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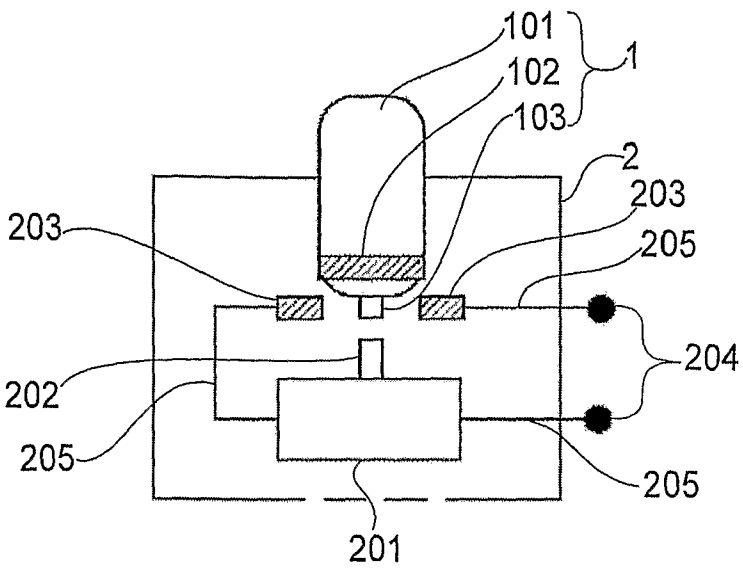
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(54) **Title:** FUEL CARTRIDGE AND FUEL CELL



(57) **Abstract:** A fuel cell is constituted by a fuel cartridge 1 including a fuel storage portion 101 and a fuel feed opening 103, and a fuel cell body 2 including an output terminal 204 and a power generation portion 201. The fuel cell comprises a wiring portion 12 for electrically connecting the output terminal 204 and power generation portion 201 of the fuel cell body 2 with each other when the fuel cartridge 1 is mounted to the fuel cell 2 body to place a fuel in a state in which the fuel is feedable from the fuel cartridge 1 to the fuel cell body 2 and for electrically disconnecting the output terminal 204 and power generation portion 201 of the fuel cell body 2 when the fuel cartridge 1 is removed from the fuel cell body 2.

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DESCRIPTION

FUEL CARTRIDGE AND FUEL CELL

[TECHNICAL FIELD]

The present invention relates to a fuel cartridge and a fuel cell. Particularly, the present invention relates to a fuel cartridge for energizing a circuit by mounting it in a fuel cell body.

[BACKGROUND ART]

In the case where feeding of a fuel is stopped in a state in which a fuel cell is electrically constituted to electronic equipment, electric power is gradually lowered, so that generation of electric power is stopped. In this manner, when the electric power is lowered, it falls below electric power necessary to drive the electronic equipment at a certain time or later. As a result, the electric power is wasted even when the electric power is generated.

In view of such a problem, Japanese Laid-Open Patent Application (JP-A) 2005-158298 has disclosed an operating method of a fuel cell power generating system in which an external circuit is interrupted together with stopping of fuel gas feeding. However, in this operating method, an operation control means for simultaneously effecting the stopping of fuel gas

feeding and the interruption of the external circuit is required.

Further, JP-A 2004-71262 has disclosed a fuel cell device in which control as to whether the fuel cell device is actuated or not is effected on the basis of a result of mounting recognition during mounting of a fuel cartridge provided with a memory to the fuel cell device. However, this fuel cell device requires a control portion for effecting the control on the basis of the recognition result of the mounting of the fuel cartridge to the fuel cell device.

As described above, in the case where the method of JP-A 2005-158298 and the device of JP-A 2004-71262 are put into practical use, it is necessary to employ such a control circuit that a complicated electric signal is detected and on the basis of a result of the detection, the fuel feeding and the interruption of the external circuit are controlled. Accordingly, it is difficult to reduce a size and cost of the fuel cell.

[DISCLOSURE OF THE INVENTION]

An object of the present invention is to provide a fuel cell and fuel cartridge which are capable of synchronizing mounting and demounting of the fuel cartridge with a transition between a supply state and supply-interrupting state of current, caused

by electric power generation, by means of an electric circuit having a simple constitution.

According to an aspect of the present invention, there is provided a fuel cartridge comprising a fuel storage portion and a fuel feed opening, wherein the fuel cartridge comprises a wiring portion constituting a part of wiring for electrically connecting an output terminal of a fuel cell body and a power generation portion of a fuel cell body with each other when the fuel cartridge is mounted to the fuel cell body to place a fuel in a state in which the fuel is feedable from the fuel cartridge to the fuel cell body.

At least a part of the wiring portion may preferably be exposed at a first portion of a surface of the fuel cartridge, and the surface of the fuel cartridge may preferably be electrically insulative at a second portion thereof other than the first portion.

The fuel cartridge may preferably further comprise a fuel feeding mechanism driven by electric power supplied through the wiring portion.

Further, the fuel cartridge may preferably comprise a valve having a structure which is opened when the fuel cartridge is mounted in the fuel cell body and closed when the fuel cartridge is removed from the fuel cell body.

According to another aspect of the present

invention, there is provided a fuel cell comprising: a fuel cartridge comprising a fuel storage portion and a fuel feed opening; and a fuel cell body comprising an output terminal and a power generation portion, wherein the fuel cell comprises a wiring portion for electrically connecting the output terminal and power generation portion of the fuel cell body with each other when the fuel cartridge is mounted to the fuel cell body to place a fuel in a state in which the fuel is feedable from the fuel cartridge to the fuel cell body and for electrically disconnecting the output terminal and power generation portion of the fuel cell body when the fuel cartridge is removed from the fuel cell body. The wiring portion may preferably be provided to the fuel cartridge or the fuel cell body. The fuel cartridge may preferably be a polymer electrolyte fuel cell.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Figure 1 is a schematic view showing an unmounted state of a fuel cartridge to a fuel cell

body in Embodiment 1 of the present invention.

