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Power generation cell

Abstract

In a power generation cell, a first bypass stop protrusion is integrally formed on a first separator main body so as to protrude from the first separator main body. A second bypass stop protrusion is integrally formed on a second separator main body so as to project from the second separator main body. A first bypass seal member is provided on a protruding end surface of the first bypass stop protrusion so as to be positioned outside the cathode. A second bypass seal member is provided on a protruding end surface of the second bypass stop protrusion so as to be positioned outside the anode.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

(1) This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2021-026354 filed on Feb. 22, 2021, the contents of which are incorporated herein

by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

(2) The present invention relates to a power generation cell.

Description of the Related Art

(3) A power generation cell is provided with a membrane electrode assembly (MEA), a resin frame portion, and two separator members. The MEA has an electrolyte membrane and two electrodes arranged on both sides of the electrolyte membrane. The resin frame portion protrudes outward from the outer periphery of the MEA in a state of being attached to the MEA. The two separator members are disposed on both sides of the MEA. Each separator member includes a separator main body in the form of a metal plate. The separator main body has a reactant gas flow field and a flow field seal portion. The reactant gas flow field allows a reactant gas (oxygen-containing gas or fuel gas) to flow from one end of the separator main body toward the other end along the power generation area of each electrode. The flow field seal portion surrounds the reactant gas flow field in a state of being in contact with the resin frame portion to prevent leakage of the reactant gas.

(4) A bypass protrusion for preventing bypassing of the reactant gas is located between an end of the reactant gas flow field in the flow field width direction and the flow field seal portion (bypass flow path), in the separator main body (see, for example, JP 2019-079736 A).

SUMMARY OF THE INVENTION

(5) In this type of power generation cell, it is necessary to effectively suppress the inflow of reactant gas into the bypass flow path.

(6) An object of the present invention is to solve the aforementioned problem.

(7) According to an aspect of the present invention, there is provided a power generation cell including: a membrane electrode assembly including an electrolyte membrane and two electrodes arranged on both sides of the electrolyte membrane; a resin frame portion arranged on an outer periphery of the membrane electrode assembly so as to project outward from the outer periphery; and two separator members arranged on both sides of the membrane electrode assembly, wherein: each of the two separator members includes a separator main body in a form of a metal plate; the separator main body includes: a reactant gas flow field through which a reactant gas flows along a power generation area of the electrode from one end of the separator main body toward another end thereof; and a flow field seal portion that surrounds the reactant gas flow field in a state of being in contact with the resin frame portion in order to prevent leakage of the reactant gas; the flow field seal portion includes a seal bead portion protruding from the separator main body and formed integrally with the separator main body so as to be elastically deformed by a compressive load in a separator thickness direction; the separator main body includes a bypass stop protrusion formed integrally therewith so as to protrude toward the membrane electrode assembly, the bypass stop protrusion being configured to prevent the reactant gas from flowing in between an end portion of the reactant gas flow field in a flow field width direction and the flow field seal portion; and a bypass seal member is provided on a protruding end surface of the bypass stop protrusion so as to be positioned outside the electrode.

(8) According to the present invention, the bypass seal member is provided on the protruding end surface of the bypass stop protrusion so as to be positioned outside the electrode. Therefore, the inflow of the reactant gas into the bypass flow path (i.e., between the end portion of the reactant gas flow field in the flow field width direction and the flow field seal portion) can be effectively suppressed by the bypass stop protrusion and the bypass seal member.

(9) The above and other objects features and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings, in which a preferred embodiment of the present invention is shown by way of illustrative example.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is an exploded perspective view of a power generation cell according to an embodiment of the present invention;

(2) FIG. **2** is a cross-sectional view of the power generation cell taken along line II-II in FIGS. **1** and **4**;

(3) FIG. **3** is a plan view of a joint separator viewed from a first separator member toward a second separator member;

(4) FIG. **4** is an enlarged plan view of a main portion of the first separator member;

(5) FIG. **5** is a plan view of the joint separator viewed from the second separator member toward the first separator member;

(6) FIG. **6** is an enlarged plan view of a main portion of the second separator member; and

(7) FIG. **7** is a view showing a state in which the second separator member is stacked on the first separator member.

DESCRIPTION OF THE INVENTION

(8) As shown in FIG. **1**, a power generation cell **10** according to an embodiment of the present invention is a unit cell of a fuel cell stack **12**. The fuel cell stack **12** includes a plurality of power generation cells **10**. The plurality of power generation cells **10** are stacked in the direction of the arrow A. A compressive load in the stacking direction of the plurality of power generation cells **10** is applied to the fuel cell stack **12**. For example, the fuel cell stack **12** is mounted in a fuel cell electric vehicle (not shown) as an in-vehicle fuel cell stack.

(9) The power generation cell **10** has a horizontally long rectangular shape. The power generation cell **10** has a resin frame equipped membrane electrode assembly (hereinafter referred to as “resin frame equipped MEA **14**”), and a first separator member **16** and a second separator member **18**. The resin frame equipped MEA **14** is disposed between the first separator member **16** and the second separator member **18**.

