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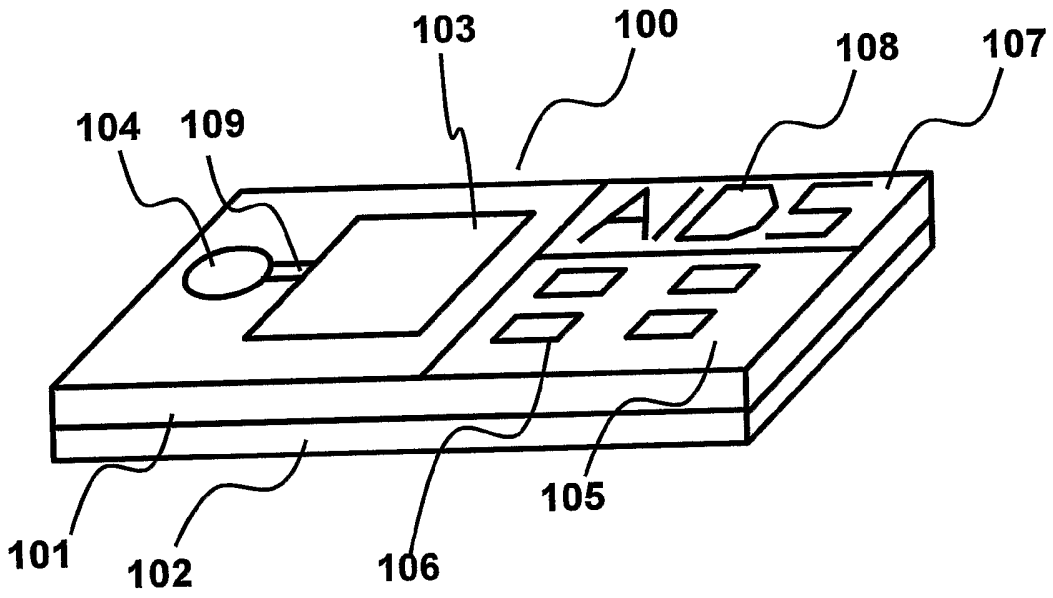

(57) Abstract: This patent relates to systems to diagnose bio-information such DNA etc. It is suitable for biosystems, MEMS, and nanosystems. Any liquid including water, blood or urine first activates a battery on a substrate, and energy consuming parts on the substrate use the electrical energy from the battery for disease diagnosis or health screen. It has a potential application in the area of any systems using electrical power activated by water such as disposable health screen kit, DNA chip (Microarray) and a Lab-on-a-chip.

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SYSTEMS WITH WATER-ACTIVATED BATTERY

FIELD OF THE INVENTION

The present invention relates to systems with water-activated battery that can be used for MEMS (Micro Electro Mechanical Systems), nanosystem, biosystems such as lab-on-a-chip or micro fluidics.

BACKGROUND OF THE INVENTION

The advances in the areas of MEMS (Micro Electro Mechanical Systems) and micromachining over the past decades have made possible the fabrication of micro- and nano-level systems such as the lab-on-a-chip, DNA chip, optical microsystems and micro-transceiver. Using batch process such as bulk and surface micromachining technology, these MEMS or bioMEMS devices can be easily fabricated with microactuator, microsensor and circuits on a substrate. Today, the applications of these nano-scale devices have diversified into a myriad of purposes, most notably in the area of the sensing and amplification of bio-signals. Indeed, the application of nanotechnology to the development of biosensors constitutes one of the main thrusts in today biotechnology research.

However, one of the major problems face by current MEMS or bioMEMS technologies is that of the energy source. Although systems such as lab-on-a-chip or DNA chip are fabricated on a chip, the current microsystems still require electrical energy from outside conventional battery or light for detection. For example, a microarray (DNA chip) requires an ultraviolet scanner to detect DNA hybridization information on a chip.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a system embodying the principles of this invention.

Fig. 2 is a cross section of the system shown in Fig.1

Fig. 3 is a schematic showing DNA chip portion in Fig.2.

Fig. 4 is a schematic showing battery portion in Fig.2.

Fig. 5 is a signal flow chart in Fig.1.

Fig. 6-11 are embodiments depicting systems with a needle to extract liquid.

Fig. 12 is an embodiment of s system with two needle to extract liquid and to inject liquid medicine.

SUMMARY OF THE INVENTION

It is an objective of the present invention to provide systems with water-activated battery to supply electrical energy to biosensors or electrical circuits. Water activated battery is first activated by liquids such as water, blood or urine, and other biosensors or electric part are then activated by the electrical energy from the water activated battery. For the battery activation, biofluids from body can be used as well as water. To achieve the above object, the following systems might be made.

There is disclosed herein a system including in combination:

a substrate;

an energy supplying part placed on a portion of said substrate that can be activated by water;

energy consuming parts sitting on other portion of said substrate that consume energy generated by said energy supplying part;

wherein said energy supplying part is activated to supply electrical energy to said energy consuming parts when a liquid including water is introduced to said energy supplying part, then said energy parts consume said electrical energy.

In addition to the embodiment of this invention, the following in any combination may provide better system.

- said energy supplying and consuming parts are connected via channels to allows said liquid to flow to a specific position.
- said energy consuming part tests or diagnoses liquid including material that is extracted from human body.
- energy consuming part is a device, chip or array that diagnoses or analyzes at least one of DNA, RNA or protein.

- said energy consuming part is a diagnostic device that diagnoses or analyzes some or all of components of blood.
- said energy consuming part is a diagnostic device that diagnoses or analyzes some or all of components of urine.
- said energy consuming part is a diagnostic device that diagnoses or analyzes at least one of the following; 1) blood, saliva, snivel, urine, vaginal discharge, feces, biofluid, DNA, RNA, protein, cell or cell debris of an animal; 2) sap, DNA, RNA, protein , cell or cell debris of a plant.
- said energy consuming part transmits a signal (information) to outside or receives a signal (information) from outside.
- said energy consuming part is a telecommunication device that transmit to outside or receive from outside at least one of information of audio, video, and data.
- said energy consuming part is a television that generate audio information and shows video like pictures.
- said energy consuming part is a radio that receive audio information from outside.
- said energy supplying part is a battery that is activated by water.
- said battery is a battery that includes a cavity to allow liquid to be transported by the capillary force.
- said battery uses magnesium as the anode and silver chloride (AgCl) or copper chloride (CuCl) as cathode and is activated to supply electrical when liquid including water is introduced.
- said liquid can be moved to a predetermined or specific position by the surface tension of said liquid when said liquid is introduced to said energy supplying and consuming parts.
- said energy supplying and consuming parts have a liquid inlet for easy introduction of said liquid.
- said liquid inlet is a hole.
- said liquid inlet is a pricker
- said pricker has a stopper to prick skin by predetermined depth.
- said pricker has a prick-holding means that faces said pricker and can firmly hold said pricker when said pricker is removed from said skin.