Figure 2 is a schematic view showing a mounted state of a fuel cartridge to a fuel cell body in Embodiment 1 of the present invention.

Figure 3 is a schematic view showing an unmounted state of a fuel cartridge to a fuel cell body in Embodiment 2 of the present invention.

Figure 4 is a schematic view showing a mounted state of a fuel cartridge to a fuel cell body in Embodiment 2 of the present invention.

Figure 5 is a schematic perspective view showing an embodiment of a fuel cartridge used in the present invention.

Figure 6 is a schematic sectional view showing an embodiment of a fuel cartridge used in the present invention.

Figure 7 is a schematic sectional view showing an embodiment of a fuel feeding opening provided to a fuel cartridge in an unmounted state of the fuel cartridge used in the present invention to a fuel cell body.

Figure 8 is a schematic sectional view showing an embodiment of a fuel feeding opening provided to a fuel cartridge and a pipe of a receiving opening provided to a fuel cell body in a mounted state of the fuel cartridge used in the present invention to the fuel cell body.

Figure 9 is a schematic view showing an embodiment of a polymer electrolyte fuel cell body in Embodiment 4 of the present invention.

Figure 10 is a schematic view showing a mounted state of a fuel cartridge to a fuel cell body in Embodiment 4 of the present invention.

Figure 11 is a schematic view showing an embodiment of a polymer electrolyte fuel cell body in Embodiment 5 of the present invention.

Figure 12 is a schematic view showing a mounted state of a fuel cartridge to a fuel cell body in Embodiment 5 of the present invention.

[BEST MODE FOR CARRYING OUT THE INVENTION]

Hereinbelow, embodiments of the fuel cell according to the present invention will be described with reference to the drawings while taking a polymer electrolyte fuel cell (solid polymer-type fuel cell) as an example. However, the fuel cell of the present invention is not limited thereto.

(Embodiment 1)

Figures 1 and 2 are schematic views showing an unmounted state and a mounted state, respectively, of a fuel cartridge in or to a fuel cell body in Embodiment 1 of the present invention.

A fuel cartridge 1 at least includes a fuel storage portion 101 having therein a predetermined

volume (space) capable of storing fuel, a first wiring portion or part 102, and a fuel feeding opening 103. On the other hand, a fuel cell body 2 at least includes an electric power generation portion 201 having a membrane electrode assembly (MEA), a fuel receiving opening 202 for receiving the fuel from the fuel cartridge 1 and feeding the fuel to the power generation portion 201, and a second wiring portion constituted by a contact terminal 203, an output terminal 204 for supplying generated electric power to an external equipment, and a connecting line 205.

In this embodiment, the fuel cell body 2 is a portion other than the fuel cartridge 1 of the fuel cell. The fuel cartridge 1 is mounted or loaded to (in or on) the fuel cell body 2 to function as the fuel cell. The power generation portion 201 is a structure including the MEA, a separator, etc. Here, the MEA is an integrated member prepared by joining an electrolyte film and an electrode together. More specifically, the MEA may include those prepared by not only welding the electrolytic film and the electrode through heating, pressure application, etc., but also fixing the electrolytic film and the electrode with a fixing member such as a screw in a contact state therebetween. Further, the fuel cartridge in this embodiment is a fuel storing container which is easily detachably mountable to the

fuel cell body and is easily replaceable.

In the fuel cell, by mounting the fuel cartridge 1 to the fuel cell body 2 including the power generation portion 201, the first wiring portion 102 contacts the contact terminal 203 as a part of the second wiring portion. As a result, wiring connecting the power generation portion 201 and the output terminal 204 is formed. More specifically, a portion consisting of the power generation portion 201, one contact terminal 203, and the connecting line 205 connecting the power generation portion 201 and the contact terminal 203 and a portion consisting of the output terminal 204, the other contact terminal 203, and the connecting line connecting these terminals 204 and 203 are electrically connected.

In this manner, when the fuel cartridge 1 is mounted to the fuel cell body 2 to be placed in a state in which fuel is feedable from the fuel cartridge 1 to the fuel cell body 2, the output terminal 204 of the fuel cell body 2 and the power generation portion 201 are electrically connected with each other to create a state in which electric power can be supplied from the fuel cell (Figure 2). Herein, the "state in which fuel is feedable from the fuel cartridge 1 to the fuel cell body 2" means a state in which fuel is capable of being fed from the fuel cartridge 1 to the fuel cell body 2, thus being not

limited to a state in which the fuel is actually feeding from the fuel cartridge 1 to the fuel cell body 2. In other words, the state includes both of a state in which the fuel cartridge 1 is properly mounted to the fuel cell body 2 and the fuel is actually feed feeding and a state in which the fuel cartridge 1 is properly mounted to the fuel cell body 2 but the fuel is not fed.

Further, the electrically connected state is held by removing the fuel cartridge 1 from the fuel cell body 2. Herein, "removing the fuel cartridge 1 from the fuel cell body 2" means not only a case where the fuel cartridge 1 is completely separated spatially from the fuel cell body 2 but also a case where the fuel cartridge 1 is not completely separated spatially from the fuel cell body 2 as shown in Figure 1. In other words, the latter case is a case where the fuel cartridge 1 and the fuel cell body 2 are not completely separated although the fuel feeding opening 103 and the fuel receiving opening 202 are completely separated. In this case, the fuel cartridge 1 and the fuel cell body 2 may also be connected at portions other than the fuel feeding opening 103 and the fuel receiving opening 202.

The fuel cartridge 1 used in the present invention contains fuel for the fuel cell inside the fuel storage portion.

The fuel usable in the present invention is not particularly limited but may be gaseous fuel or liquid fuel. Of these fuels, the gaseous fuel may preferably include hydrogen gas as a main component. In the case where the gaseous fuel principally including hydrogen gas is stored, the fuel storage portion 101 may preferably contain therein hydrogen-storing alloy as desired. Further, as the liquid fuel, a liquid principally including alcohol, particularly an aqueous alcohol solution may preferably be used. Examples of the aqueous alcohol solution may include an aqueous methanol solution and an aqueous ethanol solution, preferably the aqueous methanol solution.