(10) Each of the first separator member **16** and the second separator member **18** is formed by press-forming a metal thin plate to have a corrugated shape in cross section and a wavy shape on the surface. The metal thin plate is, for example, a steel plate, a stainless steel plate, an aluminum plate, or a plated steel plate. The metal thin plate may be a stainless steel plate whose surface is surface-treated for anti-corrosion or an aluminum plate whose surface is surface-treated for anti-corrosion. The first separator member **16** and the second separator member **18** are joined to each other by a plurality of joining lines (not shown) to form a joint separator **20**.

(11) The resin frame equipped MEA **14** includes a membrane electrode assembly (hereinafter referred to as “MEA **22**”) and a resin frame portion **24** (resin film). The resin frame portion **24** protrudes outward from an outer periphery of the MEA **22**.

(12) As shown in FIG. **2**, the MEA **22** has an electrolyte membrane **26**, a cathode **28**, and an anode **30**. The cathode **28** is disposed on one surface **26***a* of the electrolyte membrane **26**. The anode **30** is disposed on the other surface **26***b* of the electrolyte membrane **26**. The electrolyte membrane **26** is, for example, a solid polymer electrolyte membrane (cation exchange membrane). For example, the solid polymer electrolyte membrane is a thin membrane of perfluorosulfonic acid containing water. The electrolyte membrane **26** is sandwiched between the cathode **28** and the anode **30**. The electrolyte membrane **26** may be a fluorine-based electrolyte membrane or an HC (hydrocarbon)-based electrolyte.

(13) The cathode **28** has a first electrode catalyst layer **32** and a first gas diffusion layer **34**. The first electrode catalyst layer **32** is joined to one surface **26***a* of the electrolyte membrane **26**. The first gas diffusion layer **34** is laminated on the first electrode catalyst layer **32**. The anode **30** has a second electrode catalyst layer **36** and a second gas diffusion layer **38**. The second electrode

catalyst layer **36** is joined to the other surface **26***b* of the electrolyte membrane **26**. The second gas diffusion layer **38** is laminated on the second electrode catalyst layer **36**.
(14) The first electrode catalyst layer **32** includes, for example, porous carbon particles having a platinum alloy supported on the surface thereof. The porous carbon particles are uniformly coated on the surface of the first gas diffusion layer **34** together with the ion conductive polymer binder. The second electrode catalyst layer **36** includes, for example, porous carbon particles having a platinum alloy supported on the surface thereof. The porous carbon particles are uniformly coated on the surface of the second gas diffusion layer **38** together with the ion conductive polymer binder. The first gas diffusion layer **34** and the second gas diffusion layer **38** include carbon paper, carbon cloth, or the like.
(15) The resin frame portion **24** is joined to the outer periphery of the MEA **22** and extends to surround the outer periphery (see FIG. **1**). The resin frame portion **24** has a first frame-shaped sheet **40** and a second frame-shaped sheet **42**. An inner periphery of the first frame-shaped sheet **40** is joined to the outer periphery of the MEA **22**. The second frame-shaped sheet **42** is joined to the first frame-shaped sheet **40**. The first frame-shaped sheet **40** and the second frame-shaped sheet **42** are joined to each other in the thickness direction by an adhesive layer **44** made of an adhesive. The second frame-shaped sheet **42** is joined to an outer periphery of the first frame-shaped sheet **40**. The thickness of the first frame-shaped sheet **40** is smaller than that of the second frame-shaped sheet **42**. The resin frame portion **24** may be formed of only the first frame-shaped sheet **40** without joining the second frame-shaped sheet **42** to the first frame-shaped sheet **40**.
(16) The first frame-shaped sheet **40** and the second frame-shaped sheet **42** are made of resin material. Examples of the constituent materials of the first frame-shaped sheet **40** and the second frame-shaped sheet **42** include PPS (polyphenylene sulfide), PPA (polyphthalamide), PEN (polyethylene naphthalate), PES (polyether sulfone), LCP (liquid crystal polymer), PVDF (polyvinylidene fluoride), silicone resin, fluororesin, m-PPE (modified polyphenylene ether resin), PET (polyethylene terephthalate), PBT (polybutylene terephthalate), and modified polyolefin.
(17) An inner periphery **25** of the resin frame portion **24** (the inner periphery of the first frame-shaped sheet **40**) is disposed between an outer periphery **29** of the cathode **28** and an outer periphery **31** of the anode **30**. Specifically, the inner periphery **25** of the resin frame portion **24** is sandwiched between an outer periphery **27** of the electrolyte membrane **26** and the outer periphery **31** of the anode **30**. The inner periphery **25** of the resin frame portion **24** and the outer periphery **27** of the electrolyte membrane **26** are joined to each other through the adhesive layer **44**. The inner periphery **25** of the resin frame portion **24** may be sandwiched between the outer periphery **27** of the electrolyte membrane **26** and the outer periphery **29** of the cathode **28**.
(18) An outer surface **29***a* of the outer periphery **29** of the cathode **28** is located on the same plane (common plane) as one surface **46***a* (outer surface facing the first separator member **16**) of the power generation area **46** of the MEA **22**. An outer surface **31***a* of the outer periphery **31** of the anode **30** is located on the opposite side (in the direction indicated by arrow A**2**), with respect to the other surface **46***b* (the outer surface facing the second separator member **18**) of the power generation area **46**, from the cathode **28**. The outer surface **31***a* of the outer periphery **31** of the anode **30** is located on the opposite side (in the direction indicated by arrow A**2**), with respect to an outer surface **40***a* (the surface opposite to the second frame-shaped sheet **42**) of the first frame-shaped sheet **40**, from the cathode **28**.
(19) The resin frame portion **24** may be a portion in which the electrolyte membrane **26** protrudes outward from the cathode **28** and the anode **30**. The resin frame portion **24** may have a protruding portion in which the electrolyte membrane **26** protrudes outward from the cathode **28** and the anode **30**, and frame-shaped films attached to both surfaces of the protruding portion.
(20) As shown in FIG. **1**, one end edge portion in the long side direction of each power generation cell **10** has an oxygen-containing gas supply passage **48***a*, a coolant supply passage **50***a*, and a fuel gas discharge passage **52***b*. The one end edge portion in the long side direction of each power

