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Ozaki et al.

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(54) **FUEL CELL AND FUEL CELL SYSTEM AS DESCRIBED AND CLAIMED IN**

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H01M 8/10 (2016.01)
(Continued)

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CPC ***H01M 8/04089*** (2013.01); ***H01M 8/0247*** (2013.01); ***H01M 8/04201*** (2013.01); *F17C 11/00* (2013.01); *H01M 8/0258* (2013.01); *H01M 2008/1095* (2013.01); *Y02E 60/50* (2013.01); *Y02E 60/521* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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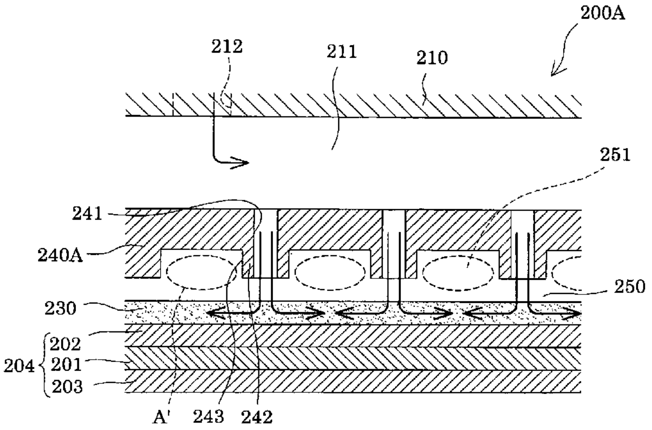
(57) **ABSTRACT**

A fuel cell has a membrane electrode assembly (MEA), a supply member for supplying an anode fluid to the MEA, and a gas diffusion layer provide between the supply member and the MEA. The MEA has an electrolyte membrane and an anode catalyst. The supply member has at least one anode fluid flow path for supplying the anode fluid toward the MEA. The anode fluid flow path has an opening provided on a discharge side thereof for the anode fluid. A space for storing a gas pushed by the supply of the anode fluid is disposed between the opening of the anode fluid flow path and the gas diffusion layer so that the opening of the anode fluid flow path and the gas diffusion layer are not in direct contact with one another.

17 Claims, 10 Drawing Sheets



(51) **Int. Cl.**

H01M 8/02	(2016.01)
F17C 11/00	(2006.01)

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FIG. 1

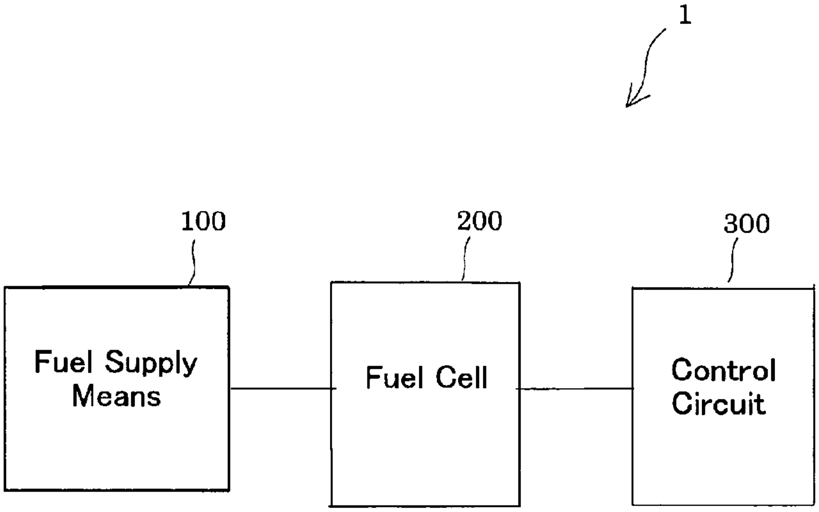


FIG. 2

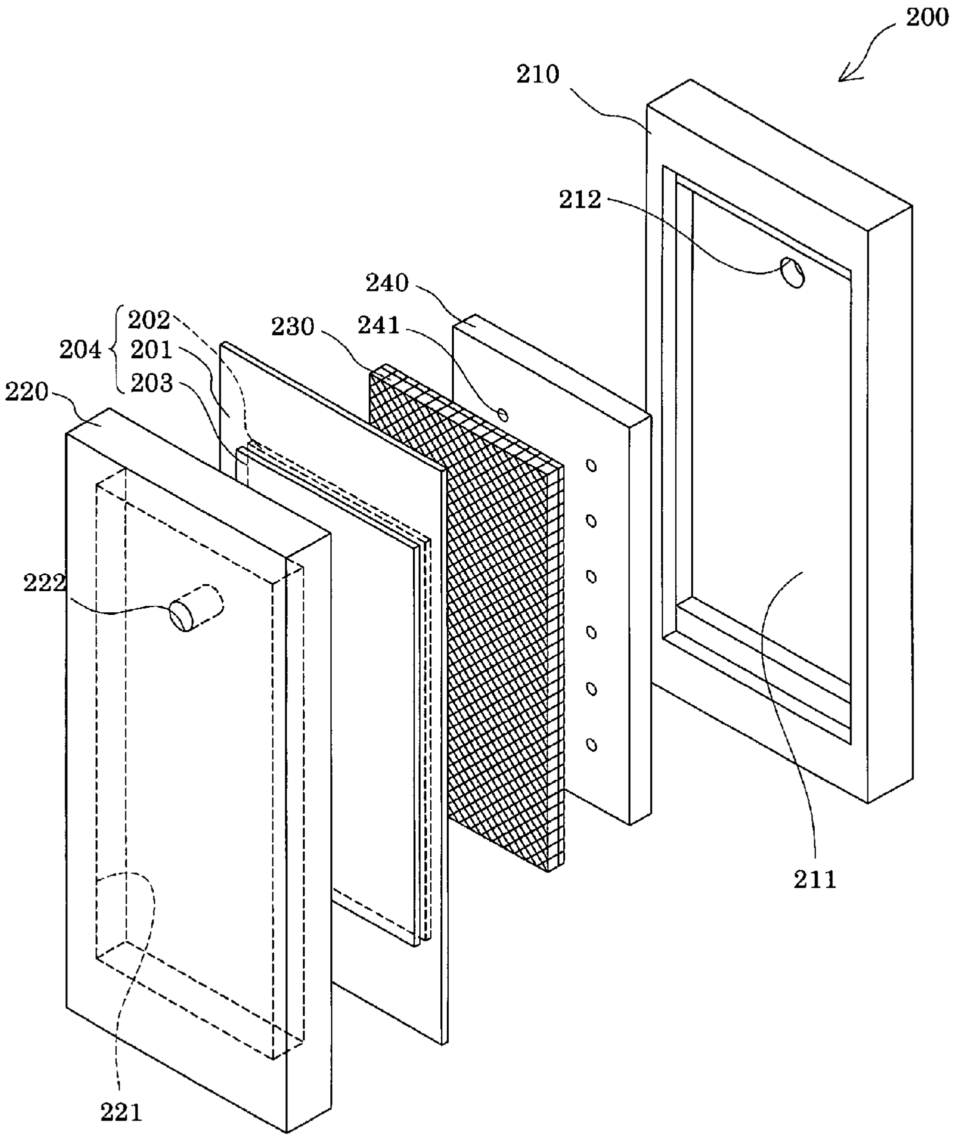


FIG. 3

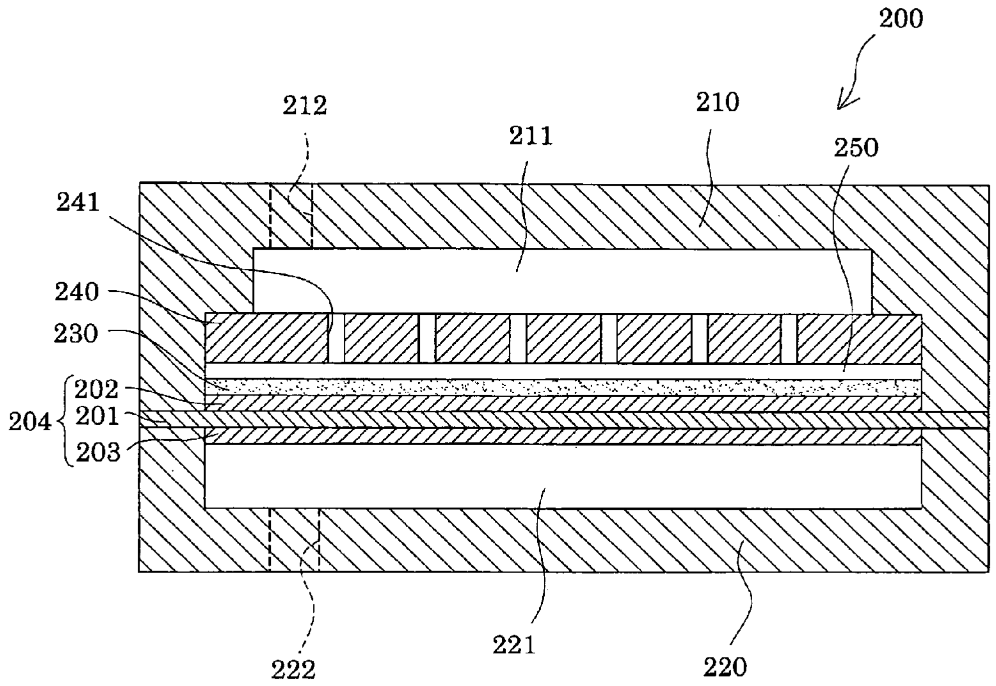
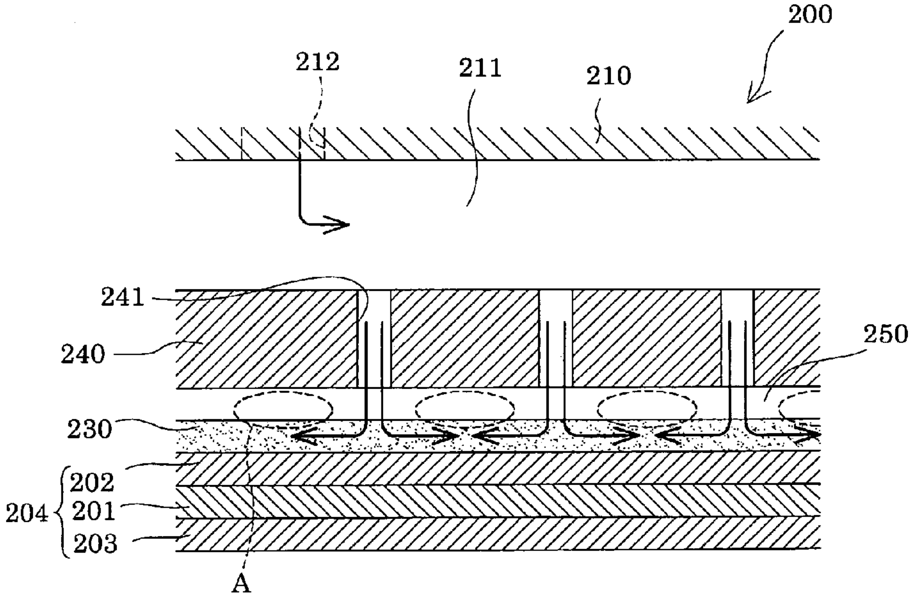