A material for a wall member of the fuel storage portion of the fuel cartridge 1 can be constituted by an electroconductive material such as metal or alloy or an electrically insulating material such as resin. The wall member may also be prepared by molding the electroconductive material and coating at least one of its inner and outer surfaces with the electrically insulating material. Further, in the case of using the liquid fuel, the wall member material for the fuel storage portion may preferably be a material having a resistance to the liquid fuel. For example, as the wall member material for the fuel storage portion suitable for the aqueous methanol solution, it

is possible to use polyethylene, polypropyrene, polyethylene terephthalate, polyacrylnitrile, polyethylene naphthalate, etc. In the case of storing the aqueous ethanol solution, in addition to these polymers (resins), it is possible to preferably use polyamide, polyacetal, acrylonitrile butadiene styrene resin (copolymer), etc.

Further, in the case where the fuel is gas, an internal pressure of the fuel storage portion 101 may preferably be higher than atmospheric pressure. This is because the fuel is smoothly injected from the fuel cartridge 1 including the fuel storage portion 101 into the polymer electrolyte fuel cell body 2 by making the internal pressure of the fuel storage portion 101 higher than atmospheric pressure.

Further, the fuel storage portion 101 may also be provided with a portion at which waste fuel is stored.

The fuel stored in the fuel storage portion 101 is fed to the fuel cell body 2 through the fuel feeding opening 103 located at the surface of the fuel cartridge 1. The fuel feeding opening 103 may preferably be provided with a valve having such a structure that the valve is placed in an open state when the fuel cartridge 1 is mounted to the fuel cell body 2 and in a closed state when the fuel cartridge 1 is not mounted to the fuel cell body 2.

The structure of such a valve is shown in Figure 7 or 8. Figure 7 is a sectional view of the fuel feeding opening 103 provided to the fuel cartridge in an unmounted state of the fuel cartridge to the fuel cell body in this embodiment. Figure 8 is a sectional view of the fuel feeding opening 103 provided to the fuel cartridge in a mounted state of the fuel cartridge to the fuel cell body. A valve 1031 provided to the fuel feeding opening 103 is, as shown in Figure 8, opened by mounting the fuel cartridge 1 to the fuel cell body 2 to push a pipe or tube 2021 provided to the fuel receiving opening 202 into the fuel feeding opening 103. The shape of the pipe 2021 of the fuel receiving opening 202 is not limited to a pipe-like shape so long as the pipe 2021 has such a structure that it can open the valve 1031 and does not block the feeding of fuel. Further, in a state in which the fuel feeding opening 103 is not mounted to the fuel receiving opening 202, as shown in Figure 7, the valve 1031 is placed in the closed state, thus preventing the fuel from flowing out.

In the present invention, the power generation portion may also be of a type wherein hydrogen gas is directly supplied to the power generation portion and is reacted with oxygen taken in from outside air at the power generation portion or a so-called methanol direct type wherein in place of hydrogen gas, methanol

is directly supplied to an oxidation anode. Further, the power generation portion may preferably be of a solid polymer-type using an ion-exchange polymeric membrane as an electrolyte.

In the present invention, the first wiring portion may have any shape, such as circular shape, dot shape, line shape, ring shape, or combinations of these shapes. At least a part of the first wiring portion is exposed at a surface of the fuel cartridge. A position where the first wiring portion is disposed is not limited to those shown in Figures 1 and 2 in this embodiment but may also be any position capable of electrically connecting a pair of contact terminals 203 with each other. Further, as shown in Figures 1 and 2, the first wiring portion is not required that the entire surface thereof is exposed at the surface of the fuel cartridge. Herein, the expression "exposed at the surface of the fuel cartridge" may include not only a case where at least a part of the first wiring portion is always exposed at an outermost surface of the fuel cartridge but also a case where at least a part of the first wiring portion is exposed at the surface of the fuel cartridge as desired, specifically only in the case of mounting the fuel cartridge to the fuel cell body. For example, the expression may include a case where the first wiring portion is capable of being exposed at the outermost surface of

the fuel cartridge depending on a mounting operation of the fuel cartridge, such as a case where a protective member such as a movable cover (lid) is attached in the neighborhood of the first wiring portion 2. In this manner, the movable cover is provided in the neighborhood of the first wiring portion 2, whereby an effect of preventing damage of the first wiring portion is also achieved.

The first wiring portion shown in Figure 1 constitutes a part of wiring for supplying generated current only when the fuel cartridge 1 is properly mounted to the fuel cell body 2. The first wiring portion may preferably have a low electric resistance, specifically a sheet resistance of 10^3 ohm/□ or less. Examples of a material for forming the first wiring portion may include metals such as gold, gold-plated metal, aluminum, copper, iron, nickel, and platinum; alloy such as stainless steel; and electroconductive materials such as electroconductive carbon, electroconductive ceramics, and electroconductive polymers. A method of forming such a first wiring portion is not particularly limited. For example, the first wiring portion may be formed by any method including a liquid-phase method such as application of paste, a vapor-phase deposition method such as vapor deposition or sputtering, adhesion of an electroconductive tape, etc. It is also possible to

form the first wiring portion by forming an electroconductive material such as metal on the surface of the fuel cartridge and then covering a portion other than the first wiring portion with an electrically insulating material.

At the surface of the fuel cartridge 1, the portion other than the portion where the first wiring portion is exposed may preferably be electrically insulative. Such an electrically insulating surface portion of the fuel cartridge 1 may preferably have a sheet resistance of 10^8 ohm/□ or more, more preferably 10^{13} ohm/□ or more. The portion other than the first wiring portion 102 is made electrically insulative, so that it is also possible to prevent energization during erroneous mounting of the fuel cartridge 1 to the fuel cell body 2. Accordingly, the portion other than the first wiring portion 102 or a portion of the first wiring portion 102 exposed at the surface of the fuel cartridge 1 may preferably have a minimum size.