generation cell **10** is an end edge portion in the arrow B**1** direction of each power generation cell **10**. The oxygen-containing gas supply passage **48***a*, the coolant supply passage **50***a*, and the fuel gas discharge passage **52***b* are arranged in the short side direction of the power generation cell **10**. The short side direction of each power generation cell **10** is along the direction of arrow C.

(21) An oxygen-containing gas (for example, an oxygen-containing gas), which is one of the reactant gases, flows through the oxygen-containing gas supply passage **48***a* in the direction of arrow A**2**. A coolant (for example, pure water, ethylene glycol, oil, or the like) flows through the coolant supply passage **50***a* in the direction of arrow A**2**. A fuel gas (for example, a hydrogen-containing gas) which is the other reactant gas flows through the fuel gas discharge passage **52***b* in the direction of the arrow A**1**.

(22) The other end edge portion in the long side direction of each power generation cell **10** has a fuel gas supply passage **52***a*, a coolant discharge passage **50***b*, and an oxygen-containing gas discharge passage **48***b*. The other end edge portion of each power generation cell **10** in the long-side direction is an end edge portion of each power generation cell **10** in the direction of arrow B**2**. The fuel gas supply passage **52***a*, the coolant discharge passage **50***b*, and the oxygen-containing gas discharge passage **48***b* are arranged in the direction of the arrow C.

(23) Fuel gas flows through the fuel gas supply passage **52***a* in the direction indicated by arrow A**2**. The coolant flows through the coolant discharge passage **50***b* in the direction of the arrow A**1**. The oxygen-containing gas flows through the oxygen-containing gas discharge passage **48***b* in the direction of the arrow A**1**.

(24) The arrangement, shape, and size of the passages (such as the oxygen-containing gas supply passage **48***a*) described above are not limited to those in the present embodiment, and may be appropriately set according to required specifications.

(25) As shown in FIGS. **2** and **3**, the first separator member **16** includes a metal plate-shaped first separator main body **54**. The first separator main body **54** is formed in a rectangular shape. A surface (hereinafter referred to as "surface **54***a*") of the first separator main body **54** facing the resin frame equipped MEA **14** has an oxygen-containing gas flow field **56** (reactant gas flow field) extending in the long side direction (arrow B direction) of the power generation cell **10**. The oxygen-containing gas flow field **56** is in fluid communication with the oxygen-containing gas supply passage **48***a* and the oxygen-containing gas discharge passage **48***b*. The oxygen-containing gas flow field **56** supplies oxygen-containing gas to the cathode **28**.

(26) The oxygen-containing gas flow field **56** has a plurality of first flow grooves **60**. Each of the first flow grooves **60** is located between a plurality of first flow field protrusions **58** extending in the direction of arrow B. That is, in the oxygen-containing gas flow field **56**, the first flow field protrusion **58** and the first flow groove **60** are alternately arranged in the flow field width direction (the direction of arrow C). The first flow field protrusions **58** and the first flow grooves **60** are integrally formed with the first separator main body **54** by press forming. The first flow field protrusions **58** and the first flow grooves **60** extend in a wavy pattern in the direction of arrow B. However, the first flow field protrusions **58** and the first flow grooves **60** may extend linearly in the direction of the arrow B.

(27) In FIG. **2**, the first flow field protrusion **58** has a trapezoidal cross-sectional shape. That is, the cross-sectional shape of the first flow field protrusion **58** is tapered toward the protruding direction of the first flow field protrusion **58**. The first flow field protrusion **58** may have a rectangular cross-sectional shape. Hereinafter, among the plurality of first flow field protrusions **58**, first flow field protrusions **58** located at both ends in the flow field width direction are referred to as "first end flow field protrusions **58***a*". The first end flow field protrusion **58***a* is located inside an outer peripheral end face **28***e* of the cathode **28**.