200
212
211
210
250
241
240
230
202
204
201
203
222
221
220

FIG. 4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212
211
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201
203
A

FIG. 5

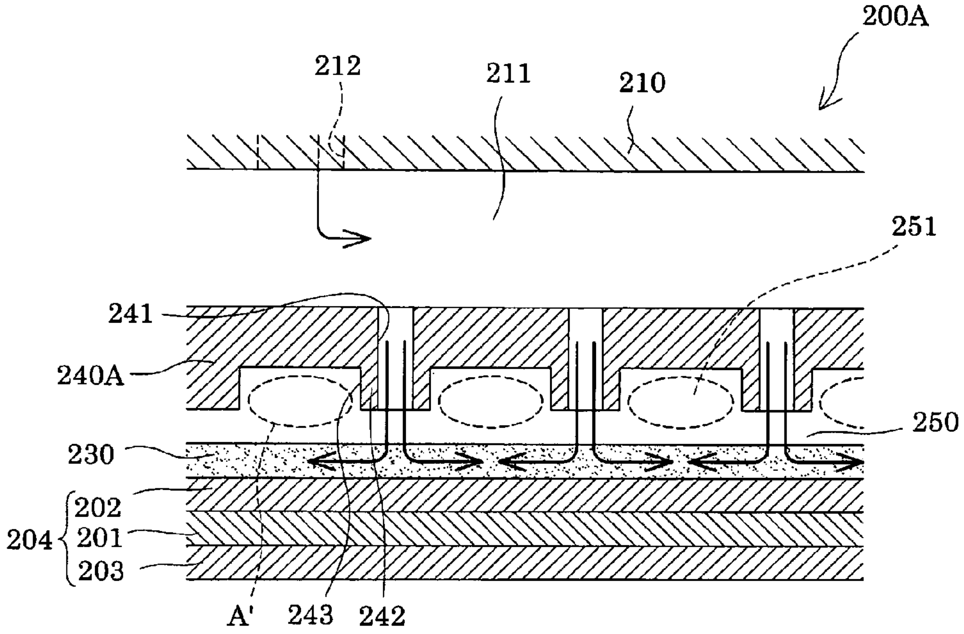

200A
212
211
210
251
241
240A
250
230
202
204
201
203
A'
243
242

FIG. 6

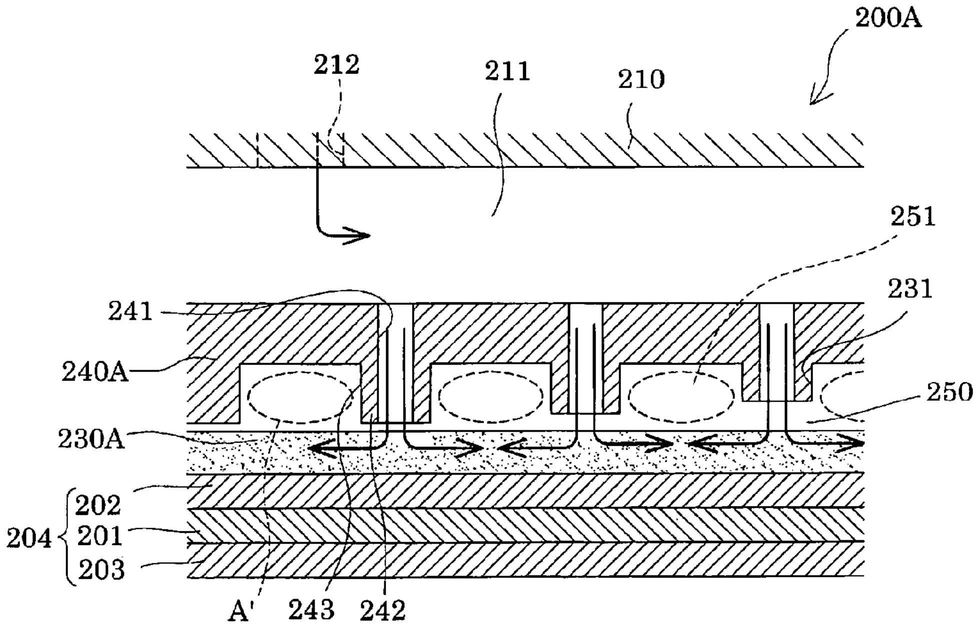

200A
212
211
210
251
231
241
240A
250
230A
202
204
201
203
A'
243
242

FIG. 7

