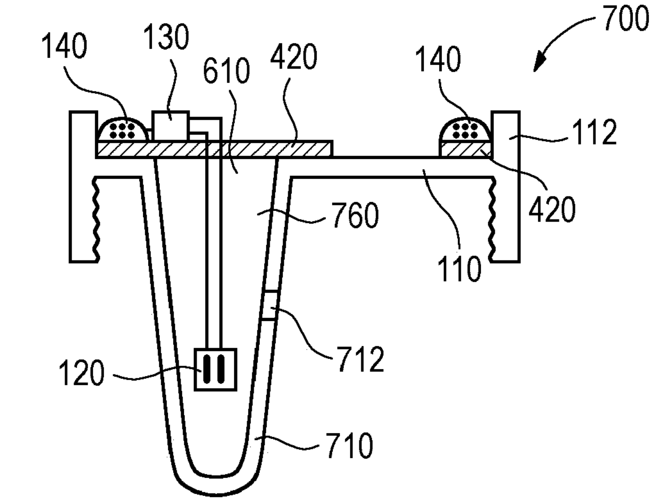
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Fig. 7

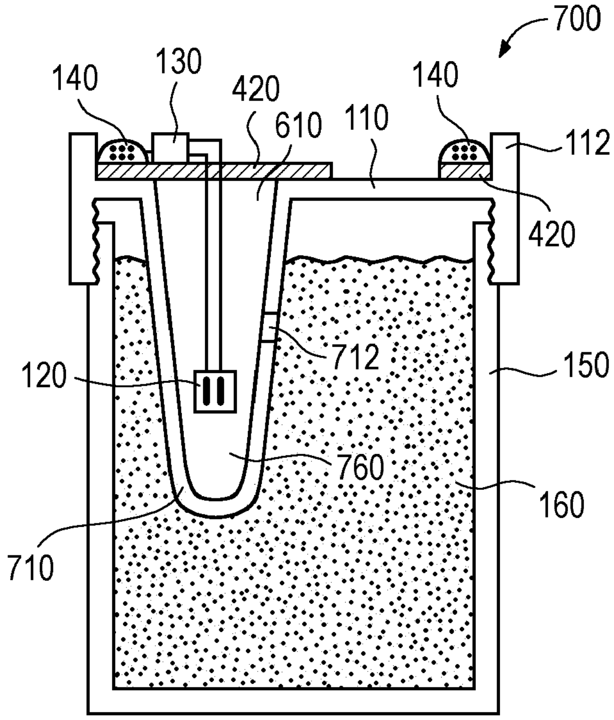
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Fig. 8

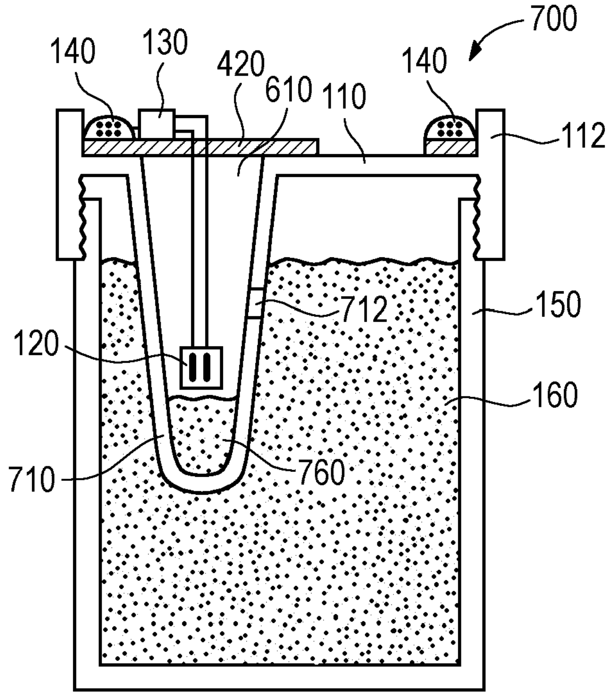
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Fig. 9