- said prick-holding means uses mechanism of a pair of saw teeth or gears for firm hold.
- said pricker faces a breaking means that can be torn or removed when said skin is pricked with said pricker to obtain blood or test liquid.
- said breaking means is a membrane.
- a soluble breaking means is inside said pricker and said breaking means is removed or solved by chemical reaction or melting to transport blood or test liquid inside when skin is pricked with said pricker.
- pressure in said system is lower than that at the tip of said pricker to allow said liquid to easily flow into inside of said system.
- said system has a prescription part that can deliver medicine according diagnostic results.
- said medicine is automatically or manually delivered via a pricker.
- said energy consuming parts has at least one of the following: a diagnostic block to diagnose or analyze chemical (or bio-related material), a display block to show test result from said diagnostic block, a memory block to store required information or data, a communication block to transmit data to outside or receive signals from outside, and a control block to control or direct said blocks.
- said communication block uses a wire-communication means using physically-connected cables such as conductive wire (copper wire) or optical cable that carry electron or electromagnetic wave such as light.
- said communication block uses one of the following wireless communication means: (1) electromagnetic waves including radio frequency wave, infrared rays, ultraviolet, visible rays and laser, (2) acoustic waves including ultrasonic waves and an audible sound.

There is further disclosed herein a system including in combination:

a substrate;

at least one electrode sitting on said substrate to apply voltage;

a chamber above said electrode that can accept liquid with charged material or particle;

a permeation layer deposited on said electrode to isolate said electrode from said liquid;

a sensor that detects said charged material or particle when said charged material or particle is bonded or attached to said permeation layer;

wherein said sensor detect said charged materials that is attached to said electrodes due to electrical field generated said applied voltage.

In addition to the embodiment of this invention, the following in any combination may provide better system.

- said system has at least one counter-electrode that faces said electrode and that is spaced apart from said electrode by predetermined distance in order to generate desired electric field on said electrode and permeation layer.
- bio-probe such as DNA, RNA or protein is placed on said permeation layer on said electrode; and said sensor then detects hybridization on said permeation layer when said probe hybridizes said charged material in said liquid.
- said system has a battery that can be activated by water in said liquid when electrical energy is required for generating electric field or detecting hybridization.
- said sensor detects hybridization of said charged material by diagnosing or analyzing at least one of the following; 1) blood, saliva, snivel, urine, vaginal discharge, feces, biofluid, DNA, RNA, protein, cell or cell debris of an animal; 2) sap, DNA, RNA, protein, cell or cell debris of a plant.
- said sensor detects said charged material by measuring change in at least one of capacitance, resistance and inductance, when said charged material or particle in said liquid is attached or bonded to said permeation layer on said electrode.
- when said charged material or particle in said liquid has with magnetic material like small magnet and is attached or bonded to said permeation layer on said electrode, said sensor might be a magnetic field sensor such Hall sensor that can detects said charged material by measuring change in magnetic field.
- when said charged material or particle in said liquid is attached or bonded to said permeation layer on said electrode, said sensor detects said charged material by

measuring change in reflectance and transmittance of a electromagnetic wave when said charged material is exposed to said electromagnetic wave such as radio frequency wave, infrared rays, ultraviolet, visible rays and laser.

- when said charged material or particle in said liquid is attached or bonded to said permeation layer on said electrode, said sensor detects said charged material by measuring change in reflectance and transmittance of an acoustic wave when said charged material is exposed to said acoustic waves including ultrasonic waves and an audible sound
- wherein said charged material or particle includes chemical or material to improve reflectance or transmittance of said electromagnetic or acoustic wave.

There is further disclosed herein a system including in combination:

a substrate;

an energy supplying part placed on a portion of said substrate that can be activated by water that is from liquid with testable or detectable material;

energy consuming parts sitting on other portion of said substrate that consume energy generated by said energy supplying part;

wherein said energy supplying part is activated to supply electrical energy to said energy consuming parts when a liquid including water is introduced to said energy supplying part, then said energy parts consume said electrical energy to detect or analyze said testable or detectable material.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figures 1-5 show preferred embodiments of system with water(liquid)-activated battery. A disposable DNA chip (micro array) for electrical DNA detection is described as an example. As shown in Fig. 1, a system 100 with liquid-activated battery consists of upper plate 101 with energy consuming parts and lower plate 102 having a battery for supplying energy. The upper plate 101 might be a transparent material for easy inspection or observation. The upper plate 101 consists of DNA sensor 103 to electrically test DNA, an inlet 104 for introduction of liquid (not shown in Fig.1)

including DNA that flows the DNA sensor 103 and a battery (described later), a channel 109 connecting the liquid introduction inlet 104 and the DNA sensor 103, a display 107 with display element 108 to show DNA test results, and input means 105 with at least one button 106 allowing users to select one of test or to input a required information during the DNA test. Fig.1 is a perspective to show the preferred system. Figs. 2-4 are used to detail cross sections of the system, a DNA sensor portion, and a battery portion. Fig. 2 shows the DNA sensor 103 and the battery 122 in the system. The inlet 104 is used for the introduction of a liquid (not shown) with DNA and it is connected to the battery 122 via the channel 109 and 121. The system working mechanism is described by using Fig. 1 and 2 when a liquid (not shown in the figures) is introduced to the inlet 104.

When a dropl of liquid (or water) with DNA is placed into the inlet 104, the surface tension (capillary force) of water drives the water to the DNA sensor 103 and the battery 122 via the channel 109 and 121. The water transferred to the battery 122 activates the water-activated battery 122 to provide electrical energy via a conductor (not shown in figure) to the DNA sensor 103, input means 105 and the display 107 (shown in Fig.1). Instead of DNA sensor portion 103 in Fig. 2, several types of DNA sensors could be incorporated for DNA analysis. As an embodiment of this invention, a DNA sensor in Fig. 3 is described that detects DNA electrically. DNA analysis in Fig.3 can be conducted by using electrical energy generated from the battery 122 shown Fig.2. The DNA sensor 103 consists of a lower plate (substrate) 131, a upper electrode 137, and a cavity (or channel) 120 between the lower plate 131 and the upper electrode 137. Liquid with DNA can easily reach the cavity 120 via the channel 109. On the lower plate 131, there are address electrodes 132, 133, and 134 and insulation material 135 between the electrodes to insulate one electrode from others. A permeation layer 136 such as agarose is on the electrodes or insulation layers. Single stranded DNA (DNA probes, not shown in Fig.3) might be immobilized on the electrodes 132, 133, and 134 (or on the permeation layer on the electrodes) to detect or analyze target DNA. Working principle of the DNA sensor shown in Fig.3 is described with DNA strands immobilized on the permeation layer on the electrode 133 for easy explanation.