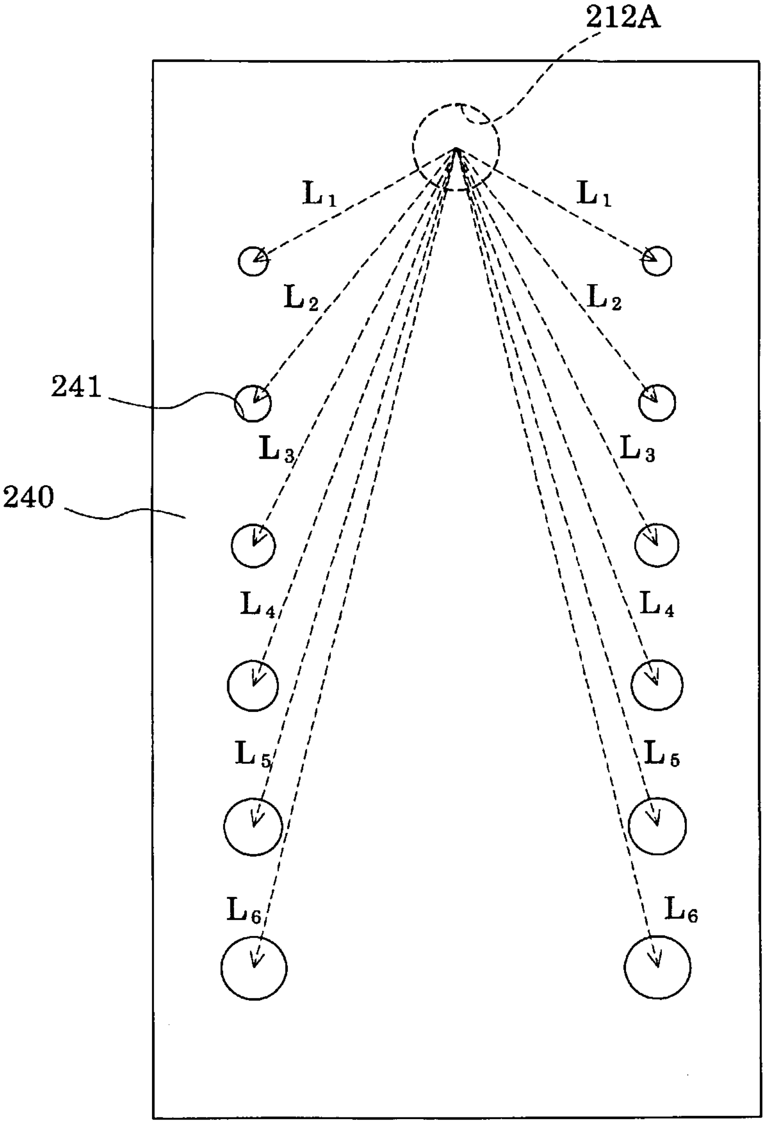


FIG. 8

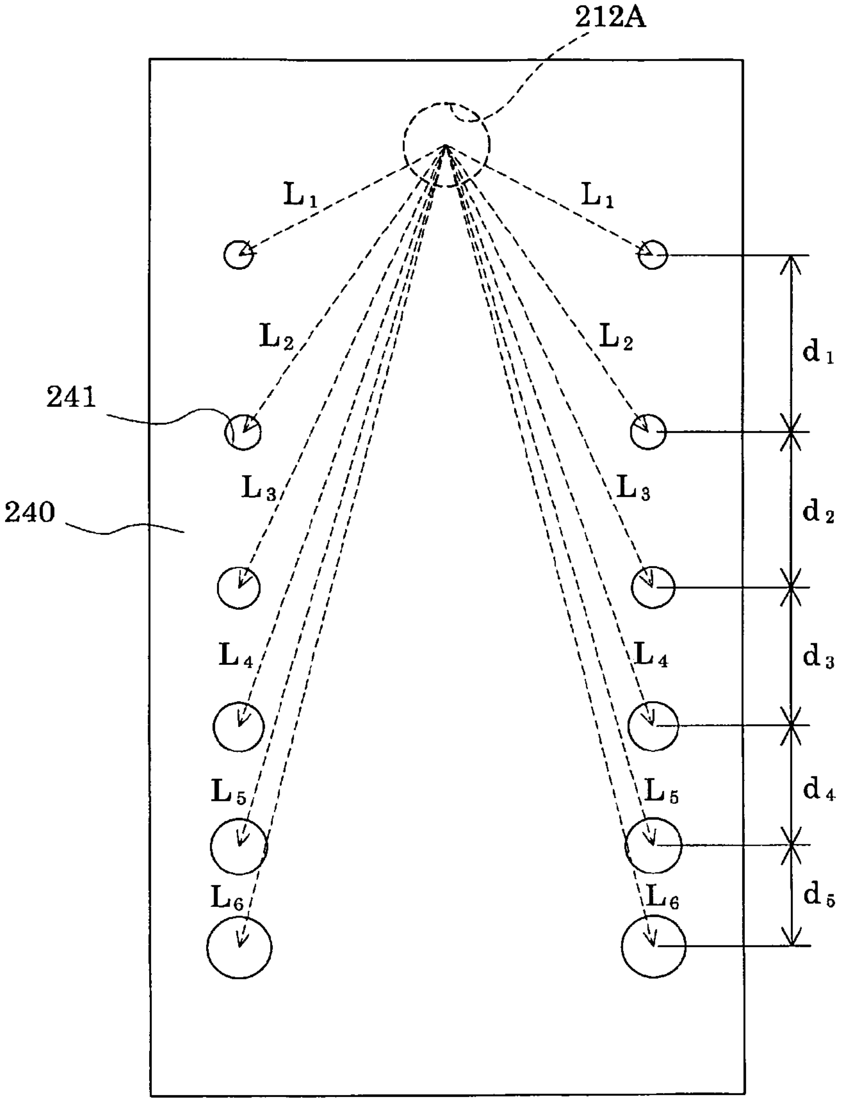


FIG. 9

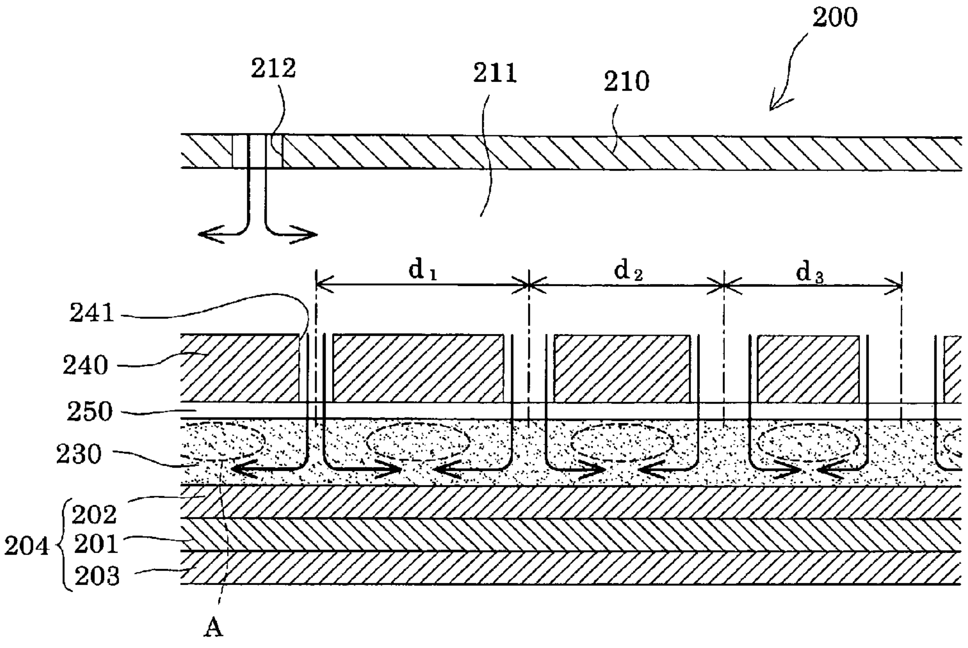


FIG. 10

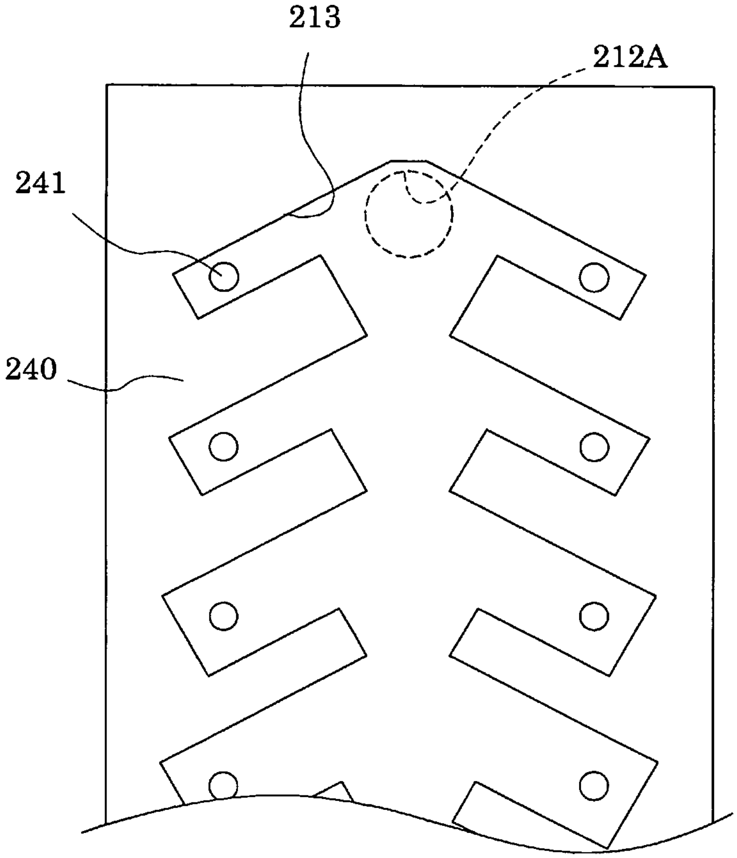
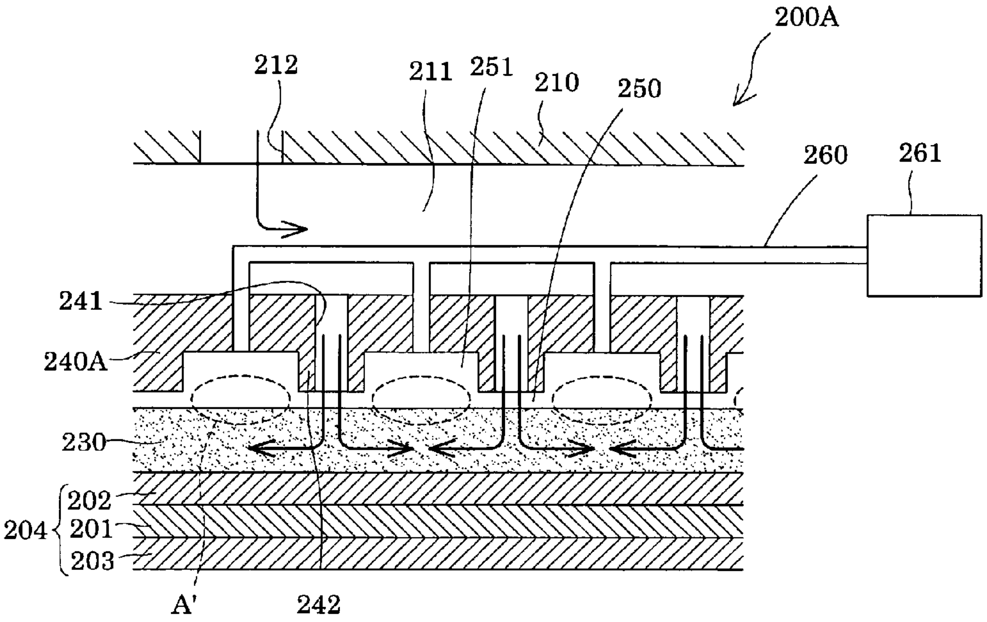


FIG. 11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211
251
210
250
260
261
241
240A
230
202
204
201
203
A'
242

FIG. 12

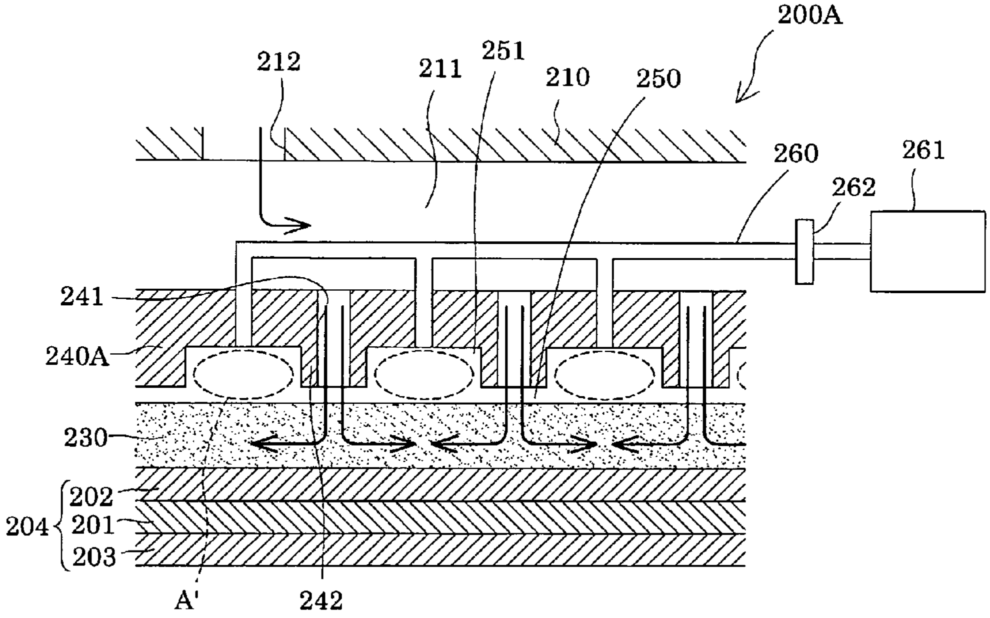
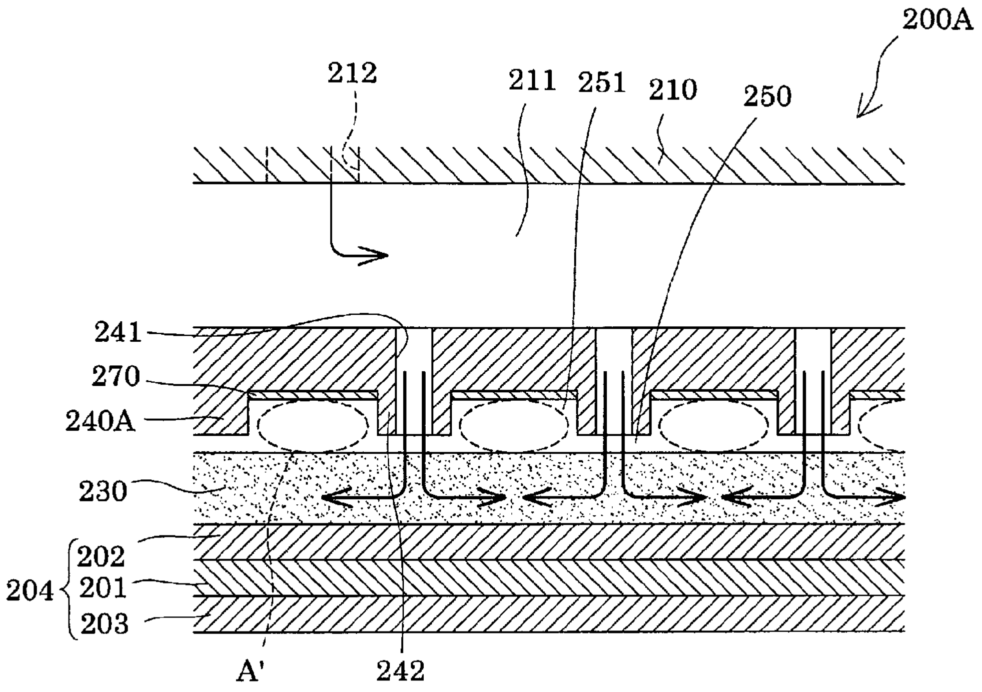