In the present invention, movement of the fuel from the fuel cartridge 1 to the polymer electrolyte fuel cell body 2 may preferably be actively effected. In order to ensure the active movement of the fuel, the fuel cartridge 1 may preferably be provided with a fuel feeding mechanism such as a pump for being actuated by electric power supplied through the first wiring portion. Incidentally, even in the case where

the fuel cartridge is not placed in a pressurization state and there is no fuel feeding mechanism, feeding of the fuel is effected more or less, so that the fuel is placed in the feedable state. However, by providing the fuel feeding mechanism, it is possible to promote the feeding of the fuel. An example of the fuel feeding mechanism of the fuel cartridge is shown in Figure 6, wherein the fuel feeding mechanism is constituted by a pump 1041 and a movable partition wall 1042. The pump 1041 is electrically connected to the first wiring portion 102 at a connection portion. When electric power is supplied from the connection portion, the pump 1041 performs an operation of supplying outside air from an inlet port (not shown), for permitting air supply, into the fuel cartridge. The movable partition wall 1042 has the function of partitioning an inner space of the fuel cartridge into the fuel storage portion 101 and a hollow portion fro storing outside air supplied to the pump 1041, and has a structure movable in the fuel cartridge. For this reason, when the pump 1041 takes in outside air, the fuel is fed by movement of the movable partition wall 1042.

Further, in the case where the fuel is gas, by creating the pressurization state with inert gas such as nitrogen, it is possible to effect the fuel movement actively even in the case of no fuel feeding

mechanism.

An operation mechanism from the mounting of the fuel cartridge to the electric power generation is as follows.

By connecting the fuel feeding opening 103 and the fuel receiving opening 202, the fuel is fed from the fuel storage portion 101 to the anode of the MEA of the power generation portion 201 to start generation of electric power in the MEA. At the same time, by contact of the contact terminal 203 with the first wiring portion 102, i.e., contact between the first and second wiring portions, an interconnecting line connecting the power generation portion 201 with the output terminal 204 is formed. The first wiring portion 102 functions as a part of the interconnecting line. Conversely, when the fuel cartridge 1 is removed from the polymer electrolyte fuel cell body 2, the contact terminal 203 and the first wiring portion 102 are placed in a noncontact state to disconnect the interconnecting line. As a result, the electric power cannot be supplied from the output terminal 204.

Further, in the above described constitution, the feeding of oxygen fuel to the cathode of the fuel cell body 2 is effected by utilizing outside air but in the present invention, the oxygen fuel may also be fed in a form of a fuel cartridge as shown in Figures 1 and 2.

More specifically, such a state that the fuel is fed to the power generation portion to generate electric power as shown in Figures 1 and 2 is taken as a normally on state. A switch for establishing the normally on state is constituted by the first wiring portion 102 and the pair of connection terminals 203. In this manner, it is possible to provide a fuel cell and fuel cartridge which have an inexpensive and simple constitution capable of synchronizing mounting/demounting of the fuel cartridge with ON/OFF of current.

(Embodiment 2)

Figures 3 and 4 show a fuel cell according to another embodiment of the present invention. Figure 3 is a schematic view showing an unmounted state of a fuel cartridge to a fuel cell body, and Figure 4 is a schematic view showing a mounted state of the fuel cartridge to the fuel cell body.

This embodiment is different from Embodiment 1 in that a first wiring portion 206 is not integrally provided to a fuel cartridge 4 but is provided to a fuel cell body 2, and is moved depending on mounting and demounting of the fuel cartridge 4. The first wiring portion 206 is formed of a platinum foil cut in a doughnut-like shape as shown in Figure 11 and is provided to a housing member via a plate spring (not shown) on the fuel cell body 2 side, not the fuel

cartridge 4 side.

When the fuel cartridge 4 is mounted to the fuel cell body 2, as shown in Figure 4, a fuel feeding opening 402 is connected to a fuel receiving opening 202 and at the same time, the first wiring portion 206 is pushed downward by the fuel cartridge 4 and moved to contact a pair of contact terminals 203. In other words, the first wiring portion 206 and a second wiring portion (including the contact terminals 203, a power generation portion 201, and a connecting line 205) contact each other. As a result, wiring in the fuel cell is created to ensure a state capable of supplying electric power from output terminals 204.

Further, in the case where the fuel cartridge 4 is removed or demounted from the fuel cell body 2, the first wiring portion 206 is returned to an original position by being moved upward by means of a spring mechanism or the like. In other words, the wiring is disconnected by noncontact between the first wiring portion 206 and the contact terminals 203, so that the supply of electric power from the output terminals 204 cannot be effected.

More specifically, when such a state that the fuel is fed to the power generation portion to generate electric power as shown in Figures 3 and 4 is taken as a normally on state, a switch for establishing the normally on state is constituted by

the first wiring portion 206 and the pair of connection terminals 203. In this manner, it is possible to provide a fuel cell and fuel cartridge which have an inexpensive and simple constitution capable of synchronizing mounting/demounting of the fuel cartridge with ON/OFF of current.

(Embodiment 3)

Figures 5 and 6 show a constitution of a fuel cartridge according to this embodiment of the present invention. Figure 5 is a perspective view showing the fuel cartridge of this embodiment, and Figure 6 is a sectional view of the fuel cartridge.

In this embodiment, a fuel storage portion 101 is formed of propylene which is electrically insulative. In the fuel storage portion 101, e.g., a 10 wt. %-aqueous methanol solution is stored. The first wiring portion 102 is formed of a platinum foil cut in a doughnut-like shape and is affixed as a surface layer of the fuel cartridge 101. A fuel feeding opening 103 is prepared by using a commercially available resinous tube joint, one end portion of which is located inside the fuel storage portion 101 and the other end portion is provided therein with a valve 1031 which cannot be opened until the fuel feeding opening 103 is connected to a connector having a shape corresponding to that of the fuel feeding opening 103, similarly as in Embodiment 1

described with reference to Figure 6.