As a drop of water with DNA target is introduced into the cavity 120, DNA targets with negative charges that can be hybridized with the DNA probes are distributed in the cavity 120. If DNA solution in the cavity includes a DNA target (strained DNA) that is related to a disease, the DNA probe will hybridize with the target. In order to accelerate the hybridization speed, we can use an electric field formed around the electrodes. When negative and positive voltages are applied to the upper electrode (common) 137 and the address electrode 133 respectively, the DNA strands (DNA target) with negative charge in the solution move to the electrode 133 and then contact the permeation layer on the electrode 133. The DNA target and DNA probe hybridize if the target can make hybridization with the probe. The same phenomenon occurs on other DNA probes placed on the permeation layers of the other electrode 132 and 143. In this case of hybridization of the probe and target on or over the electrodes, the hybridization might be electrically detected.

For this hybridization detection, we can use one of the following sensors to detect change in capacitance, resistance and inductance. Magnetic field sensors (eg. Hole sensor), and sensors for detection of electromagnetic waves including light, and sensors using acoustic wave are also used for the hybridization detection. The electric circuit between the electrodes 133 and 137 might be modeled as an equivalent circuit including inductance (L), capacitance (C), and resistance (R). The DNA hybridization can be detected by change in the inductance, capacitance or resistance of the equivalent circuit before and after the hybridization. For example, a capacitance sensor is used to measure the capacitance change when the capacitance C increases or reduces during the hybridization. A simple capacitance sensor (not described in figures) is easily realized as follows. A resistance R is connected to the electrode 133 to make a RC circuit, and an AC voltage might be applied to detect impedance change after the DNA hybridization. The capacitance due to the hybridization is detected by the amplitude of the AC voltage between the resistance or capacitance of the RC circuit. In order to avoid accumulation of more than required DNA targets (more than a required DNA for the detection) on the permeation layers of the electrode 133, negative and positive bas voltage may be applied to the electrodes 133 and 137, respectively. This bias voltage might prevent the capacitance change during capacitance detection. If DNA target has

magnetic bead or particle (not shown in figures), hybridized DNA on the permeation layer over the electrode 133 experiences magnetic field change. A magnetic sensor such as the Hole sensor can be used to detect this magnetic field change after hybridization. We can use electromagnetic wave such as light to detect the hybridization. We can consider that the upper electrode 137 is transparent electrode and the target DNA with a fluorescent material or bead (not shown in figure) is hybridized with a DNA probe on the permeation layer. The fluorescent material emits fluorescent lights when ultraviolet, a kind of electromagnetic wave, is incident on the material. We can know the hybridization after inspecting the fluorescent lights emitted from the hybridized DNA. Acoustic wave can be used to detect the hybridization. We can find the hybridization from reflectance or transmittance of ultrasonic wave when a ultrasonic wave is incident on the hybridized DNA.

In Fig.2, a water-activated battery is described in which water is used to activate the battery-chemical reaction. Any conventional batteries that are activated by water can be used as the battery 122 in Fig.2. Battery shown in Fig.4 is used for further explanation. A battery 122 consists of magnesium 144 (as the anode) on an upper plate 145, a current collector 142 (conducting material such as copper or chromium/gold layer) on a lower plate 141 (substrate), deposited or printed cathode material 143 such as silver chloride (AgCl) or copper chloride (CuCl), and a cavity 146 between the magnesium 144 and the cathode material 143. For easy explanation, we use silver chloride as the cathode. As described in Fig.2, water solution with DNA is introduced and the surface tension drives the water via the channel 121 (Fig.2) to the cavity 146 (shown Fig.4). The water contact magnesium 144 and silver chloride 143 and the following overall battery reaction occurs.

$$Mg + 2AgCl \rightarrow MgCl_2 + 2Ag \quad (1)$$

According to this chemical reaction, magnesium 144 is oxidized to provide electrons (not shown in figures) and silver chloride 143 is reduced to accept the electron via the current collector 142 and a load or circuit (not shown in figures). The battery 122 supplies electrical energy to outside circuit such as biosensor during this reaction of equation (1).

Figure 5 describes a signal flow of the invention shown in Figs. 1 and 2. Some blocks of the signal flow diagram of Fig. 5 were already described in the previous figures. In Fig.5, diagnostic block 501 (DNA sensor in Fig.1), energy-supplying block 503, display block 506, and input block 507 were already described in Figs. 1 or 2. Control block 505, memory block 502 and communication block were not described in Figs. 1 or 2 for simple explanation. Figure 5 is a signal flow diagram that might be needed in complete systems. The diagnostic block 501 and energy supplying block 503 are essential blocks and other blocks might be added when they are needed. For example, the input block 507 is not needed if the system in Fig.1 is designed to do predetermined or already-programmed test. In this case, input means 105 and input button are not required. Signal flows are now explained using Fig.5 when the systems in Figs. 1 and 2 works. When solution with DNA(or DNA strands) is introduced via the inlet 104, the energy supplying block (the battery 122 in Fig.2) generates electrical energy to activate the other blocks in Fig.5. The diagnostic block 501 (DNA sensor in Fig.1) diagnose or analyze the DNA, send the diagnostic results to the control block 505, and activate the display block 506 to show the test result if needed. The memory block 502 is used to store data or programs that might be needed for the control block. Any data storage including HDD (hard disk drive) and a semiconductor memory can be used for this purpose. The input block 507 is a means such as keyboards or button to input data or program to the memory block or other blocks of the systems. The control block 505 controls signal flows of blocks and give specific directions or jobs to each block. The communication block 504 is a signal transmitting or receiving block to send the test results to outside computer or recording means such as data storage, and to receive direction or data from an outside computer or remote controller. The communication block 504 might use a wire-communication means using physical cables such as conductive wire (copper wire) or optical cable that carry electron or electromagnetic wave such as light. In other cases, the communication block 504 might use one of wireless communication means: (1) electromagnetic waves including radio frequency wave, infrared rays, ultraviolet, visible rays and laser, (2) acoustic waves including ultrasonic waves and an audible sound. In Fig. 5 shown signal flow in the systems, the blocks communicate with each other by using electrical signal. For this inside signal

exchange, any signal exchange means can be used that transport energy from one place to other. For example, the inside communication might use not only electron flow in a conductor but also laser, electromagnetic waves, ultraviolet, infrared rays or acoustic wave such as ultrasonic wave.

Using Figs.1-5, we explains a diagnostic system that is operated by a water-activated battery and diagnoses DNA in a DNA sensor by using the electrical energy generated by the water activated battery. In this case, water for the water activated battery is obtained from the DNA solution. Fig. 6 is an embodiment depicting systems with a pricker to extract liquid. Figure 6 shows a diagnostic system that is activated by blood extracted from human body. A diagnostic system 600 on the front side 601 of a substrate consists of a biosensor 606 to test blood, a pricker 603 to supply blood to the biosensor 606, an air exhalation outlet 604 that is used to remove the air in the biosensor or channels (not shown) and a display 605 to show test results. A water activated battery is placed on the backside 602 of the substrate to supply electrical energy to the system. The diagnostic system 600 might include several blocks (or electric circuits) to do specific tests as shown in Fig. 5. In this case, only the diagnostic, display, control, and energy supplying blocks of the blocks shown in Fig.5 are required.