200A
212
211
251
210
250
260
262
261
241
240A
230
202
204
201
203
A'
242

FIG. 13



FUEL CELL AND FUEL CELL SYSTEM AS DESCRIBED AND CLAIMED IN

CROSS-REFERENCE to RELATED APPLICATIONS

This application is a U.S. national stage application of International Application No. PCT/JP2009/068033 filed Oct. 19, 2009, claiming a priority date of Oct. 28, 2008, and published in a non-English language.

BACKGROUND OF THE INVENTION

1. Technical Field

This invention relates to a fuel cell comprising an electrolyte membrane and an anode catalyst and a cathode catalyst provided on both sides of the electrolyte membrane, and to a fuel cell system including the fuel cell.

2. Background Art

A fuel cell has a membrane electrode assembly (hereinafter referred to as MEA) provided with an electrolyte membrane, and an anode catalyst and a cathode catalyst provided on both sides of the electrolyte membrane. The fuel cell includes an anode member (anode) provided with an anode fluid flow path for supplying an anode fluid to the anode catalyst of the MEA via a gas diffusion layer, and a cathode member (cathode) provided with a cathode fluid flow path for supplying a cathode fluid to the cathode catalyst of the MEA.

With such a fuel cell, air in the atmosphere (particularly, nitrogen which is an inert gas) mixes into the anode side as an impure gas via the electrolyte membrane when power generation is stopped. The problem arises here that even when an operation is started in this state and a hydrogen-rich anode fluid is introduced, hydrogen is not replaced immediately, and a sufficient electrical output (or amount of power generation) cannot be obtained. When the fuel cell is allowed to stand for a long term, in particular, the problem occurs that the partial pressure of the impure gas mixed into the anode rises, decreasing the amount of power generation.

To deal with these problems, a technology for purging the impure gas, which has been accumulated in the anode, with the hydrogen-rich anode fluid before start of operation has been proposed (see, for example, Patent Document 1).

Concretely, Patent Document 1 involves a purge valve for purging an impure gas accumulated in an anode with a hydrogen-rich anode fluid, and an exhaust gas treatment device for diluting an exhaust gas, which is discharged through the purge valve and contains hydrogen, and discharging the diluted gas to the outside.

According to this constitution of Patent Document 1, the impure gas on the anode side can be replaced by the hydrogen-rich anode fluid. Thus, a decrease in the amount of power generation can be prevented.

PRIOR ART DOCUMENT

Patent Document

[Patent Document 1] JP-A-2004-193107

The constitution of Patent Document 1, however, needs the purge valve and the exhaust gas treatment device, and is confronted with the problem that it results in the upsizing of equipment and a cost increase.

With the constitution of Patent Document 1, moreover, the impure gas can be excluded from the anode by purging at the starting of the equipment. However, the impure gas passes into the anode through the electrolyte membrane even during power generation. Thus, during long-term power generation, the opening and closing of the purge valve must be controlled, with the status of power generation being monitored, posing the problem of complicated control.

SUMMARY OF THE INVENTION

The present invention has been accomplished in the light of the above-described circumstances. It is an object of the present invention to provide a downsized fuel cell and a downsized fuel cell system which can prevent a power generation failure due to the impure gas and can perform power generation continuously for a long term.

A first aspect of the present invention for solving the above problems is a fuel cell, comprising: a membrane electrode assembly equipped with an electrolyte membrane and an anode catalyst; and a supply member for supplying an anode fluid to the membrane electrode assembly, and wherein the supply member is provided with an anode fluid flow path for supplying the anode fluid toward the membrane electrode assembly, and an opening of the anode fluid flow path on a discharge side thereof for the anode fluid is provided in proximity to the membrane electrode assembly, with a predetermined space being disposed between the supply member and the membrane electrode assembly, the predetermined space being adapted to store a gas pushed away by supply of the anode fluid.

According to the first aspect mentioned above, the anode fluid is supplied toward the membrane electrode assembly by the anode fluid flow path. By so doing, the impure gas present on the surface of the anode catalyst can be pushed away by the anode fluid, and the anode fluid can be supplied uniformly throughout the surface of the anode catalyst. By this means, the amount of power generation, particularly, the initial voltage, can be rendered high, and power generation can be maintained for a long term.

A second aspect of the present invention is the fuel cell according to the first aspect, wherein the supply member is provided with a protruding portion which protrudes toward the membrane electrode assembly and within which the anode fluid flow path is provided.

According to the second aspect mentioned above, by providing the protruding portion, the space is defined between the membrane electrode assembly and the supply member in the region other than the protruding portion. Thus, the impure gas is easily pushed away into this space. Moreover, a large amount of the impure gas can be stored within the space, so that power generation can be continued for an even longer term.

A third aspect of the present invention is the fuel cell according to the second aspect, wherein the protruding portion has a tapered shape pointed toward the membrane electrode assembly.

According to the third aspect mentioned above, the protruding portion is pointed, whereby a large space can be defined in the region other than the protruding portion. Thus, an even larger amount of the impure gas can be stored within the space.

A fourth aspect of the present invention is the fuel cell according to any one of the first to third aspects, wherein the anode fluid flow path has a tapered shape pointed toward the membrane electrode assembly.

According to the fourth aspect mentioned above, the anode fluid flow path is pointed, whereby the flow velocity of the anode fluid jetted from the anode fluid flow path is increased, and the impure gas present on the surface of the anode catalyst can be pushed away by the anode fluid even more efficiently.

A fifth aspect of the present invention is the fuel cell according to any one of the first to fourth aspects, wherein a plurality of the anode fluid flow paths are provided in the single supply member.

According to the fifth aspect mentioned above, the anode fluid can be supplied uniformly to the surface of the anode catalyst having a relatively large area by the plurality of anode fluid flow paths.

A sixth aspect of the present invention is the fuel cell according to any one of the first to fourth aspects, wherein a plurality of the anode fluid flow paths are provided in the single supply member, there are provided a chamber communicating with the plurality of anode fluid flow paths on a side opposite to the membrane electrode assembly, and an anode fluid introduction port for supplying the anode fluid to the chamber, the supply member is provided with a protruding portion which protrudes toward the membrane electrode assembly and within which the anode fluid flow path is provided, the protruding portion having a first protruding portion and a second protruding portion, and the second protruding portion is at a longer distance from the anode fluid introduction port than a distance from the anode fluid introduction port to the first protruding portion, and an amount of protrusion of the first protruding portion is larger than an amount of protrusion of the second protruding portion.

According to the sixth aspect mentioned above, the pressures of the anode fluid jetted from the plurality of anode fluid flow paths are uniformized, so that the anode fluid can be supplied uniformly to the surface of the anode catalyst.

A seventh aspect of the present invention is the fuel cell according to any one of the first to sixth aspects, further comprising a chamber communicating with a plurality of the anode fluid flow paths on a side opposite to the membrane electrode assembly, and an anode fluid introduction port for supplying the anode fluid to the chamber, and wherein a pressure loss in the anode fluid flow path is greater than a pressure loss in an area from the anode fluid introduction port to each of the anode fluid flow paths.

According to the seventh aspect mentioned above, the anode fluid can be vigorously ejected from the anode fluid flow path to blow off the impure gas present on the surface of the anode catalyst.

An eighth aspect of the present invention is the fuel cell according to any one of the fifth to seventh aspects, further comprising a chamber communicating with the plurality of anode fluid flow paths on a side opposite to the membrane electrode assembly, and an anode fluid introduction port for supplying the anode fluid to the chamber, and wherein the plurality of anode fluid flow paths include a first of the anode fluid flow paths, and a second of the anode fluid flow paths whose distance from the anode fluid introduction port is longer than a distance from the anode fluid introduction port to the first anode fluid flow path, and a pressure loss in the first anode fluid flow path is greater than a pressure loss in the second anode fluid flow path.

According to the eighth aspect mentioned above, the pressures of the anode fluid jetted from the plurality of anode fluid flow paths are uniformized, so that the anode fluid can be supplied uniformly to the surface of the anode catalyst.

A ninth aspect of the present invention is the fuel cell according to any one of the fifth to eighth aspects, further comprising a chamber communicating with the plurality of anode fluid flow paths on a side opposite to the membrane electrode assembly, and an anode fluid introduction port for supplying the anode fluid to the chamber, and wherein the plurality of anode fluid flow paths include a first of the anode fluid flow paths, and a second of the anode fluid flow paths whose distance from the anode fluid introduction port is longer than a distance from the anode fluid introduction port to the first anode fluid flow path, and a pressure loss in a first guide path within the chamber in an area from the anode fluid introduction port to the first anode fluid flow path is greater than a pressure loss in a second guide path within the chamber in an area from the anode fluid introduction port to the second anode fluid flow path.