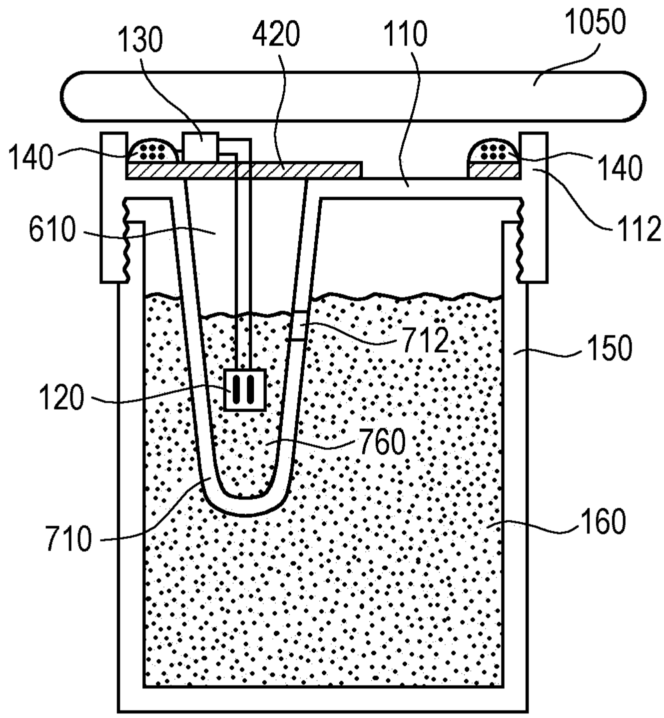
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Fig. 10