Referring to Fig.6, we describe the working principle of the diagnostic system 600 that is activated by blood and that tests the blood. When we prick our finger or skin (not shown) with the pricker 603, blood (not shown) flows through the pricker 603 to the battery (not shown) on the backside 602 of the substrate and the biosensor 606. Water of the blood activates the battery to generate electrical energy that is supplied to other parts or blocks via conductors (not shown). Some blood flows to a channel of the biosensor 606, sensors (not shown) in the channel do a diagnostic test, and the test result is displayed on a display 605. While blood flows through the channel of biosensor, gas such as air in the channel goes outside via the air exhalation outlet 604.

In order to describe how to easily get blood, Figs. 7-11 are shown as partial pictures of the diagnostic part 701 with a pricker 702. Figs. 7, 8 and 9 shows drawings of diagnostic part 701 of an embodiment of the invention that easily accepts the test liquid such as blood in Fig. 6. In these Figures, the diagnostic part 701 has a pricker 702 for the test liquid. The pricker may have a stopper 703 that allows the pricker 702

to penetrate into the skin by a predetermined depth. Figures 8-11 are crossal views of Fig.7. In Fig. 8, the diagnostic part 701 consists of a cavity 708, a diagnostic means 709 which is adjacent to the cavity 708, a pricker 702, and a stopper 703 fixed on the pricker 702. The pricker 702 is connected to a cap 706 via a guide 704, and the cap has a path 705 that can guide the pricker 702. There is a breaking means 707 such as a membrane at the end of the cap 706.

The following paragraph will describe the withdrawal of the blood. The human skin is pricked with the pricker 702, then the stopper 703 on the pricker is pressed by the skin, the pricker 702 move into inside along the guide 704 and the path 705, finally the breaking means 707 is torn as shown in Fig 9. The blood 710 of body can flow to the diagnostic means 709 via the pricker 702. The cavity 708 might be at the atmospheric pressure or vacuum to assist the blood flow.

The embodiment of Fig. 8 has a potential problem; the pricker 702 may remain on the skin when the diagnostic part is taken out from the skin. In order to resolve this problem, Fig. 10 is presented describing the enlarged view of needle using saw teeth. When the skin is pricked with the pricker 1101, the saw teeth 1102 moves in the right direction (1105). The moved pricker is prevented from moving in the left direction when it is taken out from the skin. The 1104 indicates the support of the opposite saw teeth 1103.

Fig. 11 shows an embodiment of the invention where the breaking means 1102 is in a pricker 1101. The pricker 1101 fixed by a stopper 1103 has a soluble breaking means 1102 such as sugar. The stopper 1103 is connected to a cap 1104, which is connected to a diagnostic part 1105 that consists of a cavity 1107 and a diagnostic means 1106. When the human skin is pricked with the pricker 1101, a chemical (for example water) in blood reacts to the breaking means 1102 to remove the breaking means 1102 and finally the blood can be transport from the human body to the cavity 1107 to supply blood to the diagnostic means 1106.

In Figs. 6-11, only one needle (pricker) was used to get blood from the human body. Figure 12 is an embodiment of the invention that has another needle for a drug injection. In Fig. 12, a diagnostic and prescription part 1200 has an inspection needle (pricker) 1202 and prescription needle 1203 connected to a diagnostic means 1201. Blood

coming from the inspection needle 1202 is examined by a sensor (not shown in the figure) in the diagnostic and prescription part 1200. If needed, a drug can be supplied to the human body via the prescription needle 1203.

So far, several embodiments and details for the invention are explained. If a person tries to easily modify or simply combine the embodiments that are described in this patent, they should be included in this patent. For example, a water-activated battery is placed on the backside of a substrate in the above explanation of this invention. A person who understands this invention can easily make a modification that places all components on the front side of a substrate including the water activated battery, the diagnostic means, etc. In this case, the modification must belong to this patent. In Figs 3 and 6, biosensors testing DNA and blood are described. A person who understands this patent uses water of any test liquids to activate a water-activated battery of a system. In this case, the modification must also belong to this patent. For example, any biofluids (urine, saliva, blood, etc), a mixture of water and other chemical, can activate the water-activated battery of a system of this patent to complete a specific diagnostic test. Basically, this invention describes systems shown in Fig. 5 including energy supplying block and energy consuming parts (e.g. diagnostic and display blocks) that can be activated when water-base liquid is introduced into the systems. For example, we can make a system on a substrate that includes a water activated battery on the backside of the substrate and any power consuming parts such as electrical circuit and related-components for a radio, television or cellular phone on the front side of the substrate. In this case, the systems of the radio, television, or cellular phone are also included in the invention

ADVANTAGE OF THE INVENTION

Disposable diagnostic devices, diagnostic kits or health screen kits that utilized water activated battery for power source can be easily and cheaply fabricated. These disposable devices are able to perform complex biochemical diagnosis on the tested fluid such as urine or blood and extract vital information them. The integrated

biosystems are designed such that every individual could conduct a series of diagnostic tests that is currently done by medical professionals. We can make radio, television, or cellular phone as energy consuming parts on a substrate that can be operated by water activated battery on the substrate.

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WHAT IS CLAIMED IS:

1. A system including in combination:

a substrate;

an energy supplying part placed on a portion of said substrate that can be activated by water;

energy consuming parts sitting on other portion of said substrate that consume energy generated by said energy supplying part;

wherein said energy supplying part is activated to supply electrical energy to said energy consuming parts when a liquid including water is introduced to said energy supplying part, then said energy parts consume said electrical energy.

2. The system of claim 1, wherein said energy supplying and consuming parts are connected via channels to allows said liquid to flow to a specific position.

3. The system of claim 1, wherein said energy consuming part tests or diagnoses liquid including material that is extracted from human body.

4. The system of claim 3, wherein said energy consuming part is a device, chip or array that diagnoses or analyzes at least one of DNA, RNA or protein.

5. The system of claim 3, wherein said energy consuming part is a diagnostic device that diagnoses or analyzes some or all of components of blood.

6. The system of claim 3, wherein said energy consuming part is a diagnostic device that diagnoses or analyzes some or all of components of urine.

7. The system of claim 1, wherein said energy consuming part is a diagnostic device that diagnoses or analyzes at least one of the following; 1) blood, saliva, snivel, urine, vaginal discharge, feces, biofluid, DNA, RNA, protein, cell or cell debris of an animal; 2) sap, DNA, RNA, protein, cell or cell debris of a plant.

8. The system of claim 1, wherein said energy consuming part transmits a signal (information) to outside or receives a signal (information) from outside.

9. The system of claim 8, wherein said energy consuming part is a telecommunication device that transmit to outside or receive from outside at least one of information of audio, video, and data.