According to the ninth aspect mentioned above, the pressures of the anode fluid jetted from the plurality of anode fluid flow paths are uniformized, so that the anode fluid can be supplied uniformly to the surface of the anode catalyst.

A tenth aspect of the present invention is the fuel cell according to the eighth aspect, wherein spacings between the adjacent anode fluid flow paths of the plurality of anode fluid flow paths of the supply member gradually decrease from the anode fluid flow paths at shorter distances from the anode fluid introduction port toward the anode fluid flow paths at longer distances from the anode fluid introduction port.

By varying the pressure losses in the anode fluid flow paths, variations occur in the flow velocity of the anode fluid, and the range of spread of the anode fluid differs according to the distribution of the flow velocity. According to the tenth aspect mentioned above, however, the spacings between the adjacent anode fluid flow paths are varied, whereby the unevenness in the in-plane distribution of the anode fluid can be reduced.

An eleventh aspect of the present invention is the fuel cell according to any one of the first to tenth aspects, further comprising removal means for removing the gas from the region storing the gas pushed away by the anode fluid.

According to the eleventh aspect mentioned above, the gas, such as an impure gas, pushed away within the space charged with the anode fluid can be removed from the space charged with the anode fluid. Thus, the amount of power generation can be increased further, and power generation can be maintained for a long term.

A twelfth aspect of the present invention is the fuel cell according to the eleventh aspect, wherein the removal means is a lead-out path which communicates with the region storing the gas pushed away by the supply of the anode fluid to discharge the gas as a buffer.

According to the twelfth aspect mentioned above, the gas such as an impure gas can be discharged via the lead-out path as a buffer. Thus, the amount of power generation can be increased further, and power generation can be maintained for a long term.

A thirteenth aspect of the present invention is the fuel cell according to the twelfth aspect, wherein the lead-out path is provided with a check valve which permits a flow of the gas from the region storing the gas to the buffer and restrains a flow of the gas in a reverse direction.

According to the thirteenth aspect mentioned above, the gas discharged to the buffer does not return because of the check valve. Thus, the amount of power generation can be increased further, and power generation can be maintained for a long term.

A fourteenth aspect of the present invention is the fuel cell according to the eleventh aspect, wherein the removal means is an adsorbent provided in the region storing the gas pushed away by the anode fluid.

According to the fourteenth aspect mentioned above, the gas, such as an impure gas, is selectively adsorbed to the adsorbent, and can be removed thereby. Thus, the amount of power generation can be increased further, and power generation can be maintained for a long term.

A fifteenth aspect of the present invention is a fuel cell system, comprising: the fuel cell according to any one of the first to fourteenth aspects; and fuel supply means for supplying the anode fluid to the fuel cell.

According to the fifteenth aspect mentioned above, a fuel cell system can be realized which prevents a power generation failure due to an impure gas, which can perform power generation continuously for a long term, and which has been downsized.

With the present invention, the anode fluid is flowed toward the membrane electrode assembly by the anode fluid flow path. By so doing, the impure gas on the surface of the anode catalyst is pushed away, and the anode fluid can be supplied throughout the surface of the anode catalyst. Thus, there is no need to provide a complicated mechanism such as a purge valve or a gas treatment device. Also, a power generation failure, or a decrease in the amount of power generation, due to the impure gas is prevented, the amount of power generation is increased, and long-term power generation can be maintained. Moreover, it suffices to provide the anode fluid flow path for flowing the anode fluid toward the membrane electrode assembly. Thus, the provision of a purge valve, or a procedure such as complicated opening and closing of the purge valve becomes unnecessary, downsizing can be achieved, and the cost can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing the schematic configuration of a fuel cell system according to Embodiment 1 of the present invention.

FIG. **2** is an exploded perspective view showing the fuel cell according to Embodiment 1 of the present invention.

FIG. **3** is a sectional view showing the fuel cell according to Embodiment 1 of the present invention.

FIG. **4** is a sectional view of essential parts showing the supply state of an anode fluid in the fuel cell according to Embodiment 1 of the present invention.

FIG. **5** is a sectional view of essential parts of a fuel cell according to Embodiment 2 of the present invention.

FIG. **6** is a sectional view of essential parts of another example of the fuel cell according to Embodiment 2 of the present invention.

FIG. **7** is a plan view of essential parts of a fuel cell according to another embodiment of the present invention.

FIG. **8** is a plan view of essential parts of a fuel cell according to still another embodiment of the present invention.

FIG. **9** is a sectional view of essential parts of the fuel cell according to the still another embodiment of the present invention.

FIG. **10** is a plan view of essential parts of a fuel cell according to a further embodiment of the present invention.

FIG. **11** is a sectional view of essential parts of a fuel cell according to a still further embodiment of the present invention.

FIG. **12** is a sectional view of essential parts of a fuel cell according to an additional embodiment of the present invention.

FIG. **13** is a sectional view of essential parts of a fuel cell according to a further additional embodiment of the present invention.

DETAILED DESCRIPTION of the INVENTION

Hereinbelow, the present invention will be described in detail based on its embodiments.

(Embodiment 1)

FIG. **1** is a view showing the schematic configuration of a fuel cell system according to the present invention.

As shown in FIG. **1**, a fuel cell system **1** of the present embodiment comprises a fuel supply means **100**, a fuel cell **200**, and a control circuit **300**.

The fuel supply means **100** supplies a fuel as an anode fluid to the fuel cell **200**. Hydrogen is optimal as the fuel, and a hydrogen absorbing or storage alloy, a cylinder enclosing hydrogen, etc. are named as the fuel supply means **100**. The fuel supply means **100** may be one for gene rating hydrogen, and an example thereof is of a configuration in which a hydrogen generating substance and a hydrogen generation accelerator are mixed to produce hydrogen. For example, sodium borohydride can be used as the hydrogen generating substance, and an aqueous solution of malic acid can be used as the hydrogen generation accelerator. Moreover, a solution of methanol may be supplied as the fuel.

The control circuit **300** is connected to the fuel cell **200**, and driven by a voltage supplied by the fuel cell **200**.

The fuel cell **200** will be described in detail by reference to FIGS. **2** to **4**. FIG. **2** is an exploded perspective view showing the schematic configuration of the fuel cell. FIG. **3** is a sectional view of the fuel cell. FIG. **4** is a sectional view of essential parts showing the supply state of the anode fluid in the fuel cell.

As shown in FIGS. **2** and **3**, the fuel cell **200** has a membrane electrode assembly **204** (hereinafter referred to as MEA) composed of a solid polymer electrolyte membrane **201** as an electrolyte membrane, and an anode catalyst **202** and a cathode catalyst **203** provided on both sides of the solid polymer electrolyte membrane **201**.

An anode member **210** and a cathode member **220** are provided on the respective surfaces of the MEA **204**. That is, the MEA **204** is sandwiched between the anode member **210** and the cathode member **220**.

The cathode member **220** is composed of a plate-shaped member provided on a side of the MEA **204** where the cathode catalyst **203** is located. The cathode member **220** is provided with a cathode fluid flow path **221** for supplying an oxidizing agent (air containing oxygen), as a cathode fluid, to the cathode catalyst **203**. That is, the cathode member **220** functions as a supply member for supplying the cathode fluid to the cathode catalyst **203**. The cathode fluid flow path **221**, in the present embodiment, has a concave shape opening at a side of the cathode member **220** facing the cathode catalyst **203**. In the bottom surface of the cathode fluid flow path **221**, a cathode fluid introduction port **222** is provided for supplying air into the cathode fluid flow path **221**.

The anode member **210** is composed of a plate-shaped member provided on a side of the MEA **204** where the anode catalyst **202** is located. The anode member **210** has a chamber **211** of a concave shape opening toward the anode catalyst **202**, and an anode fluid introduction port **212** provided as a through-hole in the thickness direction of the bottom surface of the chamber **211**.

The chamber **211** has an opening area comparable to the surface area of the anode catalyst **202**. The interior of the chamber **211** is supplied with the anode fluid via the anode fluid introduction port **212** provided in the bottom surface thereof.

Between the anode member **210** and the MEA **204**, there are provided a gas diffusion layer **230**, and a supply member **240** for supplying the anode fluid within the chamber **211** to the gas diffusion layer **230**.

The gas diffusion layer (GDL) **230** is provided between the anode member **210** and the MEA **204** to face the MEA **204**, that is, to be located on the anode catalyst **202** of the MEA **204**, and comprises a member having permeability which allows the anode fluid to pass therethrough. As the gas diffusion layer **230**, a well-known material can be used, for example, a metal mesh or a material having a porous structure such as a carbon cloth, a carbon paper, or a carbon felt.

The supply member **240** comprises a plate-shaped member provided on a side opposite to the MEA **204** across the gas diffusion layer **230**. The supply member **240** is disposed in such a state as to be separated from the gas diffusion layer **230** by a predetermined spacing, and a predetermined space **250** is defined between the supply member **240** and the gas diffusion layer **230**. A surface of the supply member **240** on a side opposite to the gas diffusion layer **230** seals one surface of the chamber **211**.

The supply member **240** is provided with an anode fluid flow path **241** to penetrate the supply member **240** in its thickness direction, thereby bringing the chamber **211** and the space **250** into communication. That is, the anode fluid flow path **241** has one end opening into the chamber **211** and the other end opening into the space **250**, thereby establishing communication between them. As described above, the one surface of the supply member **240** is not brought into contact with the gas diffusion layer **230**, but is separated therefrom by a predetermined spacing. Because of this configuration, the one surface of the supply member **240** is provided in proximity to the anode catalyst **202**, with the space **250** being disposed between the opening of the anode fluid flow path **241** on its discharge side for the anode fluid (the opening facing the gas diffusion layer **230**) and the gas diffusion layer **230**.