Further, in this embodiment, as shown in Figure 6, the air supply pump 1041, the movable partition wall 1042, and the inlet port (not shown) have the same structure as those in Embodiment 1.

(Embodiment 4)

Figure 9 is a schematic view for illustrating a constitution of a polymer electrolyte fuel cell body according to this embodiment of the present invention, wherein a left section is a plan view when the fuel cell body is viewed from a fuel receiving opening side, a central section is a sectional view, and a right section is a plan view when the fuel cell body is viewed from a cathode diffusion layer side.

A power generation portion 201 having an MEA is constituted by an anode diffusion layer 2011, a solid polymer electrolytic membrane 2012, and a cathode diffusion layer 2013. The anode diffusion layer 2011 and the cathode diffusion layer 2013 are formed of electroconductive carbon and also have the function as electrodes. The cathode diffusion layer 2013 is provided with slits for externally taking in air. Further, a catalyst layer (not shown) for accelerating decomposition of fuel is provided at each of interfaces between the anode diffusion layer 2011 and the solid polymer electrolytic membrane 2012 and between the solid polymer electrolytic membrane 2012

and the cathode diffusion layer 2013.

The fuel receiving opening 202 is prepared by cutting a commercially available resinous tube. At one end portion, the fuel receiving opening 202 is connected to a diffusion structure portion of the anode diffusion layer 2011 and at the other end portion, the fuel receiving opening 202 has a double structure such that a pipe or tube 2021 is provided therein. When the fuel receiving opening 202 is connected with the fuel feeding opening 103 of the fuel cartridge in the above described embodiments, the pipe 2021 is inserted into the fuel feeding opening 103 to open the valve 1031.

Contact terminals 203 are provided at two positions where they contact the first wiring portion 102 during the mounting of the fuel cartridge 1. One of the contact terminals 203 is electrically connected to the anode diffusion layer 2011 via a copper interconnecting line 205 as a connecting line and the other contact terminal 203 is electrically connected to one of output terminals 204 via a copper interconnecting line 205. The other output terminal 204 is electrically connected to the cathode diffusion layer 2013 via a copper interconnecting line 205.

Further, in this embodiment, as a constitution of the fuel cartridge, it is possible to employ the same constitution as that shown in Figures 5 and 6.

Figure 10 shows a state in which the fuel cartridge in Embodiment 3 is mounted to the polymer electrolyte fuel cell body 2 shown in Figure 9 to prepare a polymer electrolyte fuel cell.

As shown in Figure 10, in this embodiment, external equipment 3 such as an electric tester is provided. When the fuel feeding opening 103 and the fuel receiving opening 102 are properly connected, the valve is opened to feed methanol fuel to the MEA in the power generation portion 201. At the same time, generation of electric power is started by contact of the first wiring portion 102 with the two contact terminals 203, thus actuating also the air supply pump of the fuel cartridge. By the electric tester, an average electric power of 0.5 V and 0.2 A, i.e., an output of 0.1 W can be confirmed. After a stable operation for 30 minutes, when the fuel cartridge is removed, the circuit is immediately disconnected. As a result, the output (power) detected by the electric tester is 0 W.

(Embodiment 5)

Figure 11 is a schematic view for illustrating a constitution of a polymer electrolyte fuel cell body according to this embodiment, and Figure 12 is a schematic view showing a constitution of a fuel cell of this embodiment in which a fuel cartridge is mounted to the fuel cell body.

This embodiment is different from Embodiment 4 in that a movable first wiring portion 206 formed of a copper plate (sheet) having a doughnut-like shape is provided to a housing member via a plate spring (not shown) on the fuel cell body 2 side, not the fuel cartridge 4 side.

Referring to Figure 12, the fuel cartridge 4 is mounted to the polymer electrolyte fuel cell body 2 to be actuated as a fuel cell. By the mount of the fuel cartridge 4, the first wiring portion 206 is pushed toward the side of the power generation portion 201 having the MEA to contact the contact terminals 203. When a fuel feeding opening 402 and the fuel receiving opening 202 are properly connected, the valve is opened similarly as in the above described embodiments. As a result, methanol fuel is fed from a fuel feeding opening 401 to the power generation portion 201 having the MEA to start generation of electric power. When electric power outputted from the output terminals 204 is measured by the electric tester 3, it is possible to confirm average electric power of 0.5 V and 0.16 A, i.e., an output (power) of 0.08 W. After a stable operation for 30 minutes, when the fuel cartridge 4 is removed, the circuit is immediately disconnected. As a result, the output detected by the electric tester is 0 W.

Incidentally, in this embodiment, the wiring

may be established by mounting the fuel cartridge to the fuel cell body to move the movable first wiring portion. Accordingly, the movement of the first wiring portion may be effected by moving not only directly the first wiring portion by the fuel cartridge but also indirectly the first wiring portion. For example, by mounting the fuel cartridge to the fuel cell body to actuate a member such as a lever (utilizing leverage), the first wiring portion may also be moved.

[INDUSTRIAL APPLICABILITY]

As described hereinabove, according to the present invention, there are provided a fuel cell and fuel cartridge which are capable of synchronizing mounting and demounting of the fuel cartridge with a transition between a supply state and supply-interrupting state of current, caused by electric power generation, by means of an electric circuit having a simple constitution.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purpose of the improvements or the scope of the following claims.

CLAIMS

1. A fuel cartridge comprising:

a fuel storage portion; and

a fuel feed opening,

wherein said fuel cartridge comprises a wiring portion, said wiring portion constituting a part of wiring for electrically connecting an output terminal of a fuel cell body and a power generation portion of a fuel cell body with each other when said fuel cartridge is mounted to the fuel cell body to place a fuel in a state in which the fuel is feedable from said fuel cartridge to the fuel cell body.

2. A cartridge according to Claim 1, wherein at least a part of said wiring portion is exposed at a first portion of a surface of said fuel cartridge, and the surface of said fuel cartridge is electrically insulative at a second portion thereof other than the first portion.