10. The system of claim 8, wherein said energy consuming part is a television that generates audio information and shows video like pictures.

11. The system of claim 8, wherein said energy consuming part is a radio that receive audio information from outside.

12. The system of claim 1, wherein said energy supplying part is a battery that is activated by water.

13. The system of claim 12, wherein said battery is a battery that includes a cavity to allow liquid to be transported by the capillary force.

14. The system of claim 12, wherein said battery uses magnesium as the anode and silver chloride (AgCl) or copper chloride (CuCl) as cathode and is activated to supply electrical when liquid including water is introduced.

15. The system of claims 1, 2, and 3, wherein said liquid can be moved to a predetermined or specific position by the surface tension of said liquid when said liquid is introduced to said energy supplying and consuming parts.

16. The system of claims 1 and 2, wherein said energy supplying and consuming parts have a liquid inlet for easy introduction of said liquid.

17. The system of claim 16, wherein said liquid inlet is a hole.

18. The system of claim 16, wherein said liquid inlet is a pricker

19. The system of claim 18, wherein said pricker has a stopper to prick skin by predetermined depth.

20. The system of claims 18 and 19, wherein said pricker has a prick-holding means that faces said pricker and can firmly hold said pricker when said pricker is removed from said skin.

21. The system of claim 20, wherein said prick-holding means uses mechanism of a pair of saw teeth or gears for firm hold.

22. The system of claims 18, 19, and 20, wherein said pricker faces a breaking means that can be torn or removed when said skin is pricked with said pricker to obtain blood or test liquid.

23. The system of claim 22, wherein said breaking means is a membrane.

10. The system of claim 8, wherein said energy consuming part is a television that generates audio information and shows video like pictures.

11. The system of claim 8, wherein said energy consuming part is a radio that receive audio information from outside.

12. The system of claim 1, wherein said energy supplying part is a battery that is activated by water.

13. The system of claim 12, wherein said battery is a battery that includes a cavity to allow liquid to be transported by the capillary force.

14. The system of claim 12, wherein said battery uses magnesium as the anode and silver chloride (AgCl) or copper chloride (CuCl) as cathode and is activated to supply electrical when liquid including water is introduced.

15. The system of claims 1, 2, and 3, wherein said liquid can be moved to a predetermined or specific position by the surface tension of said liquid when said liquid is introduced to said energy supplying and consuming parts.

16. The system of claims 1 and 2, wherein said energy supplying and consuming parts have a liquid inlet for easy introduction of said liquid.

17. The system of claim 16, wherein said liquid inlet is a hole.

18. The system of claim 16, wherein said liquid inlet is a pricker

19. The system of claim 18, wherein said pricker has a stopper to prick skin by predetermined depth.

20. The system of claims 18 and 19, wherein said pricker has a prick-holding means that faces said pricker and can firmly hold said pricker when said pricker is removed from said skin.

21. The system of claim 20, wherein said prick-holding means uses mechanism of a pair of saw teeth or gears for firm hold.

22. The system of claims 18, 19, and 20, wherein said pricker faces a breaking means that can be torn or removed when said skin is pricked with said pricker to obtain blood or test liquid.

23. The system of claim 22, wherein said breaking means is a membrane.

24. The system of claims 18, 19, 20 and 22, wherein a soluble breaking means is inside said pricker and said breaking means is removed or solved by chemical reaction or melting to transport blood or test liquid inside when skin is pricked with said pricker.

25. The system of claims 22 and 24, wherein pressure in said system is lower than that at the tip of said pricker to allow said liquid to easily flow into inside of said system.

26. The system of claims 3, 7 and 18, wherein said system has a prescription part that can deliver medicine according diagnostic results.

27. The system of claim 26, wherein said medicine is automatically or manually delivered via a pricker.

28. The system of claim 1, wherein said energy consuming parts has at least one of the following: a diagnostic block to diagnose or analyze chemical (or bio-related material), a display block to show test result from said diagnostic block, a memory block to store required information or data, a communication block to transmit data to outside or receive signals from outside, and a control block to control or direct said blocks.

29. The system of claim 28, wherein said communication block uses a wire-communication means using physically-connected cables such as conductive wire (copper wire) or optical cable that carry electron or electromagnetic wave such as light.

30. The system of claim 28, wherein said communication block uses one of the following wireless communication means: (1) electromagnetic waves including radio frequency wave, infrared rays, ultraviolet, visible rays and laser, (2) acoustic waves including ultrasonic waves and an audible sound.

31. A system including in combination:

a substrate;

at least one electrode sitting on said substrate to apply voltage;

a chamber above said electrode that can accept liquid with charged material or particle;

a permeation layer deposited on said electrode to isolate said electrode from said liquid;

a sensor that detects said charged material or particle when said charged material or particle is bonded or attached to said permeation layer;

wherein said sensor detect said charged materials that is attached to said electrodes due to electrical field generated said applied voltage.

32. The system of claim 31, wherein said system has at least one counter-electrode that faces said electrode and that is spaced apart from said electrode by predetermined distance in order to generate desired electric field on said electrode and permeation layer.

33. The system of claim 31, wherein bio-probe such as DNA, RNA or protein is placed on said permeation layer on said electrode; and said sensor then detects hybridization on said permeation layer when said probe hybridizes said charged material in said liquid.

34. The system of claims 31, 32 and 33, wherein said system has a battery that can be activated by water in said liquid when electrical energy is required for generating electric field or detecting hybridization.

35. The system of claim 31, wherein said sensor detects hybridization of said charged material by diagnosing or analyzing at least one of the following; 1) blood, saliva, snivel, urine, vaginal discharge, feces, biofluid, DNA, RNA, protein, cell or cell debris of an animal; 2) sap, DNA, RNA, protein, cell or cell debris of a plant.

36. The system of claims 31, 32 and 33, wherein said sensor detects said charged material by measuring change in at least one of capacitance, resistance and inductance, when said charged material or particle in said liquid is attached or bonded to said permeation layer on said electrode.

37. The system of claims 31, 32 and 33, when said charged material or particle in said liquid has with magnetic material like small magnet and is attached or bonded to said permeation layer on said electrode, said sensor might be a magnetic field sensor such Hall sensor that can detects said charged material by measuring change in magnetic field.

38. The system of claims 31and 32, when said charged material or particle in said liquid is attached or bonded to said permeation layer on said electrode, said sensor detects said charged material by measuring change in reflectance and transmittance of a

electromagnetic wave when said charged material is exposed to said electromagnetic wave such as radio frequency wave, infrared rays, ultraviolet, visible rays and laser.

39. The system of claims 31and 32, when said charged material or particle in said liquid is attached or bonded to said permeation layer on said electrode, said sensor detects said charged material by measuring change in reflectance and transmittance of an acoustic wave when said charged material is exposed to said acoustic waves including ultrasonic waves and an audible sound

40. The system of claims 38 and 39, wherein said charged material or particle includes chemical or material to improve reflectance or transmittance of said electromagnetic or acoustic wave.