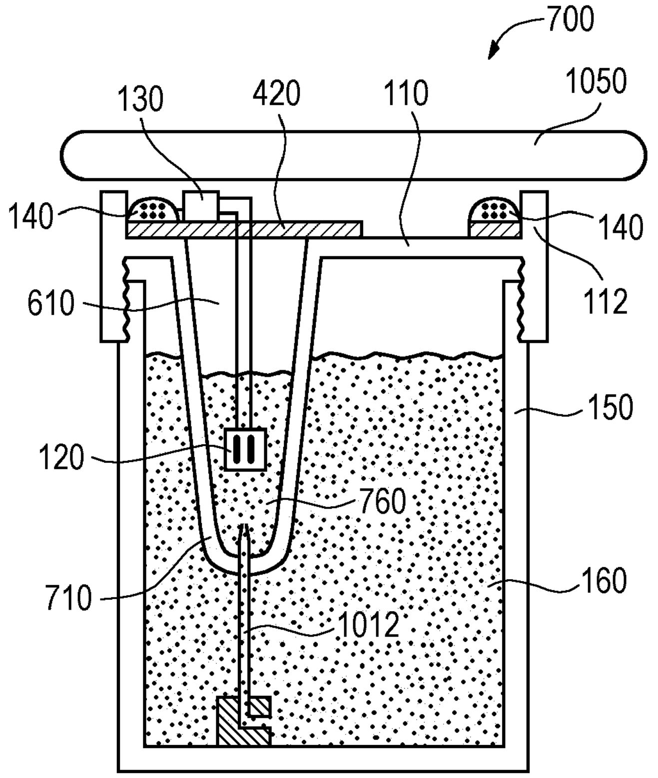

Fig. 11

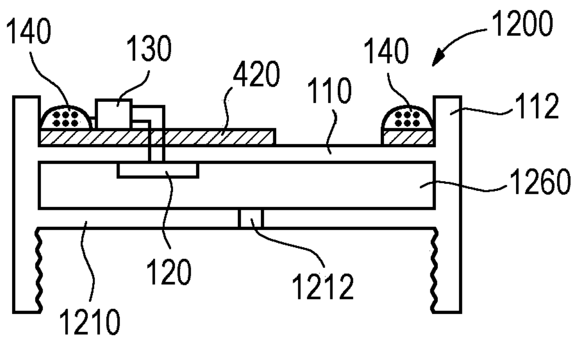

Fig. 12A

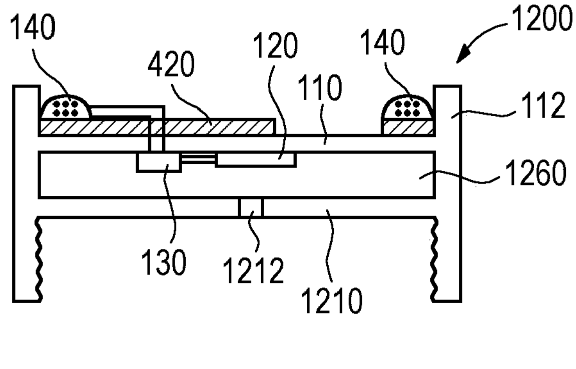

Fig. 12B

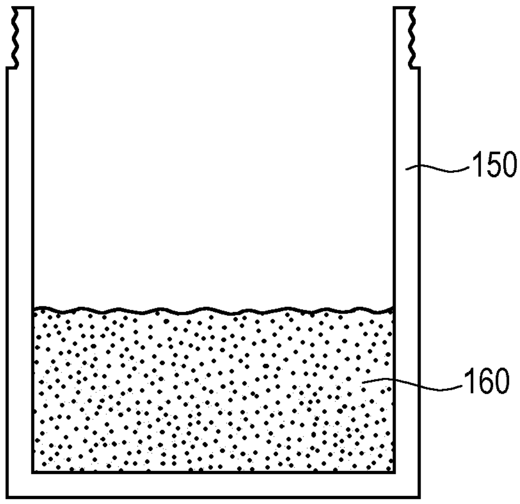

Fig. 13

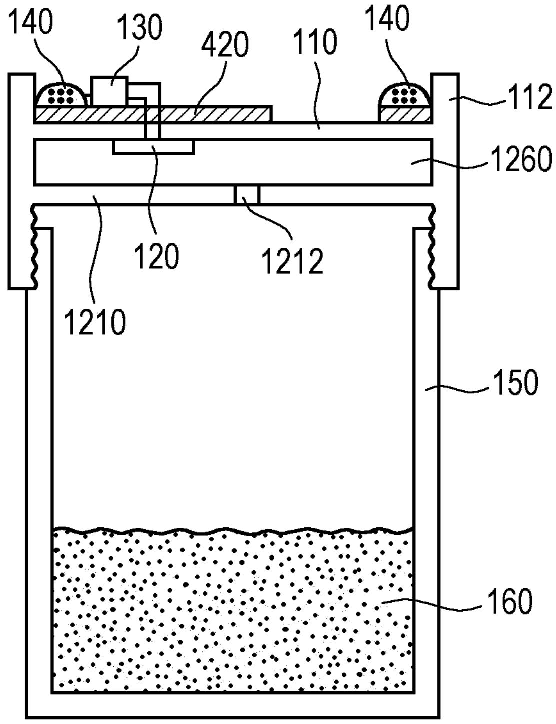

Fig. 14

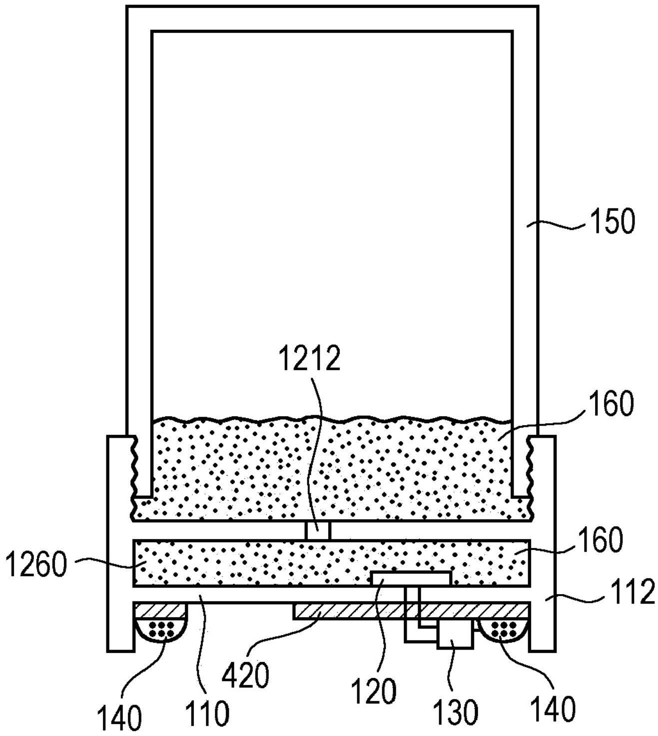
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Fig. 15