3. A cartridge according to Claim 1, wherein said fuel cartridge further comprises a fuel feeding mechanism driven by electric power supplied through said wiring portion.

4. A cartridge according to Claim 1, wherein said

fuel cartridge further comprises a valve having a structure which is opened when said fuel cartridge is mounted in the fuel cell body and closed when said fuel cartridge is removed from the fuel cell body.

5. A fuel cell comprising:

a fuel cartridge comprising a fuel storage portion and a fuel feed opening; and

a fuel cell body comprising an output terminal and a power generation portion,

wherein said fuel cell comprises a wiring portion for electrically connecting the output terminal and power generation portion of said fuel cell body with each other when said fuel cartridge is mounted to said fuel cell body to place a fuel in a state in which the fuel is feedable from said fuel cartridge to said fuel cell body and for electrically disconnecting the output terminal and power generation portion of said fuel cell body when said fuel cartridge is removed from said fuel cell body.

6. A cell according to Claim 5, wherein said wiring portion is provided to said fuel cartridge.

7. A cell according to Claim 5, wherein said wiring portion is provided to said fuel cell body.

8. A cell according to Claim 5, wherein said fuel cell is a polymer electrolyte fuel cell.

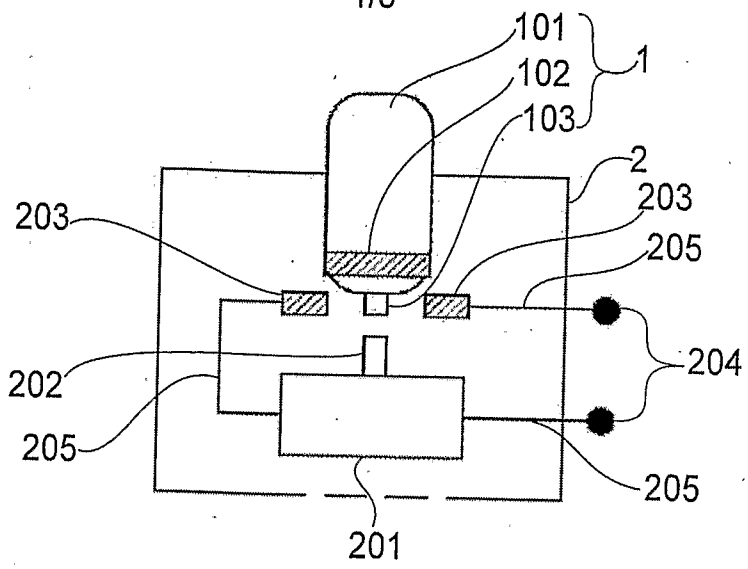