41. A system including in combination:

a substrate;

an energy supplying part placed on a portion of said substrate that can be activated by water that is from liquid with testable or detectable material;

energy consuming parts sitting on other portion of said substrate that consume energy generated by said energy supplying part;

wherein said energy supplying part is activated to supply electrical energy to said energy consuming parts when a liquid including water is introduced to said energy supplying part, then said energy parts consume said electrical energy to detect or analyze said testable or detectable material.

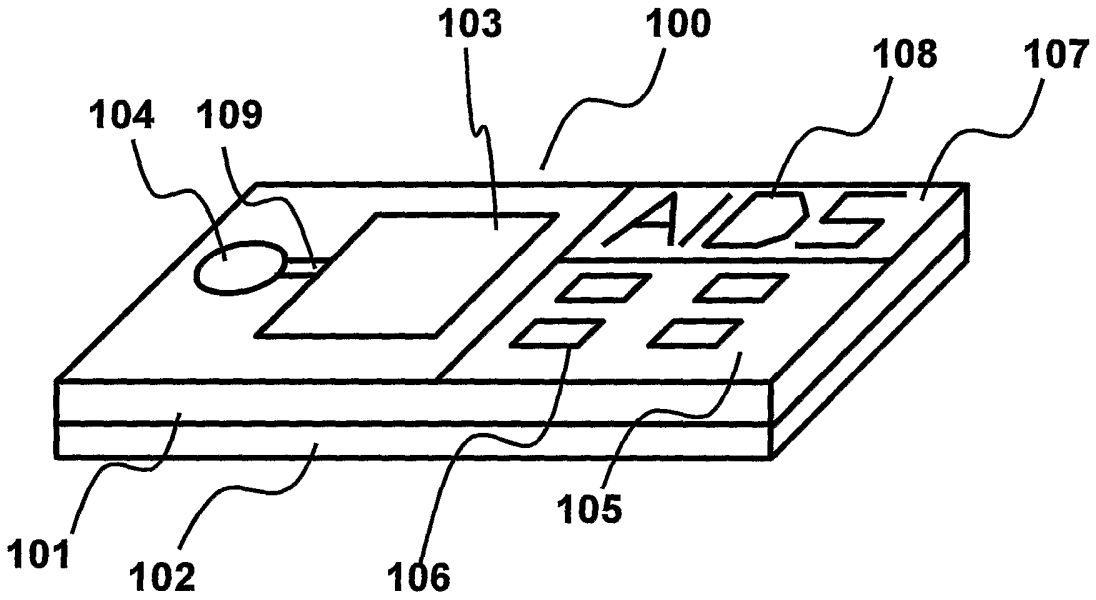
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Fig.1

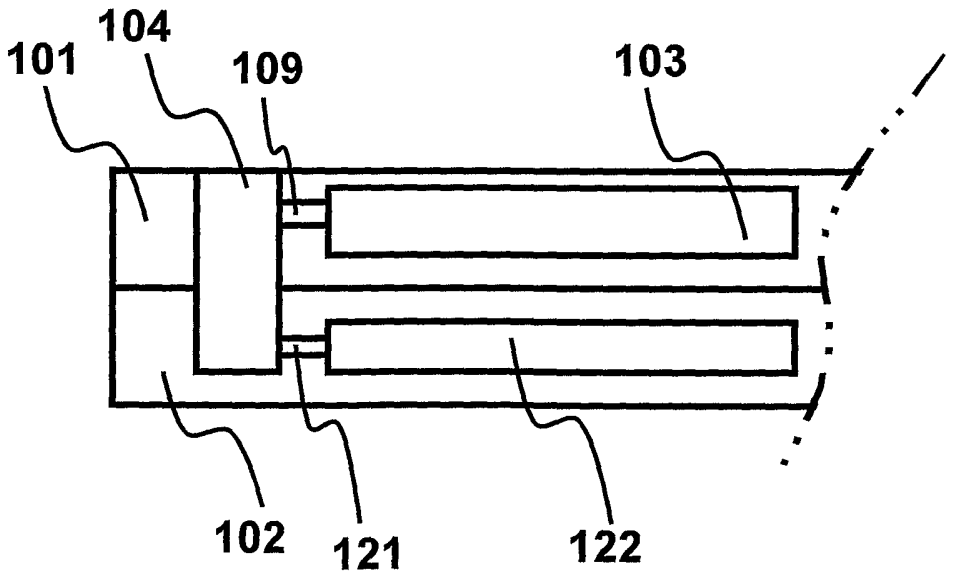
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Fig.2