(28) In FIG. **3**, the surface **54***a* of the first separator main body **54** is provided with a first seal portion **61** for preventing leakage of reactant gas (oxygen-containing gas or fuel gas) or a fluid, which is a coolant. The first seal portion **61** is pressed against an outer surface **42***a* of the second

frame-shaped sheet **42** (the outer surface of the second frame-shaped sheet **42** opposite to the first frame-shaped sheet **40**) (see FIG. **2**). The first seal portion **61** extends in a wavy shape when viewed in the separator thickness direction (direction of arrow A). However, the first seal portion **61** may extend linearly as viewed in the separator thickness direction.

(29) The first seal portion **61** has a plurality of first passage seal portions **62** and a first flow field seal portion **64**. The plurality of first passage seal portions **62** respectively surround the plurality of passages (e.g., the oxygen-containing gas supply passage **48***a*). The first flow field seal portion **64** is located on the outer periphery of the first separator main body **54**.

(30) As shown in FIG. **2**, the first seal portion **61** includes a first seal bead portion **66** and a first resin seal member **68**. The first seal bead portion **66** is integrally formed with the first separator main body **54** so as to project toward the resin frame equipped MEA **14**. The first resin seal member **68** is attached to the protruding end surface of the first seal bead portion **66**. The first seal bead portion **66** is elastically deformed by a compressive load in the direction of the arrow A.

(31) The first seal bead portion **66** has a trapezoidal cross-sectional shape. That is, the cross-sectional shape of the first seal bead portion **66** is tapered toward the protruding direction of the first seal bead portion **66**. The cross-sectional shape of the first seal bead portion **66** may be rectangular. The first resin seal member **68** is a rubber seal that is fixed to the protruding end surface of the first seal bead portion **66** by printing or coating. Examples of the resin material constituting the first resin seal member **68** include polyester fiber, silicone rubber, EPDM (ethylene-propylene-diene rubber), FKM (fluororubber), and the like. The first resin seal member **68** may be fixed to the outer surface **42***a* of the second frame-shaped sheet **42**.

(32) In FIGS. **2** and **4**, the first separator main body **54** has a plurality of first bypass stop protrusions **70**. Each of the first bypass stop protrusions **70** is located between the end portion of the oxygen-containing gas flow field **56** in the flow field width direction (i.e., the first end flow field protrusion **58***a*) and the first flow field seal portion **64**. The first bypass stop protrusions **70** prevent the oxygen-containing gas from bypassing the oxygen-containing gas flow field **56** from the oxygen-containing gas supply passage **48***a* to the oxygen-containing gas discharge passage **48***b*. That is, the plurality of first bypass stop protrusions **70** prevent the oxygen-containing gas from entering a first bypass flow path **72**. Stated otherwise, the first bypass stop protrusions **70** prevent the oxygen-containing gas from bypassing the oxygen-containing gas flow field **56**. The first bypass flow path **72** is located between the first end flow field protrusion **58***a* and the first flow field seal portion **64**.

(33) In this embodiment, the flow field width direction of the oxygen-containing gas flow field **56** is a direction along the short side of the first separator main body **54** (arrow C direction). The plurality of first bypass stop protrusions **70** are integrally formed with the first separator main body **54** by press forming. The plurality of first bypass stop protrusions **70** protrude from the first separator main body **54** toward the resin frame equipped MEA **14**. The first bypass stop protrusions **70** are arranged at intervals in the extending direction of the first end flow field protrusion **58***a* (the direction of arrow B).

(34) Each of the first bypass stop protrusions **70** has a trapezoidal cross-sectional shape (see FIG. **4**). That is, the cross-sectional shape of each first bypass stop protrusion **70** is tapered in the protruding direction of the first bypass stop protrusion **70**. However, the cross-sectional shape of each first bypass stop protrusion **70** may be a rectangular shape.

(35) The first end flow field protrusion **58***a* has a plurality of first concave curved portions **74** and a plurality of first convex curved portions **76**. Each of the first concave curved portions **74** is curved so as to be recessed in a direction away from the first flow field seal portion **64**. Each of the first convex curved portions **76** is curved so as to project toward the first flow field seal portion **64**. The first bypass stop protrusions **70** include a plurality of first bypass stop protrusions **70***a* and a plurality of first bypass stop protrusions **70***b*. The first bypass stop protrusions **70***a* are located between the first concave curved portions **74** of the first end flow field protrusion **58***a* and the first