In the present embodiment, there are provided two rows of the anode fluid flow paths **241**, each row including a plurality of (six) the anode fluid flow paths **241** arranged with predetermined spacing, so that 12 of the anode fluid flow paths **241** are provided. The anode fluid flow path **241** is provided such that a pressure loss in the anode fluid flow path **241** is greater than a pressure loss occurring in a region ranging from the anode fluid introduction port **212** to each anode fluid flow path **241**. Concretely, in the present embodiment, the chamber **211** is provided to be of such a size as to be in common communication with the plurality of anode fluid flow paths **241** (namely, the opening area of the chamber **211** is comparable to the surface area of the anode catalyst **202**), and the opening areas (cross-sectional areas) of the anode fluid flow paths **241** are much smaller than the opening area of the chamber **211**. Consequently, the pressure loss in the anode fluid flow path **241** is rendered greater than the pressure loss occurring in the region ranging from the anode fluid introduction port **212** of the chamber **211** to each anode fluid flow path **241**. By so increasing the pressure loss in the anode fluid flow path **241**, the anode fluid supplied into the chamber **211** can be supplied as jets at a desired pressure toward the surface of the anode catalyst **202** by the anode fluid flow path **241**, although the details of this action will be described later. The anode fluid flow path **241** may be of a shape pointed toward the anode catalyst **202**. Of course, the anode fluid flow path **241** is not limited in size (opening area), number or position, and the size, number and position may be determined, as appropriate, based on the pressure of the anode fluid within the chamber **211**, the partial pressure of an impure gas on the surface side of the anode catalyst **202**, the flow velocity of the anode fluid supplied to the anode catalyst **202** to push away the impure gas, and so on. If the anode fluid flow path **241** is shaped to be pointed or tapered toward the anode catalyst **202**, as mentioned above, the flow velocity of the anode fluid jetted from the anode fluid flow path **241** can be increased. By so doing, the anode fluid can be easily supplied to the surface of the anode catalyst **202**; that is, the impure gas existent on the surface of the anode catalyst **202** can be easily pushed away, although the details will be offered later.

The anode fluid flow path **241** of the supply member **240** penetrates the supply member **240** in its thickness direction, and is thereby provided along a direction intersecting the surface of the anode catalyst **202**. By this measure, the anode fluid supplied into the chamber **211** can be passed through the gas diffusion layer **230** by way of the anode fluid flow path **241**, and supplied as jets toward the surface of the anode catalyst **202**. That is, it suffices for the anode fluid flow path **241** of the supply member **240** to be provided along the direction intersecting the surface of the anode catalyst **202**. The anode fluid flow path **241** may be orthogonal to the surface of the anode catalyst **202**, or may be inclined at a predetermined angle with respect to this surface.

With the above-described fuel cell **200**, the cathode fluid flow path **221** is open to the atmosphere. If the fuel cell is allowed to stand for a long term, therefore, air in the atmosphere (particularly, nitrogen as an inert gas) slips, as an impure gas, into a space where the anode catalyst **202** is provided, i.e., within the gas diffusion layer **230** or the space **250**, through the solid polymer electrolyte membrane **201**. Arise in the partial pressure of the impure gas (nitrogen) causes a drop in the partial pressure of the anode fluid in the anode catalyst **202**. Thus, a sufficient amount of the anode fluid for power generation cannot be supplied, so that the amount of power generation decreases.

With the fuel cell **200** of the present embodiment, however, the anode fluid is supplied by the anode fluid flow paths **241** to be blown toward the surface of the anode catalyst **202**, as shown in FIG. **4**. Thus, the impure gas existent on the surface of the anode catalyst **202** is pushed away, and the anode fluid can be supplied to the surface of the anode catalyst **202**. That is, the anode fluid supplied by the anode fluid flow paths **241** toward the surface of the anode catalyst **202** (from the direction intersecting the surface) spreads along the surface of the anode catalyst **202** while pushing away the impure gas within the gas diffusion layer **230** filled as an atmosphere for the anode catalyst **202**. On this occasion, the impure gas pushed away from the surface side of the anode catalyst **202** remains in regions on a side of the gas diffusion layer **230** opposite to the anode catalyst **202**, and within the space **250**, namely, in regions A shown in FIG. **4**. Since the space **250** is present, the impure gas is easily pushed away from the surface of the anode catalyst **202**.

As described above, the anode fluid is supplied toward the surface of the anode catalyst **202** by the anode fluid flow paths **241** to push away the impure gas (nitrogen) from the surface of the anode catalyst **202**, whereby the efficiency of power generation or the power efficiency of the anode catalyst **202** can be increased. For example, if the anode fluid flow path **241** is not provided, namely, if the chamber **211** is provided to face the gas diffusion layer **230** directly, the anode fluid supplied from the anode fluid introduction port **212** is supplied along the surface of the anode catalyst **202**. If the anode fluid is supplied in the planar direction of the surface of the anode catalyst **202** in this manner, power generation takes place only on the side where the anode fluid is supplied. In a region extending long from the side where the anode fluid is supplied, on the other hand, the partial pressure of the impure gas becomes so high that power generation substantially does not occur. That is, when the anode fluid is supplied along the surface of the anode catalyst **202**, the entire surface of the anode catalyst **202** cannot be used efficiently, so that the amount of power generation decreases. By contrast, the anode fluid flow path **241** supplying the anode fluid in such a manner as to blow it against the surface of the anode catalyst **202** is provided as in the present embodiment, whereby the anode fluid can be supplied uniformly over the entire surface of the anode catalyst **202**. Thus, power generation can be performed with the use of the entire surface of the anode catalyst **202**, and the amount of power generation, particularly, the initial voltage, can be rendered high.

With the fuel cell **200**, moreover, the mixing of the impure gas, such as nitrogen in the air, into the anode catalyst **202** (gas diffusion layer **230**) occurs during power generation as well. Thus, long-term power generation cannot be maintained, if the anode fluid flow path **241** is not provided. In the present embodiment, on the other hand, the anode fluid is supplied toward the surface of the anode catalyst **202** by the anode fluid flow paths **241**. By so doing, the anode fluid can continue to be supplied to the surface of the anode catalyst **202**, with the impure gas present on the surface of the anode catalyst **202** being constantly pushed away, so that long-term power generation can be maintained.

In the present embodiment, moreover, the anode fluid is blown against the surface of the anode catalyst **202** by the anode fluid flow path **241**. Thus, the thickness of the gas diffusion layer **230** can be rendered relatively small. Even if the gas diffusion layer **230** is not provided, the anode fluid can be supplied uniformly throughout the surface of the anode catalyst **202**.

(Embodiment 2)

FIG. **5** is a sectional view of essential parts of a fuel cell according to Embodiment 2 of the present invention. The same members as those in the aforementioned Embodiment 1 will be assigned the same numerals as in the Embodiment 1, and duplicate explanations will be omitted.

As shown in FIG. **5**, a fuel cell **200**A of Embodiment 2 has an MEA **204**, an anode member **210**, a cathode member **220** (not shown), a gas diffusion layer **230**, and a supply member **240**A.

A surface of the supply member **240**A facing the gas diffusion layer **230** is provided with protruding portions **242** which protrude toward the gas diffusion layer **230** and inside each of which an anode fluid flow path **241** is provided. That is, the protruding portion **242** is provided in a cylindrical nozzle-like form within which the anode fluid flow path **241** is provided. The shape of the protruding portion **242** is not limited to the cylindrical form, but may be a prismatic shape, or a tapered shape which is pointed toward the MEA **204**. For example, the protruding portion **242** is formed in a tapered shape pointed toward the MEA **204**, whereby the volume of the space between the adjacent protruding portions **242** can be rendered larger than that of the space between the adjacent cylindrical protruding portions **242**, and further the amount of the impure gas storable in this space is increased, thereby making it possible to maintain long-term power generation. Details in this connection will be described later.

The protruding leading end surface of the protruding portion **242** is provided in such a state as to be separated from the gas diffusion layer **230** by a predetermined spacing, that is, with a space **250** being disposed between the protruding portion **242** and the gas diffusion layer **230**. In a region of the supply member **240**A other than the protruding portion **242**, a space **251** broader than the space **250** is provided between the supply member **240**A and the gas diffusion layer **230**.

With the fuel cell **200**A described above, the anode fluid is supplied toward the surface of the anode catalyst **202** by the anode fluid flow paths **241**, as in the aforementioned Embodiment 1. Thus, the impure gas such as nitrogen is pushed away, so that the amount of initial power generation can be increased, and power generation can be maintained for a long term. In the present embodiment, moreover, the wider space **251** is defined between the gas diffusion layer **230** and the supply member **240**A in the region of the supply member **240**A other than the protruding portion **242**. By this configuration, the impure gas such as nitrogen which has been expelled from the surface of the anode catalyst **202** can be stored in a region A' including this space **251**. Thus, the impure gas on the surface side of the anode catalyst **202** is easily pushed away toward the region A'. Furthermore, the impure gas pushed away can be stored in the relatively wide region A', so that power generation of an even longer duration can be maintained.

In the present embodiment, a plurality of the protruding portions **242** having the same amount of protrusion are provided. However, this is not limitative, and the amount of protrusion of the protruding portion **242** may be varied based on the distance within the chamber **211** from the anode fluid introduction port **212** to each anode fluid flow path **241**. Such an example is shown in FIG. **6**. FIG. **6** is a sectional view of essential parts showing a modification of the fuel cell according to Embodiment 2 of the present invention.

In the fuel cell **200**A, as shown in FIG. **6**, the amount of protrusion of the protruding portion **242** is larger for the anode fluid flow path **241** at a shorter distance from the anode fluid introduction port **212** in the chamber **211**, while the amount of protrusion of the protruding portion **242** is smaller for the anode fluid flow path **241** at a longer distance from the anode fluid introduction port **212**. In this case, the opening of the anode fluid flow path **241** provided in each protruding portion **242** is provided not to contact the gas diffusion layer **230**A.

By so changing the amount of protrusion of the protruding portion **242**, the pressure loss in the anode fluid flow path **241** close to the anode fluid introduction port **212** is increased, while the pressure loss in the anode fluid flow path **241** distant from the anode fluid introduction port **212** is decreased. As a result, the pressure of the anode fluid supplied from each anode fluid flow path **241** can be uniformized, regardless of the distance from the anode fluid introduction portion **212**. Consequently, the amount of power generation in the plane of the anode catalyst **202** can be uniformized to increase the power efficiency.