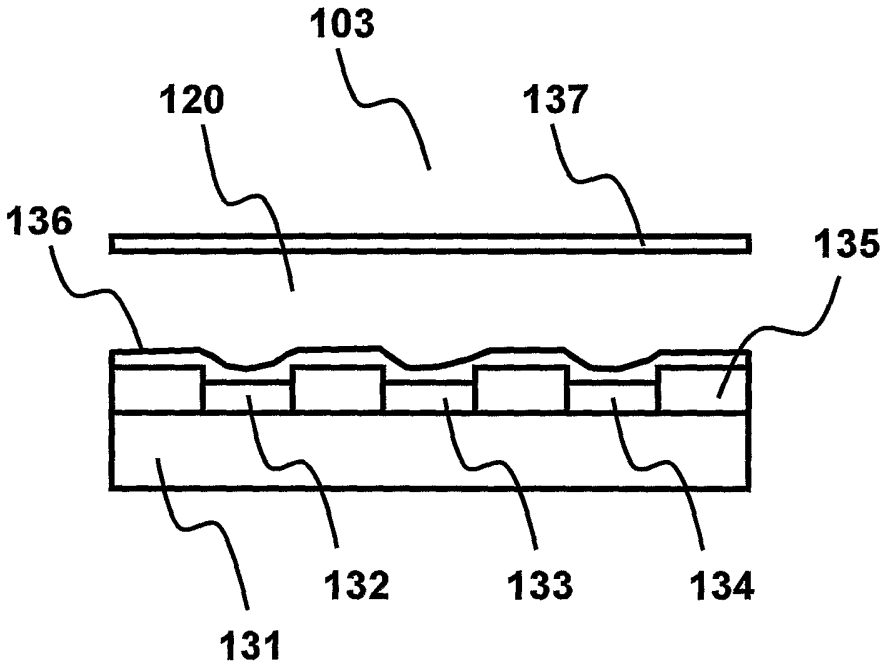

Fig.3

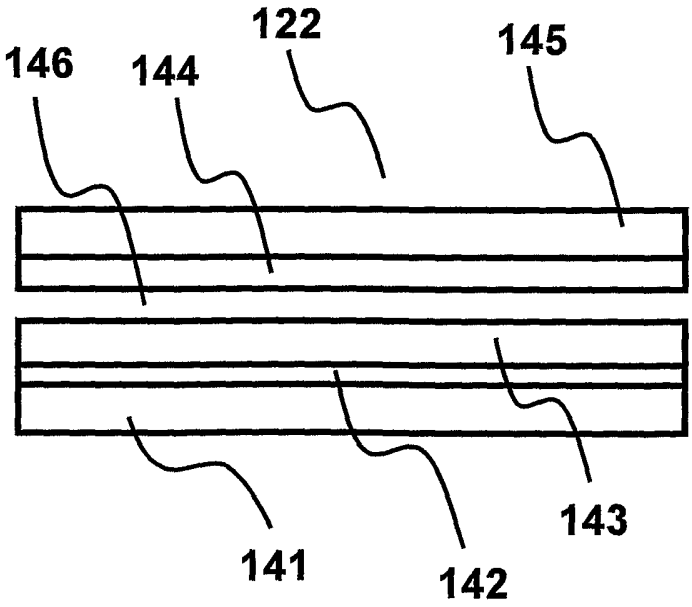

Fig.4

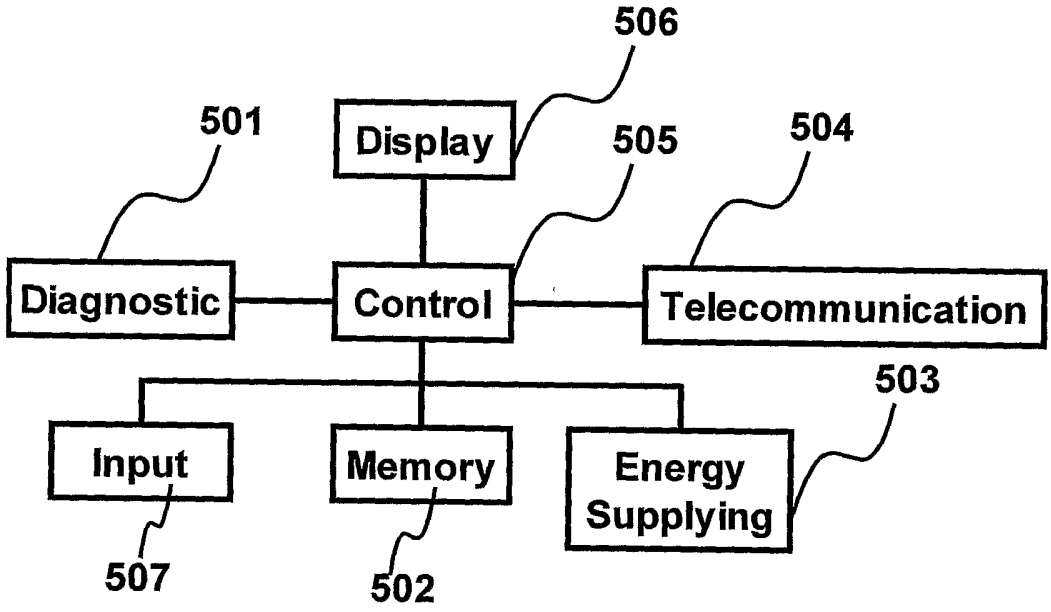
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Fig.5

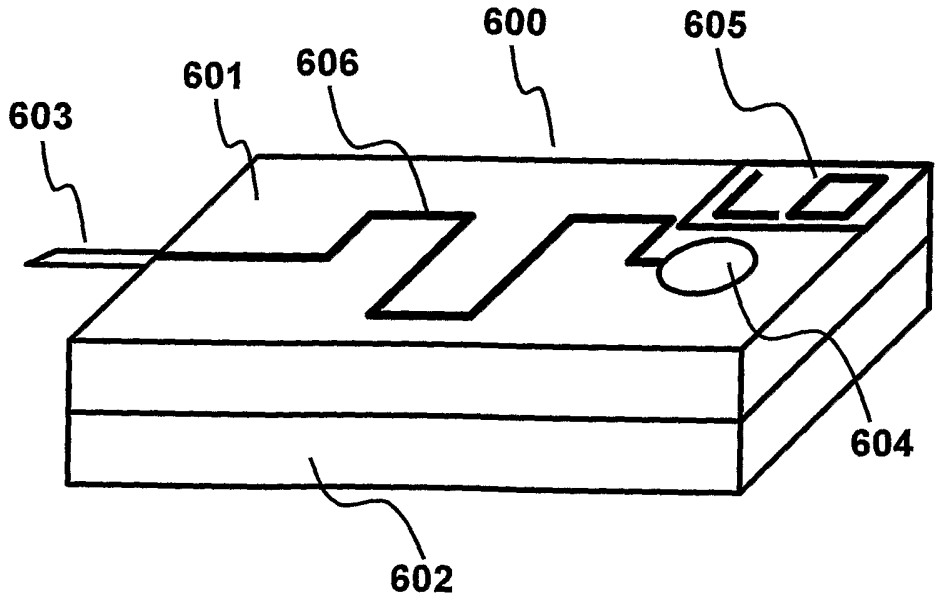
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Fig.6