flow field seal portion **64**. The first bypass stop protrusions **70***b* are located between the first convex curved portions **76** of the first end flow field protrusion **58***a* and the first flow field seal portion **64**. The first bypass stop protrusions **70***a* and the first bypass stop protrusions **70***b* are alternately arranged at intervals along the extending direction of the first end flow field protrusion **58***a*.
(36) One end of each of the first bypass stop protrusions **70***a* is connected to an inner side portion **66***a* of the first seal bead portion **66**. The other end of each of the first bypass stop protrusions **70***a* is connected to each of the first concave curved portions **74** of the first end flow field protrusion **58***a*. One end of each of the first bypass stop protrusions **70***b* is connected to the inner side portion **66***a* of the first seal bead portion **66**. The other end of each of the first bypass stop protrusions **70***b* is connected to each of the first convex curved portions **76** of the first end flow field protrusion **58***a*.
(37) The height H**1** (the protruding length from the first separator main body **54**) of each first bypass stop protrusion **70** is lower than the height H**2** of the first flow field seal portion **64** (see FIG. **2**). The protruding end surface of each first bypass stop protrusion **70** includes a first inner end surface **78** and a first outer end surface **80**. Each first inner end surface **78** faces the outer surface **29***a* of the outer periphery **29** of the cathode **28**. Each first outer end surface **80** is located outside the cathode **28** in a state of being separated from the outer surface **42***a* of the second frame-shaped sheet **42**.
(38) A portion of each first outer end surface **80** adjacent to the inner side portion **66***a* of the first seal bead portion **66** has a first recessed portion **82**. Each of the first recessed portions **82** is recessed in a direction away from the resin frame portion **24**. That is, the back surface (coolant surface) of each first recessed portion **82** protrudes in a direction away from the resin frame portion **24**. As a result, the rigidity of the inner side portion **66***a* of the first flow field seal portion **64** can be reduced, compared to the case where each first bypass stop protrusion **70** does not have the first recessed portion **82**. Therefore, since the first seal bead portion **66** can be effectively elastically deformed by a compressive load, an appropriate seal surface pressure can be applied to the seal surface (first resin seal member **68**) of the first flow field seal portion **64**.
(39) A first bypass seal member **83** is attached to the first outer end surface **80** of each first bypass stop protrusion **70**. Each first bypass seal member **83** is a rubber seal fixed to the first outer end surface **80** by printing, coating, or the like. The resin material constituting each first bypass seal member **83** may include the same material as the materials constituting the first resin seal member **68** and a second resin seal member **106** described above. In other words, each first bypass seal member **83** is made of a rubber material. The first bypass seal member **83** is made of the same material as the first resin seal member **68**. In this case, for example, when the resin material is applied to the protruding end surface of the first seal bead portion **66**, the resin material can also be applied to the first outer end surface **80**. Therefore, the first bypass seal member **83** can be efficiently attached to the first outer end surface **80** of each first bypass stop protrusion **70**.
(40) In FIG. **2**, each first bypass seal member **83** is attached to the entire first outer end surface **80**. In other words, each first bypass seal member **83** is also attached to the bottom surface of each first recessed portion **82**. An outer surface **83***a* of each first bypass seal member **83** facing the resin frame portion **24** is close to the outer surface **42***a* of the second frame-shaped sheet **42**. There is a slight gap between the outer surface **83***a* and the outer surface **42***a*. Thus, since a compressive load is prevented from acting on the plurality of first bypass seal members **83**, an appropriate sealing surface pressure can be applied to the sealing surface of the first flow field seal portion **64**.
(41) However, the outer surface **83***a* of each first bypass seal member **83** may contact the outer surface **42***a* of the second frame-shaped sheet **42**. Even in this case, since each of the first bypass seal members **83** is made of a rubber material (i.e., being more easily elastically deformed than the first seal bead portion **66**), it is possible to suppress a large decrease in the sealing surface pressure of the first flow field seal portion **64**.

(42) An outer surface **83***b* of each first bypass seal member **83** facing the MEA **22** is in contact with or close to the outer peripheral end face **28***e* of the cathode **28**. An outer surface **83***c* of each first bypass seal member **83** on the side opposite to the MEA **22** is spaced apart from the inner side portion **66***a* of the first seal bead portion **66**. Thus, when a compressive load is applied to the plurality of power generation cells **10**, elastic deformation of the inner side portion **66***a* of the first seal bead portion **66** is not inhibited by the plurality of first bypass seal members **83**.
(43) The plurality of first bypass seal members **83** are not necessarily attached to all of the first bypass stop protrusions **70**. The plurality of first bypass seal members **83** may be provided at least in a first bypass stop protrusion **70** closest to the inlet of the oxygen-containing gas flow field **56** among the plurality of first bypass stop protrusions **70**.
(44) In FIG. **4**, a plurality of first intermediate protrusions **84** for supporting the outer periphery of the MEA **22** are located between the first bypass stop protrusions **70** adjacent to each other. Each of the first intermediate protrusions **84** protrudes from the first separator main body **54** toward the resin frame equipped MEA **14**. Each of the first intermediate protrusions **84** extends in a direction intersecting the extending direction of the first end flow field protrusion **58***a*. Each of the first intermediate protrusions **84** is disposed at a position overlapping the outer peripheral end face **28***e* of the cathode **28** when viewed from the stacking direction.
(45) As shown in FIGS. **1**, **2**, and **5**, the second separator member **18** includes a metal plate-shaped second separator main body **90**. The second separator main body **90** is formed in a rectangular shape. A surface (hereinafter referred to as “surface **90***a*”) of the second separator main body **90** facing the resin frame equipped MEA **14** has a fuel gas flow field **92** (reactant gas flow field) extending in the long side direction (arrow B direction) of the power generation cell **10**. The fuel gas flow field **92** is in fluid communication with the fuel gas supply passage **52***a* and the fuel gas discharge passage **52***b*. The fuel gas flow field **92** supplies fuel gas to the anode **30**.
(46) The fuel gas flow field **92** has a plurality of second flow grooves **96**. Each second flow groove **96** is located between a plurality of second flow field protrusions **94** extending in the direction of arrow B. That is, in the fuel gas flow field **92**, the second flow field protrusion **94** and the second flow groove **96** are alternately arranged in the flow path width direction (arrow C direction). The plurality of second flow field protrusions **94** and the plurality of second flow grooves **96** are integrally formed with the second separator main body **90** by press forming. The second flow field protrusions **94** and the second flow grooves **96** extend in a wavy manner in the direction of arrow B. However, the second flow field protrusions **94** and the second flow grooves **96** may extend linearly in the direction of the arrow B.
(47) In FIG. **2**, the cross-sectional shape of the second flow field protrusion **94** is a trapezoidal shape. That is, the cross-sectional shape of the second flow field protrusion **94** is tapered toward the protruding direction of the second flow field protrusion **94**. The cross-sectional shape of the second flow field protrusion **94** may be rectangular. Hereinafter, among the plurality of second flow field protrusions **94**, second flow field protrusions **94** located at both ends in the flow field width direction will be referred to as “second end flow field protrusions **94***a*”. The second end flow field protrusion **94***a* is located inside an outer peripheral end face **30***e* of the anode **30**.
(48) In FIG. **5**, the surface **90***a* of the second separator main body **90** is provided with a second seal portion **98** for preventing leakage of a reactant gas (oxygen-containing gas or fuel gas) or a fluid serving as a coolant. The second seal portion **98** is pressed against the outer surface **40***a* of the first frame-shaped sheet **40** (the outer surface of the first frame-shaped sheet **40** opposite to the second frame-shaped sheet **42**) (see FIG. **2**). The second seal portion **98** extends in a wavy shape when viewed in the separator thickness direction (direction of arrow A). However, the second seal portion **98** may extend linearly as viewed in the separator thickness direction.
(49) The second seal portion **98** has a plurality of second passage seal portions **100** and a second flow field seal portion **102**. The plurality of second passage seal portions **100** respectively surround the plurality of passages (e.g., the oxygen-containing gas supply passage **48***a*). The second flow