In the present embodiment, the gas diffusion layer **230**A can be rendered relatively thin, and it is permissible not to provide the gas diffusion layer **230**A. Even in this case, the anode fluid can be supplied uniformly throughout the surface of the anode catalyst **202**.

(Other Embodiments)

The respective embodiments of the present invention have been described above. However, the basic features of the present invention are not limited to those mentioned above.

For example, in the aforementioned Embodiments 1 and 2, the plurality of anode fluid flow paths **241** having the same opening area are provided in the supply member **240**, **240**A. However, this is not limitative and, for example, the pressure loss in the anode fluid flow path **241** may be varied according to the distance from the anode fluid introduction port **212**. A concrete example is shown in FIG. **7**. FIG. **7** illustrates a modification of the aforementioned Embodiment 1, but the configuration of FIG. **7** can be applied to the aforementioned Embodiment 2 as well. As shown in FIG. **7**, of the plurality of anode fluid flow paths **241**, the anode fluid flow path **241** at a shorter distance (distance L_1) from the anode fluid introduction port **212** (projected part **212**A obtained by projection of the anode fluid introduction port **212**) is given a smaller cross-sectional area to impart a larger pressure loss, while the anode fluid flow path **241** at a longer distance (distance L_6)

from the anode fluid introduction port **212** is given a larger cross-sectional area to impart a smaller pressure loss. That is, let the anode fluid flow path **241** at the short distance from the anode fluid introduction port **212** be the first anode fluid flow path, and let the anode fluid flow path **241** at the long distance from the anode fluid introduction port **212** be the second anode fluid flow path. In this case, the pressure loss in the first anode fluid flow path may be greater than the pressure loss in the second anode fluid flow path.

In the present embodiment, the anode fluid introduction port **212** is provided in the bottom surface of the chamber **211** and outside the rows of the juxtaposed anode fluid flow paths **241**. However, the anode fluid introduction port **212** may be provided halfway through the rows of the juxtaposed anode fluid flow paths **241**. The distance from the anode fluid introduction port **212** to the anode fluid flow path **241** may be actually taken on the premise that the position of the anode fluid introduction port **212** is the position of the projected part **212**A obtained by projecting the anode fluid introduction port **212** onto the supply member **240**.

As noted above, the opening area (cross-sectional area) of the anode fluid flow path **241** is varied based on the distance from the anode fluid introduction port **212**, whereby the pressure loss in the anode fluid flow path **241** can be varied based on the distance from the anode fluid introduction port **212**. That is, the fact that the opening area of the anode fluid flow path **241** is small means that the pressure loss in the anode fluid flow path **241** is great, whereas the fact that the opening area of the anode fluid flow path **241** is large means that the pressure loss in the anode fluid flow path **241** is small. The path within the chamber **211** from the anode fluid introduction port **212** to the anode fluid flow path **241** at a short distance therefrom is short. Thus, the pressure loss of the anode fluid passing along this path in the chamber **211** is small. The longer the distance over which the anode fluid passes through the chamber **211** from the anode fluid introduction port **212** until its supply to the anode fluid flow path **241**, the larger its pressure loss becomes. Hence, variations in the pressure loss of the anode fluid passing within the chamber **211** can be counterbalanced by varying the pressure loss in the anode fluid flow path **241**, whereby the pressure of the anode fluid supplied from each anode fluid flow path **241** can be rendered uniform. By this measure, the anode fluid can be supplied uniformly to the surface of the anode catalyst **202** to provide a uniform amount of power generation in the plane of the anode catalyst **202** and increase the efficiency of power generation (i.e., power efficiency).

In the example shown in FIG. **7**, the flow rate of the anode fluid supplied from each anode fluid flow path **241** can be uniformized. However, as the distance from the anode fluid introduction port **212** (projected part **212**A obtained by projection of the anode fluid introduction port **212**) to the anode fluid flow path **241** increases, the bore of the anode fluid flow path **241** differs, so that the flow velocity of the anode fluid flowed out of the anode fluid flow path **241** changes. If the flow velocity of the anode fluid flowed out of the anode fluid flow path **241** changes in this manner, the range of spread of the anode fluid differs according to the distribution of the flow velocity. As a result, unevenness occurs in the in-plane distribution of the anode fluid, causing a possibility for a decrease in the power efficiency. Thus, in the plurality of anode fluid flow paths **241**, the spacing between the adjacent anode fluid flow paths **241** is gradually decreased as the distance from the anode fluid introduction port **212** increases. By so doing, the unevenness in the in-plane distribution of the anode fluid can be curtailed. An example of such a configuration is shown in FIGS. **8** and **9**. FIG. **8** is a plan view of essential parts of a fuel cell according to other embodiment of the present invention. FIG. **9** is a sectional view of essential parts of FIG. **8**.

As shown in FIGS. **8** and **9**, in the plurality of anode fluid flow paths **241** having the opening areas differentiated in the same manner as in FIG. **7**, the spacing (e.g., spacing d_5) between the adjacent anode fluid flow paths **241** at a longer distance from the anode fluid introduction port **212** (projected part **212**A) is rendered smaller than the spacing (e.g., spacing d_1) between the adjacent anode fluid flow paths **241** at a shorter distance from the anode fluid introduction port **212** (projected part **212**A). Because of this configuration, the flow velocity slows from a side where the spacing between the adjacent anode fluid flow paths **241** is wide (i.e., spacing d_1 side) toward a side where the spacing between the adjacent anode fluid flow paths **241** is narrow (i.e., spacing d_5 side). Even if the range of spread of the anode fluid flowed out gradually narrows, therefore, the unevenness in the in-plane distribution of the anode fluid can be reduced. Hence, the impure gas (nitrogen) present on the surface of the anode catalyst **202** can be uniformly pushed away from the surface of the anode catalyst **202**, and power generation can be carried out with high efficiency. In this connection, assume that the spacings between the adjacent anode fluid flow paths are all set to be identical. When, in this case, the anode fluid flow path **241** at a short distance from the anode fluid introduction port **212** is taken as the first anode fluid flow path, and the anode fluid flow path **241** at a long distance from the anode fluid introduction port **212** is taken as the second anode fluid flow path, the flow velocity of the anode fluid flowing out from the second anode fluid flow path is lower than the flow velocity of the anode fluid flowing out from the first anode fluid flow path. In this state, the range in which the anode fluid of a lower flow velocity flowing out of the second anode fluid flow path pushes away the gas and spreads on the surface of the anode catalyst **202** is narrower than the range in which the anode fluid of a higher flow velocity flowing out of the first anode fluid flow path spreads on the surface of the anode catalyst **202**. Consequently, unevenness occurs in the distribution of the concentration at which the anode fluid is supplied in the plane of the surface of the anode catalyst **202**, posing a possibility for the occurrence of a deficiency, such as the failure to push away the impure gas, or a decrease in the power efficiency.

The example shown in FIGS. **8** and **9** can reduce the unevenness in the in-plane distribution of the anode fluid flowed out of the plurality of anode fluid flow paths **241**. Thus, the distribution of the concentration at which the anode fluid is supplied in the plane of the surface of the anode catalyst **202** is uniformized, so that the power efficiency of the anode catalyst **202** can be increased, and the amount of power generation can be maintained for a long term. In the example shown in FIGS. **8** and **9**, the spacings between the centers of the adjacent anode fluid flow paths **241** are taken as the spacings d_1 to d_5 between the anode fluid flow paths. However, this is not limitative, and the spacing between the edges of the openings of the anode fluid flow paths may be taken as the spacing between the anode fluid flow paths.

Furthermore, it is permissible to form a guide path within the chamber **211**, the guide path serving for communication from the anode fluid introduction port **212** to the anode fluid flow path **241**, and change the pressure loss in this guide path, without changing the pressure loss in the anode fluid flow path **241**. Such an example is shown in FIG. **10**.

As shown in FIG. **10**, a guide path **213** serving for communication from the anode fluid introduction port **212** to each anode fluid flow path **241** is provided within the chamber **211**.

The guide path **213** is configured such that the guide path **213** for communication from the anode fluid introduction port **212** to the anode fluid flow path **241** at a shorter distance therefrom has a smaller width (cross-sectional area) to undergo a larger pressure loss, and the guide path **213** for communication from the anode fluid introduction port **212** to the anode fluid flow path **241** at a longer distance therefrom has a larger width (cross-sectional area) to undergo a smaller pressure loss. That is, when the anode fluid flow path **241** at a short distance from the anode fluid introduction port **212** is taken as the first anode fluid flow path, and the anode fluid flow path **241** at a long distance from the anode fluid introduction port **212** is taken as the second anode fluid flowpath, it is advisable that a pressure loss in the first guide path from the anode fluid introduction port **212** to the first anode fluid flow path be rendered greater than a pressure loss in the second guide path from the anode fluid introduction port **212** to the second anode fluid flow path. Because of this configuration, the pressure of the anode fluid supplied from each anode fluid flow path **241** can be uniformized. By this measure, the anode fluid can be supplied uniformly to the surface of the anode catalyst **202** to provide a uniform amount of power generation in the plane of the anode catalyst **202** and increase the power efficiency.

Furthermore, in a region where the gas pushed away by the anode fluid flowed out of the anode fluid flow path **241** is stored, a removal means for discharging the gas in this region to the outside may be provided. Such an example is shown in FIG. **11**. FIG. **11** is a sectional view of essential parts of a fuel cell showing a modification of the aforementioned Embodiment 2.

As shown in FIG. **11**, one end of a lead-out path **260** communicating with the space **251** which is a region for storing the gas pushed away by the anode fluid is connected to the supply member **240**A, and the other end of the lead-out path **260** is connected to a storage means **261**. The storage means **261** has a space for storing the impure gas, such as nitrogen, from the space **251**, and serves as a buffer to discharge to the outside the gas stored in the space **251** connected via the lead-out path **260**. A hollow member having a sealed space is named, for example, as the storage means **261**. By providing the storage means **261** composed of the hollow member, the pressure inside the storage means **261** becomes comparable to the pressure inside the fuel cell (chamber **211**), while the action of the fuel cell is kept at a standstill. When the anode fluid is flowed out of the anode fluid flow path **241**, the impure gas pushed away into the space **251** by the flowed-out anode fluid is discharged to the storage means **261**, as a buffer, via the lead-out path **260** under the introduction pressure of the anode fluid. Upon discharge of the impure gas in the space **251** to the storage means **261** as the buffer, the pressure inside the space **251** and the pressure inside the storage means **261** equal. When the action of the fuel cell is stopped, the pressure balance between the interior of the space **251** and the interior of the storage means **261** is disturbed, and the impure gas within the storage means **261** returns to the space **251**. In this manner, the impure gas in the space **251** is buffer-discharged to the outside of the fuel cell during the action of the fuel cell, whereby the amount of power generation (particularly, initial voltage) can be increased, and power generation can be maintained for a long term.