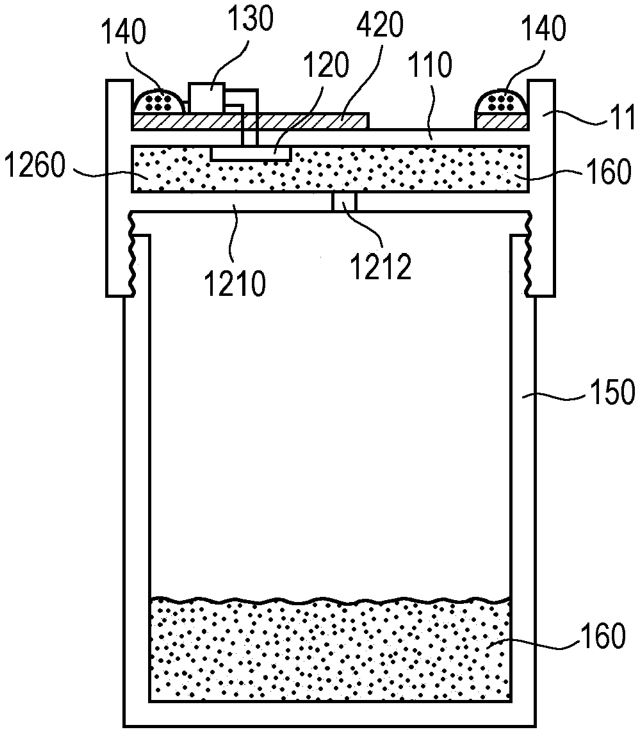
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Fig. 16

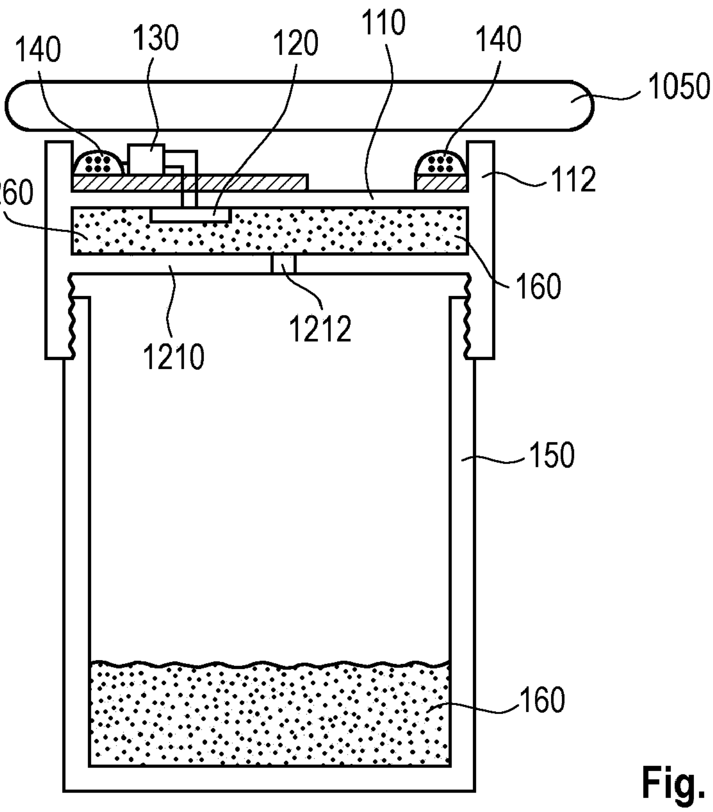

Fig. 17

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EUROPEAN SEARCH REPORT

Application Number
EP 19 16 7611

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2016/010959 A1 (ASSIMITI ROBERT [US]; CT O LLC [US]) 21 January 2016 (2016-01-21) * page 1, paragraph 1 * * page 3, paragraph 1 - page 7, paragraph 1; figures 1-5 * -----	1-17	INV. B01L3/00
A	US 2018/257068 A1 (BRINTON WILLIAM [US]) 13 September 2018 (2018-09-13) * figures 1-8 * * paragraphs [0019], [0022] - [0025], [0029] - [0030] * -----	1-17	
A	WO 2015/014858 A1 (OVIZIO IMAGING SYSTEMS NV SA [BE]) 5 February 2015 (2015-02-05) * figures 1-2 * * page 11, line 7 - page 12, line 35 * -----	1-17	

TECHNICAL FIELDS SEARCHED (IPC)

B01L
B65D

The present search report has been drawn up for all claims

3

Place of search	Date of completion of the search	Examiner
The Hague	6 September 2019	Bockstahl, Frédéric

CATEGORY OF CITED DOCUMENTS

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06-09-2019

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WO 2015014858 A1	05-02-2015	EP 3027723 A1	08-06-2016
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