field seal portion **102** is located on the outer periphery of the second separator main body **90**. The second seal portion **98** is disposed so as to overlap the first seal portion **61** when viewed from the separator thickness direction (see FIG. **2**).

(50) As shown in FIG. **2**, the second seal portion **98** includes a second seal bead portion **104** and a second resin seal member **106**. The second seal bead portion **104** is integrally formed with the second separator main body **90** so as to project toward the resin frame equipped MEA **14**. The second resin seal member **106** is attached to the protruding end surface of the second seal bead portion **104**. The second seal bead portion **104** is elastically deformed by a compressive load in the direction of the arrow A.

(51) The second seal bead portion **104** has a trapezoidal cross-sectional shape. That is, the cross-sectional shape of the second seal bead portion **104** is tapered toward the protruding direction of the second seal bead portion **104**. The cross-sectional shape of the second seal bead portion **104** may be a rectangular shape. The second resin seal member **106** is a rubber seal that is fixed to the protruding end surface of the second seal bead portion **104** by printing, coating, or the like. The resin material constituting the second resin seal member **106** may be the same as the material constituting the first resin seal member **68** described above. The second resin seal member **106** may be fixed to the outer surface **40***a* of the first frame-shaped sheet **40**.

(52) In FIGS. **2** and **6**, the second separator main body **90** has a plurality of second bypass stop protrusions **108**. Each of the plurality of second bypass stop protrusions **108** is located between the end portion of the fuel gas flow field **92** in the flow field width direction (i.e., the second end flow field protrusion **94***a*) and the second flow field seal portion **102**. The plurality of second bypass stop protrusions **108** prevent the fuel gas from bypassing the fuel gas flow field **92** from the fuel gas supply passage **52***a* to the fuel gas discharge passage **52***b*. That is, the plurality of second bypass stop protrusions **108** prevent the fuel gas from entering a second bypass flow path **110**. Stated otherwise, the second bypass stop protrusions **108** prevent the fuel gas from bypassing the fuel gas flow field **92**. The second bypass flow path **110** is located between the second end flow field protrusion **94***a* and the second flow field seal portion **102**.

(53) In this embodiment, the flow field width direction of the fuel gas flow field **92** is a direction along the short side of the second separator main body **90** (arrow C direction). The plurality of second bypass stop protrusions **108** are integrally formed with the second separator main body **90** by press forming. The plurality of second bypass stop protrusions **108** protrude from the second separator main body **90** toward the resin frame equipped MEA **14**. The second bypass stop protrusions **108** are arranged at intervals in the extending direction of the second end flow field protrusion **94***a* (the direction of arrow B).

(54) Each of the second bypass stop protrusions **108** has a trapezoidal cross-sectional shape (see FIG. **6**). That is, the cross-sectional shape of each second bypass stop protrusion **108** is tapered in the protruding direction of the second bypass stop protrusion **108**. However, the cross-sectional shape of each second bypass stop protrusion **108** may be a rectangular shape.