The hollow member has been named as an example of the storage means **261**, but it is not limitative. For example, an adsorbent for adsorbing the gas may be provided within the storage means **261**. For example, activated carbon, zeolite or the like can be used as the adsorbent, if it is desired to adsorb nitrogen as the gas.

A check valve may be provided in the lead-out path **260** shown in the aforementioned FIG. **11**. Such an example is shown in FIG. **12**. As shown in FIG. **12**, a check valve **262** is provided halfway through the lead-out path **260**, namely, between the supply member **240** and the storage means **261**. The check valve **262** is mounted in a direction in which it permits the flow of the gas from the space **251**, where the gas is stored, to the storage means **261** (buffer), and restrains the flow of the gas in the reverse direction. By providing the lead-out path **260** with the check valve **262** in this manner, the gas stored in the storage means **261** does not flow backward to the space **251** and, even when the action of the fuel cell is stopped, the gas stored in the storage means **261** does not return to the space **251**. FIG. **12** shows a modification of the aforementioned Embodiment 2, but this is not limitative. For example, even the configuration of the aforementioned Embodiment 1 without the space **251**, or even the configuration shown in any of FIGS. **7** to **10** can exhibit the same effects as above, if provided with removal means for removing the gas in the region where the gas is stored.

Further, an adsorbent may be provided in the region where the gas pushed away by the supply of the anode fluid is stored. Such an example is shown in FIG. **13**. FIG. **13** is a sectional view of essential parts showing a modification of the aforementioned Embodiment 2.

As shown in FIG. **13**, the supply member **240**A is provided with an adsorbent **270** in the space **251** which is the region where the gas pushed away by the anode fluid is stored. As the adsorbent **270**, activated carbon, zeolite or the like can be used, for example, if it is desired to adsorb nitrogen as the gas. Of course, the adsorbent is not limited thereto, but its material may be determined, as appropriate, depending on the gas whose adsorption is desired.

Even with such a configuration, the gas pushed away to the space **251** is adsorbed to the adsorbent **270**, and excess gas within the fuel cell can be removed, so that the amount of power generation (particularly, initial voltage) can be increased, and power generation can be maintained for a long term. Needless to say, the adsorbent **270** may be provided in the aforementioned Embodiment 1.

Any two or more of the configurations shown in the aforementioned configurations of FIGS. **7** to **13** may be combined.

In the above embodiments, the supply member **240**, **240**A has been provided as a member independent of the anode member **210**. However, these members may be configured as a member in which they are provided integrally. Moreover, the supply member **240**, **204**A may be one in which only the region provided with the anode fluid flow path **241** is a supply member. That is, a member corresponding to any of the supply members **240**, **240**A of the aforementioned Embodiments 1 and 2 may be composed of a base member comprising a plate-shaped member, and a plurality of supply members fixed to the base member and having anode fluid flow paths individually provided therein.

In the above embodiments, the gas diffusion layer **230** has been provided only on the side of the anode catalyst **202**. However, this is not limitative and, for example, a gas diffusion layer **230** comparable to that on the side of the anode catalyst **202** may be provided on the side of the cathode catalyst **203** as well.

The above-described fuel cell **200**, **200**A can be utilized, for example, as a single cell constituting a cell stack. That is, a cell stack may be formed by stacking a plurality of the above fuel cells **200** or **200**A.

INDUSTRIAL APPLICABILITY

The present invention can be utilized in the industrial field of fuel cells which uniformize the concentration distribution of the anode fluid in the plane of the surface of the anode catalyst to increase the amount of power generation and continue power generation for a long term.

DESCRIPTION OF THE NUMERALS

A, A'	Region
1	Fuel cell system
100	Fuel supply means
200	Fuel cell
201	Solid polymer electrolyte membrane (Electrolyte membrane)
202	Anode catalyst
203	Cathode catalyst
210	Anode member
212	Anode fluid introduction port
220	Cathode member
230, **230**A	Gas diffusion layer
240, **240**A	Supply member
241	Anode fluid flow path
242	Protruding portion
250	Space
251	Space
260	Lead-out path
261	Storage means
270	Adsorbent
300	Control circuit

The invention claimed is:

1. A fuel cell comprising:

a gas diffusion layer;

a membrane electrode assembly comprised of an electrolyte membrane and an anode catalyst over which the gas diffusion layer is disposed; and

a supply member having protruding portions each provided with an anode fluid flow path having an opening on a discharge side thereof for supplying an anode fluid toward the membrane electrode assembly, the protruding portions and the gas diffusion layer being arranged with a space therebetween so that the protruding portions do not contact, either directly or indirectly, the gas diffusion layer, the protruding portions being provided on a surface of the supply member facing the gas diffusion layer so as to protrude toward the member electrode assembly and form spaces for storing a gas pushed by the supply of the anode fluid toward the membrane electrode assembly, each of the spaces being formed between two adjacent ones of the protruding portions.

2. A fuel cell according to claim **1**; wherein each of the protruding portions of the supply member is cylindrical-shaped.

3. A fuel cell, comprising:

a gas diffusion layer;

a membrane electrode assembly comprised of an electrolyte membrane and an anode catalyst over which the gas diffusion layer is disposed; and

a supply member for supplying an anode fluid to the membrane electrode assembly, the supply member having a plurality of anode fluid flow paths each having an opening provided on a discharge side thereof for supplying the anode fluid toward the membrane electrode assembly, and a plurality of protruding portions within which the respective anode fluid flow paths are provided, the plurality of protruding portions and the gas diffusion layer being arranged with a space therebetween so that the plurality of protruding portions do not contact, either directly or indirectly, the gas diffusion layer, each of the protruding portions being provided on a portion of the surface of the supply member facing the gas diffusion layer so as to protrude toward the gas diffusion layer and form a plurality of spaces for storing a gas pushed by the supply of the anode fluid toward the membrane electrode assembly, each of the spaces being formed between two adjacent ones of the protruding portions and in a portion of the supply member other than portions of the surface on which the protruding portions are provided.

4. A fuel cell according to claim **3**; wherein each of the protruding portions has a tapered shape pointed toward the membrane electrode assembly.

5. A fuel cell according to claim **3**; wherein each of the anode fluid flow paths has a tapered shape pointed toward the membrane electrode assembly.

6. A fuel cell according to claim **3**; wherein the supply member comprises a single supply member in which the plurality of anode fluid flow paths are provided.

7. A fuel cell according to claim **6**; further comprising a chamber communicating with the plurality of anode fluid flow paths on a side opposite to the membrane electrode assembly, and an anode fluid introduction port for supplying the anode fluid to the chamber; wherein the plurality of anode fluid flow paths comprise a first anode fluid flow path and a second anode fluid flow path, a distance from the anode fluid introduction port to the second anode fluid flow path being longer than a distance from the anode fluid introduction port to the first anode fluid flow path so that a pressure loss in the first anode fluid flow path is greater than a pressure loss in the second anode fluid flow path.

8. A fuel cell according to claim **7**; wherein spacings between adjacent anode fluid flow paths of the plurality of anode fluid flow paths gradually decrease from the anode fluid flow paths at shorter distances from the anode fluid introduction port toward the anode fluid flow paths at longer distances from the anode fluid introduction port.

9. A fuel cell according to claim **6**; further comprising a chamber communicating with the plurality of anode fluid flow paths on a side opposite to the membrane electrode assembly, and an anode fluid introduction port for supplying the anode fluid to the chamber; wherein the plurality of anode fluid flow paths comprise a first anode fluid flow path and a second anode fluid flow path, a distance from the anode fluid introduction port to the second anode fluid flow path being longer than a distance from the anode fluid introduction port to the first anode fluid flow path; and wherein the chamber and the anode fluid flow paths are configured so that a pressure loss in a first guide path within the chamber in an area from the anode fluid introduction port to the first anode fluid flow path is greater than a pressure loss in a second guide path within the chamber in an area from the anode fluid introduction port to the second anode fluid flow path.

10. A fuel cell according to claim **3**; further comprising a chamber and an anode fluid introduction port for supplying the anode fluid to the chamber; wherein the supply member comprises a single supply member in which the plurality of anode fluid flow paths are provided; and wherein the plurality of protruding portions comprise a first protruding portion and a second protruding portion, with an amount of protrusion of the first protruding portion being greater than an amount of protrusion of the second protruding portion, the second protruding portion being disposed at a greater distance from the anode fluid introduction port than a distance from the first protruding portion to the anode fluid introduction port.

11. A fuel cell according to claim **3**; further comprising a chamber communicating with the plurality of the anode fluid flow paths on a side opposite to the membrane electrode assembly and an anode fluid introduction port for supplying

the anode fluid to the chamber, the anode fluid flow paths and the chamber being configured so that a pressure loss in each of the anode fluid flow paths is greater than a pressure loss in an area from the anode fluid introduction port to each of the anode fluid flow paths.

12. A fuel cell according to claim **3**; further comprising removal means for removing the gas stored in the plurality of spaces.

13. A fuel cell according to claim **12**; wherein the removal means comprises a lead-out path communicating with the plurality of spaces for discharging the stored gas to a buffer.

14. A fuel cell according to claim **13**; wherein the lead-out path is provided with a check valve that permits a flow of the stored gas from the plurality of spaces to the buffer while restraining a flow of the gas in a reverse direction.

15. A fuel cell according to claim **12**; wherein the removal means comprises an adsorbent disposed in the plurality of spaces.

16. A fuel cell system comprising:

a fuel cell according to claim **3**; and fuel supply means for supplying the anode fluid to the fuel cell.

17. A fuel cell according to claim **3**; wherein each of the plurality of protruding portions of the supply member is cylindrical-shaped.

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