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FIG.1

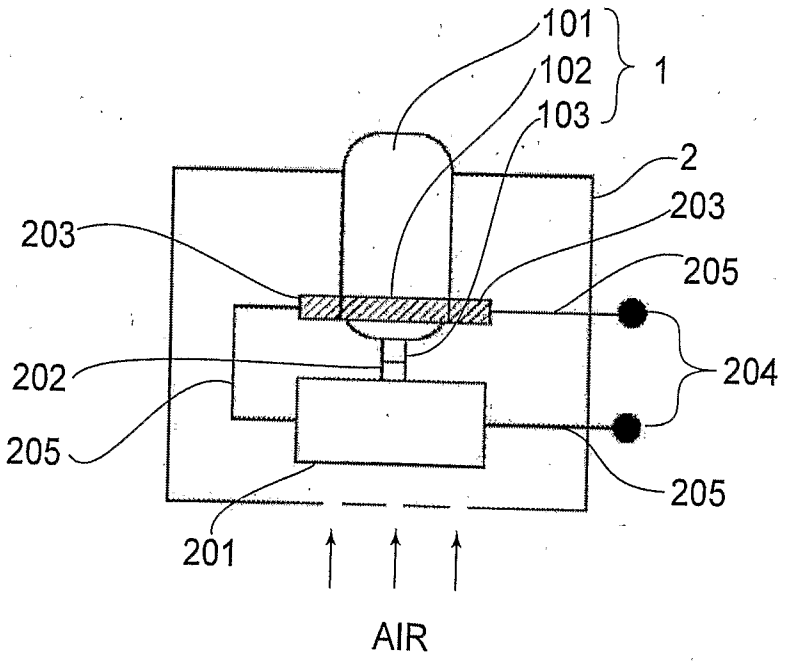

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FIG.2

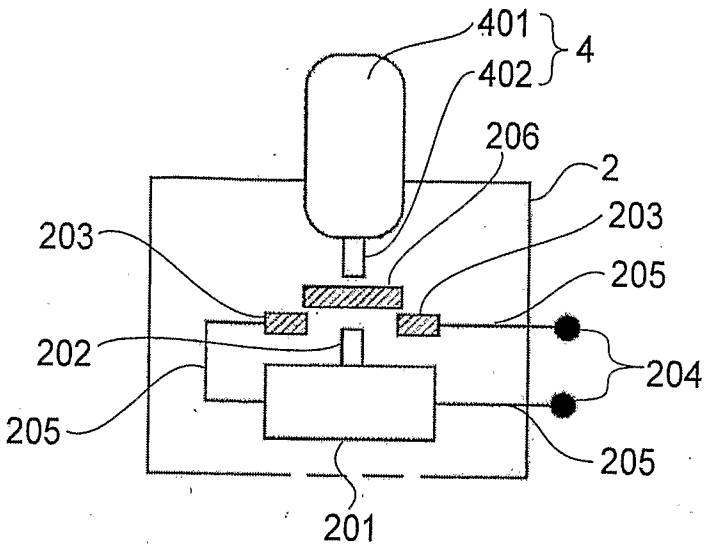

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FIG.3

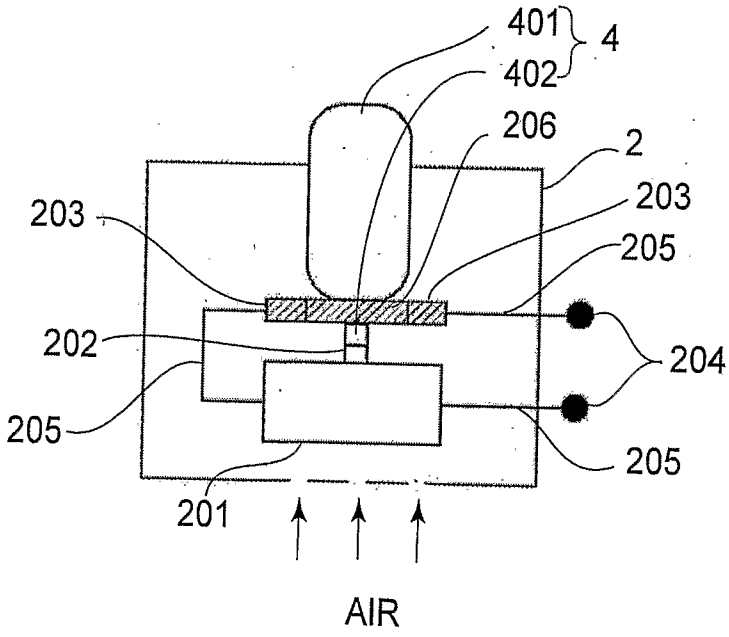

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FIG.4

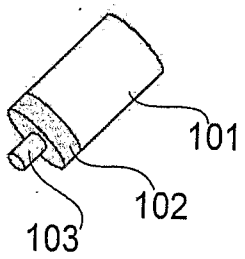


FIG.5

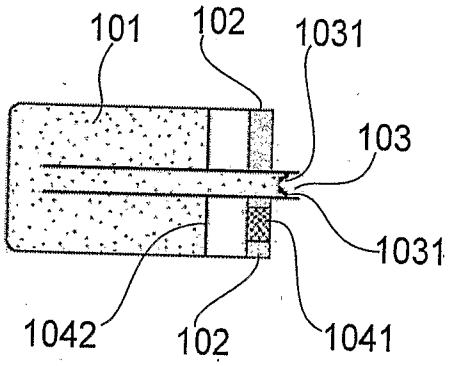


FIG.6

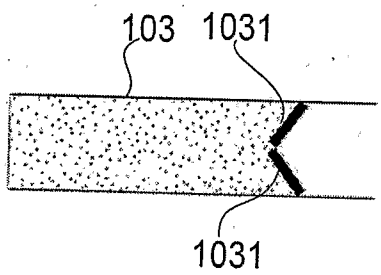


FIG.7

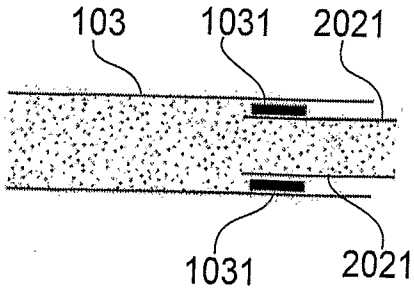


FIG.8

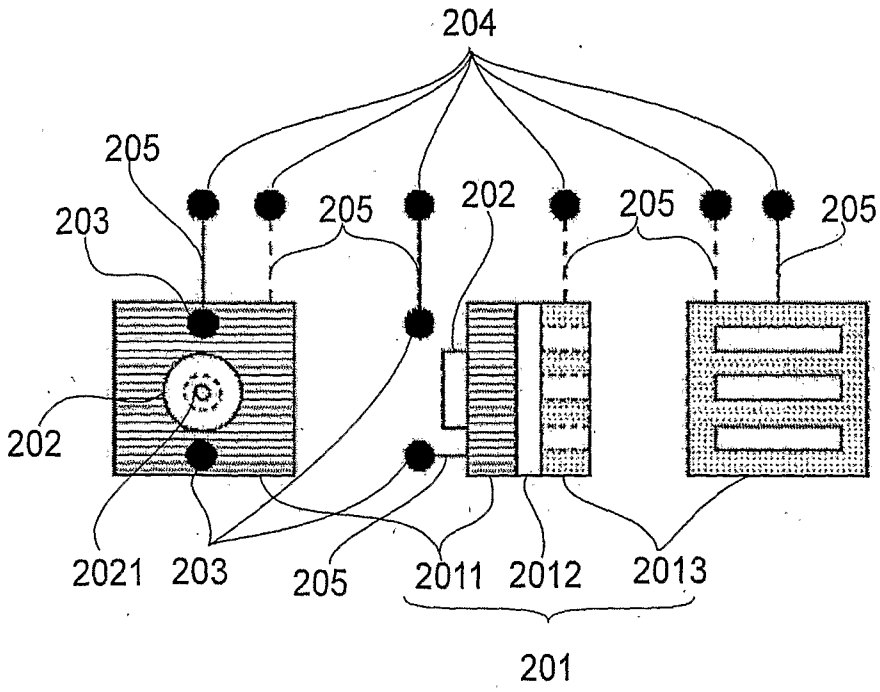

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FIG.9

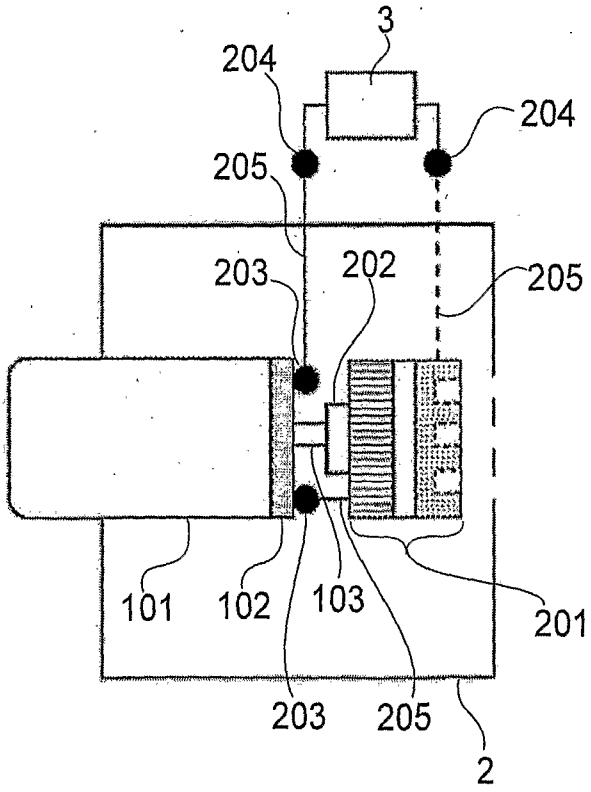

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FIG.10

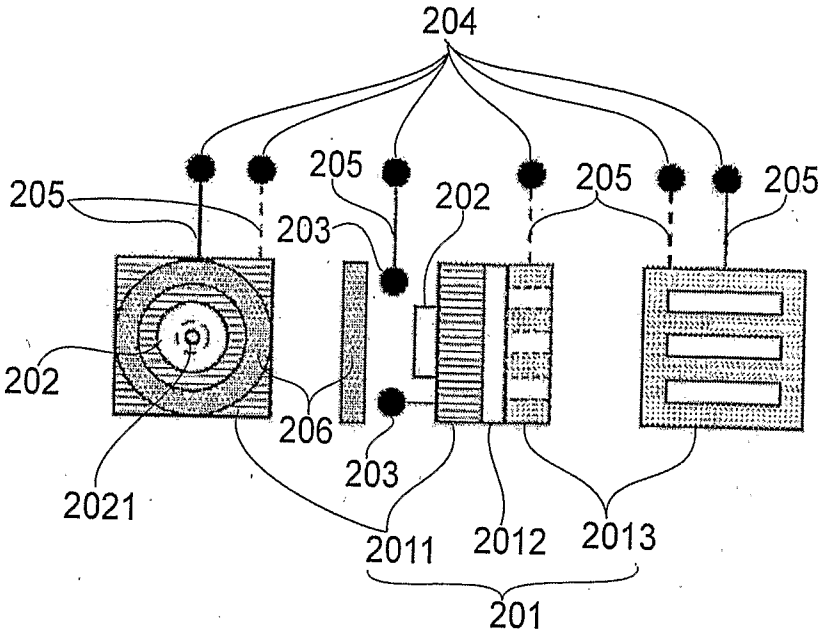

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FIG.11

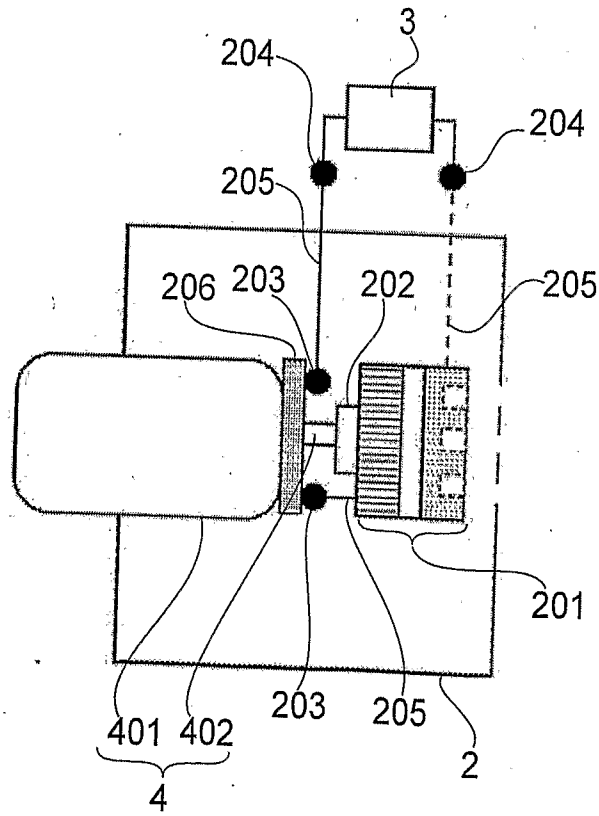

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FIG.12

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2006/325577

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01M8/04 F17C11/00

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)
H01M F17C

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/118468 A1 (ADAMS PAUL [US] ET AL) 2 June 2005 (2005-06-02)	5-8
A	paragraph [0104] paragraph [0107] paragraph [0138] figures 1,3,4	1-4
X	EP 1 306 918 A (HEWLETT PACKARD CO [US]) 2 May 2003 (2003-05-02) paragraph [0033] - paragraph [0039] figures 3,7,10	5-8