(55) The second end flow field protrusion **94***a* has a plurality of second concave curved portions **112** and a plurality of second convex curved portions **114**. Each of the second concave curved portions **112** is curved so as to be recessed in a direction away from the second flow field seal portion **102**. Each of the second convex curved portions **114** is curved so as to project toward the second flow field seal portion **102**. The second bypass stop protrusions **108** include a plurality of second bypass stop protrusions **108***a* and a plurality of second bypass stop protrusions **108***b*. The second bypass stop protrusions **108***a* are located between the second concave curved portions **112** of the second end flow field protrusion **94***a* and the second flow field seal portion **102**. The second bypass stop protrusions **108***b* are located between the second convex curved portions **114** of the second end flow field protrusion **94***a* and the second flow field seal portion **102**. The second bypass stop protrusions **108***a* and the second bypass stop protrusions **108***b* are alternately arranged at intervals along the extending direction of the second end flow field protrusion **94***a*.

(56) One end of each of the second bypass stop protrusions **108***a* is connected to an inner side portion **104***a* of the second seal bead portion **104**. The other end of each of the second bypass stop protrusions **108***a* is separated from each of the second concave curved portions **112** of the second end flow field protrusion **94***a*. One end of each of the second bypass stop protrusions **108***b* is connected to the inner side portion **104***a* of the second seal bead portion **104**. The other end of each of the second bypass stop protrusions **108***b* is connected to each of the second convex curved portions **114** of the second end flow field protrusion **94***a*.
(57) The height H**3** (the protruding length from the second separator main body **90**) of each second bypass stop protrusion **108** is lower than the height H**4** of the second flow field seal portion **102** (see FIG. **2**). The protruding end surface of each second bypass stop protrusion **108** includes a second inner end surface **116** and a second outer end surface **118**. Each second inner end surface **116** faces the outer surface **31***a* of the outer periphery **31** of the anode **30**. Each of the second outer end surfaces **118** is located outside the anode **30** in a state of being separated from the outer surface **40***a* of the first frame-shaped sheet **40**.
(58) A portion of each second outer end surface **118** adjacent to the inner side portion **104***a* of the second seal bead portion **104** has a second recessed portion **120**. Each of the second recessed portions **120** is recessed in a direction away from the resin frame portion **24**. That is, the back surface (coolant surface) of each second recessed portion **120** protrudes in a direction away from the resin frame portion **24**. As a result, the rigidity of the side wall of the second flow field seal portion **102** can be reduced, compared to the case where each second bypass stop protrusion **108** does not have the second recessed portion **120**. Accordingly, since the inner side portion **104***a* of the second seal bead portion **104** can be effectively elastically deformed by a compressive load, an appropriate sealing surface pressure can be applied to the sealing surface (second resin seal member **106**) of the second flow field seal portion **102**.
(59) A second bypass seal member **122** is attached to the second outer end surface **118** of each second bypass stop protrusion **108**. Each second bypass seal member **122** is a rubber seal fixed to the second outer end surface **118** by printing, coating, or the like. The resin material constituting each second bypass seal member **122** may include the same material as the materials constituting the first resin seal member **68** and the second resin seal member **106** described above. In other words, each second bypass seal member **122** is made of a rubber material. The constituent material of each second bypass seal member **122** is the same as that of the second resin seal member **106**. In this case, for example, when the resin material is applied to the protruding end surface of the second seal bead portion **104**, the resin material can also be applied to the second outer end surface **118**. Therefore, the second bypass seal member **122** can be efficiently attached to the second outer end surface **118** of each second bypass stop protrusion **108**.
(60) In FIG. **2**, each second bypass seal member **122** is attached to the entire second outer end surface **118**. In other words, each second bypass seal member **122** is also attached to the bottom surface of each second recessed portion **120**. An outer surface **122***a* of each second bypass seal member **122** facing the resin frame portion **24** is close to the outer surface **40***a* of the first frame-shaped sheet **40**. There is a slight gap between the outer surface **122***a* and the outer surface **40***a*. Thus, since a compressive load is prevented from acting on the plurality of second bypass seal members **122**, an appropriate sealing surface pressure can be applied to the sealing surface of the second flow field seal portion **102**.
(61) However, the outer surface **122***a* of each second bypass seal member **122** may contact the outer surface **40***a* of the first frame-shaped sheet **40**. Even in this case, since each of the second bypass seal members **122** is made of a rubber material (i.e., being more easily elastically deformed than the second seal bead portion **104**), it is possible to suppress a large decrease in the sealing surface pressure of the second flow field seal portion **102**.
(62) The outer surface **122***b* of each second bypass seal member **122** facing the MEA **22** is in contact with or close to the outer peripheral end face **30***e* of the anode **30**. An outer surface **122***c* of