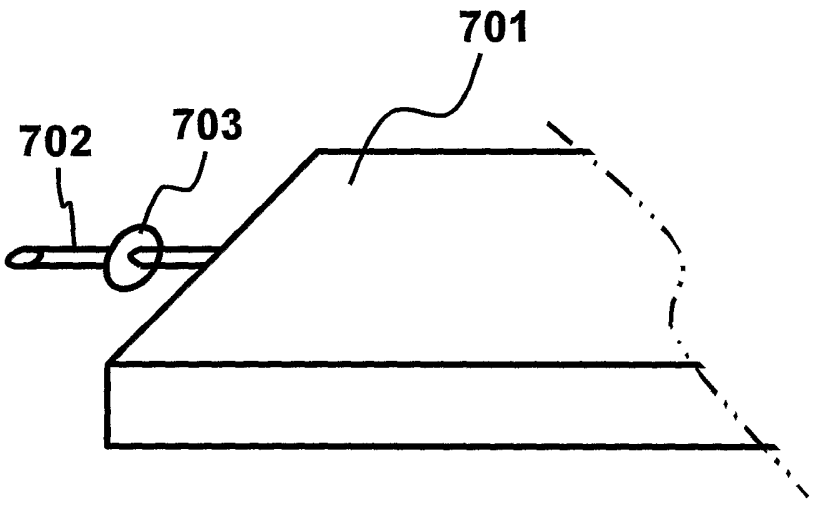

Fig.7

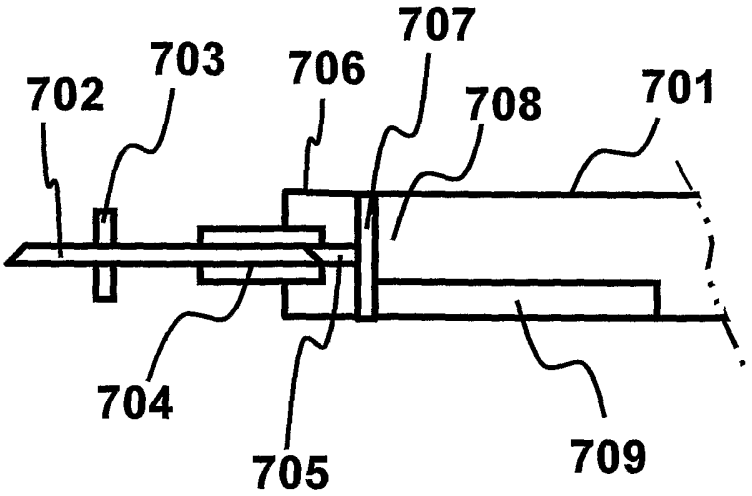

Fig.8

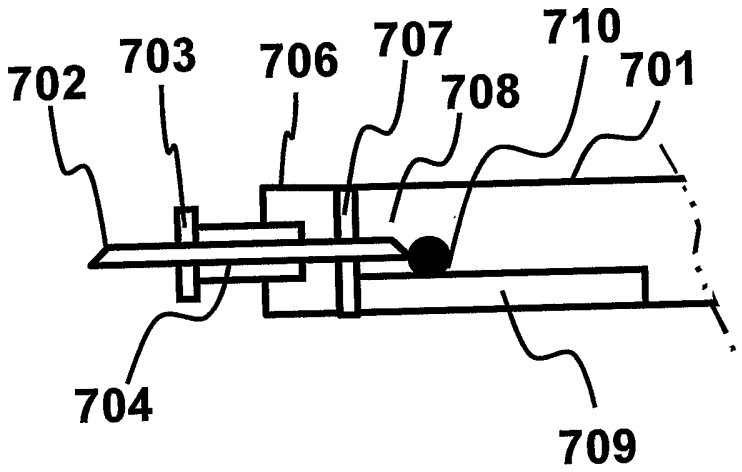

Fig.9

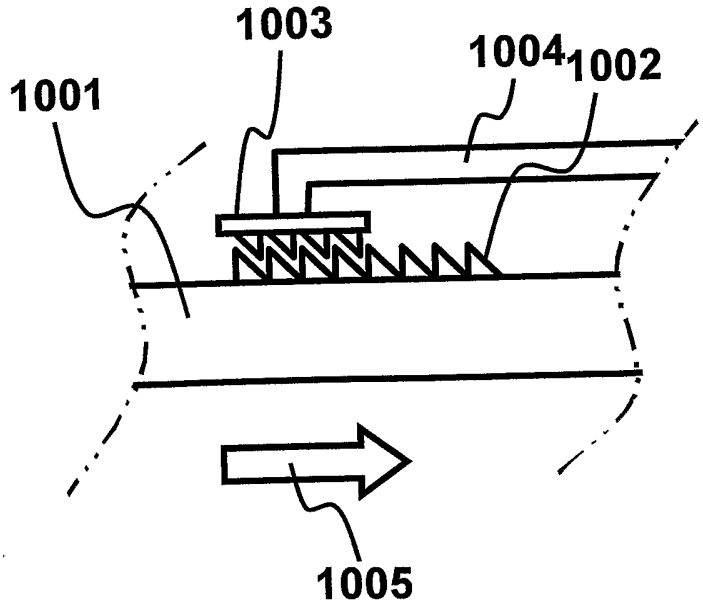

Fig.10

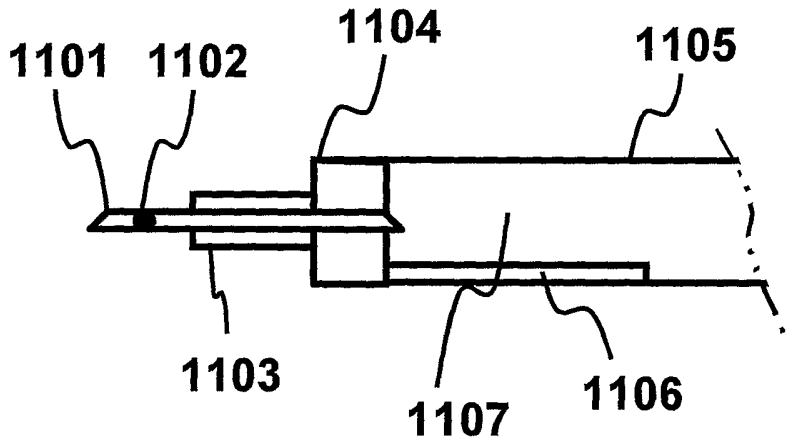

Fig.11

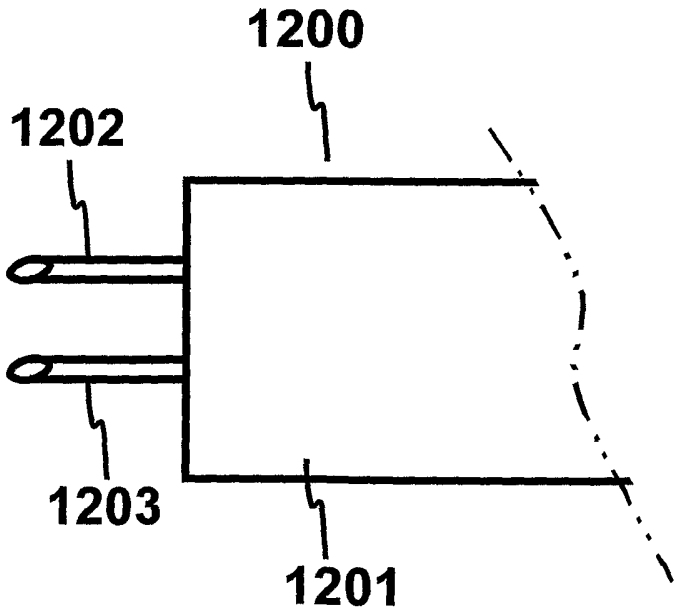

Fig.12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/002365

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 B81B 7/02

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)
IPC7 B81B 7/00, B81B 7/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for invetions since 1975
Korean Utility models and applications for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
eKIPASS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	KR 1020030075815 A (LEE, KI BANG) 26 Sep. 2003 see the whole document	1, 3-15, 26-30 2, 16-25, 34
X Y	US 6,217,744 B1 (PETER CROSBY) 17 Apr. 2001 see the whole document	1, 3-13, 15, 41 2, 16-25, 34
X Y	US 5,846,708 A (HOLLIS et al.) 8 Dec. 1998 see the whole document	31-33, 35-40 34
A	KR 1020010111393 A (LEE, KI BANG) 17 Dec. 2001 see the whole document	1 - 41
A	US 5,639,423 A (NORTHRUP; WHITE) 17 Jun. 1997 see the whole document	1 - 41

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 NOVEMBER 2005 (25.11.2005)	**25 NOVEMBER 2005 (25.11.2005)**

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Telephone No. 82-42-481-5504

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
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