A	EP 1 455 403 A (TOKYO SHIBAURA ELECTRIC CO [JP]) 8 September 2004 (2004-09-08) abstract; figure 1	1-8

-/--

[X] Further documents are listed in the continuation of Box C.

[X] 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

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Date of the actual completion of the international search	Date of mailing of the international search report
23 April 2007	02/05/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	BARENBRUG, G

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2006/325577

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2004 071262 A (TOKYO SHIBAURA ELECTRIC CO) 4 March 2004 (2004-03-04) cited in the application paragraph [0030] - paragraph [0045] figure 4	1-8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/JP2006/325577

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005118468 A1	02-06-2005	AR 046731 A1	21-12-2005
		AU 2004296031 A1	16-06-2005
		BR PI0417013 A	21-02-2007
		CA 2544271 A1	16-06-2005
		EP 1690309 A2	16-08-2006
		KR 20060103261 A	28-09-2006
		WO 2005055337 A2	16-06-2005
EP 1306918 A	02-05-2003	CA 2409503 A1	29-04-2003
		JP 3683875 B2	17-08-2005
		JP 2003203660 A	18-07-2003
		US 2003082426 A1	01-05-2003
		US 2005084722 A1	21-04-2005
EP 1455403 A	08-09-2004	JP 3713493 B2	09-11-2005
		JP 2004265833 A	24-09-2004
		US 2004224199 A1	11-11-2004
JP 2004071262 A	04-03-2004	NONE	