each second bypass seal member **122** on the side opposite to the MEA **22** is spaced apart from the inner side portion **104***a* of the second seal bead portion **104**. Thus, when a compressive load is applied to the plurality of power generation cells **10**, elastic deformation of the inner side portion **104***a* of the second seal bead portion **104** is not inhibited by the plurality of second bypass seal members **122**.
(63) The plurality of second bypass seal members **122** are not necessarily attached to all of the second bypass stop protrusions **108**. The plurality of second bypass seal members **122** may be provided at least in a second bypass stop protrusion **108** closest to the inlet of the fuel gas flow field **92** among the plurality of second bypass stop protrusions **108**.
(64) In FIG. **6**, a plurality of second intermediate protrusions **124** for supporting the outer periphery of the MEA **22** are located between the second bypass stop protrusions **108** adjacent to each other. Each of the second intermediate protrusions **124** protrudes from the second separator main body **90** toward the resin frame equipped MEA **14**. Each of the second intermediate protrusions **124** is disposed at a position overlapping the outer periphery **31** and the outer peripheral end face **30***e* of the anode **30** when viewed from the stacking direction.
(65) As shown in FIG. **7**, when viewed from the stacking direction, the first flow field protrusion **58** of the oxygen-containing gas flow field **56** and the second flow field protrusion **94** of the fuel gas flow field **92** have wave shapes having the same wavelength and opposite phases to each other. The plurality of second bypass stop protrusions **108** overlap the plurality of first bypass stop protrusions **70** respectively, when viewed from the stacking direction.
(66) As shown in FIG. **1**, a coolant flow field **126** is located between a surface **54***b* of the first separator main body **54** and the surface **90***b* of the second separator main body **90** which are joined to each other. The coolant flow field **126** is in fluid communication with the coolant supply passage **50***a* and the coolant discharge passage **50***b*. The coolant flow field **126** is formed by stacking the corrugated back surface of the first separator main body **54** and the corrugated back surface of the second separator main body **90**.
(67) The power generation cell **10**, which is configured as described above, operates in the following manner.
(68) First, as shown in FIG. **1**, the oxygen-containing gas is supplied to the oxygen-containing gas supply passage **48***a*. The fuel gas is supplied to the fuel gas supply passage **52***a*. The coolant is supplied to the coolant supply passage **50***a*.
(69) The oxygen-containing gas is introduced into the oxygen-containing gas flow field **56** of the first separator member **16** through the oxygen-containing gas supply passage **48***a*. Then, as shown in FIG. **3**, the oxygen-containing gas flows in the direction of arrow B along the oxygen-containing gas flow field **56** and is supplied to the cathode **28** of the MEA **22**.
(70) On the other hand, as shown in FIG. **1**, the fuel gas is introduced into the fuel gas flow field **92** of the second separator member **18** through the fuel gas supply passage **52***a*. As shown in FIG. **5**, the fuel gas flows in the direction of arrow B along the fuel gas flow field **92** and is supplied to the anode **30** of the MEA **22**.
(71) Therefore, in each MEA **22**, the oxygen-containing gas supplied to the cathode **28** and the fuel gas supplied to the anode **30** are consumed by the electrochemical reaction in the first electrode catalyst layer **32** and the second electrode catalyst layer **36**. As a result, power generation is performed.
(72) Then, as shown in FIG. **1**, the oxygen-containing gas supplied to and consumed by the cathode **28** flows from the oxygen-containing gas flow field **56** to the oxygen-containing gas discharge passage **48***b*. After having flowed into the oxygen-containing gas discharge passage **48***b*, the oxygen-containing gas is discharged along the oxygen-containing gas discharge passage **48***b* in the direction of arrow A. Similarly, the fuel gas supplied to and consumed by the anode **30** flows from the fuel gas flow field **92** to the fuel gas discharge passage **52***b*. After having flowed into the fuel gas discharge passage **52***b*, the fuel gas is discharged along the fuel gas discharge passage **52***b* in

the direction of arrow A.
(73) The coolant supplied to the coolant supply passage **50***a* is introduced into a coolant flow field **126** formed between the first separator main body **54** and the second separator main body **90**. The coolant flows in the direction of arrow B after being introduced into the coolant flow field **126**. After cooling the MEA **22**, the coolant is discharged from the coolant discharge passage **50***b*.
(74) The present embodiment has the following effects.
(75) The first bypass seal members **83** are attached to the protruding end surfaces of the first bypass stop protrusions **70** so as to be positioned outside the cathode **28**. The second bypass seal members **122** are attached to the protruding end surfaces of the second bypass stop protrusions **108** so as to be positioned outside the anode **30**.
(76) According to this configuration, the inflow of the oxygen-containing gas into the first bypass flow path **72** can be effectively suppressed by the plurality of first bypass stop protrusions **70** and the plurality of first bypass seal members **83**. Thus, it is possible to suppress a decrease in the flow rate of the oxygen-containing gas flowing through the oxygen-containing gas flow field **56**. Therefore, even when liquid water generated by the cathode **28** at the time of power generation stagnates in the oxygen-containing gas flow field **56**, the liquid water in the oxygen-containing gas flow field **56** can be smoothly discharged by the oxygen-containing gas.
(77) Further, the inflow of the fuel gas into the second bypass flow path **110** can be effectively suppressed by the plurality of second bypass stop protrusions **108** and the plurality of second bypass seal members **122**. Thus, it is possible to suppress a decrease in the flow rate of the fuel gas flowing through the fuel gas flow field **92**. Therefore, even when liquid water generated by the cathode **28** at the time of power generation diffuses back into the anode **30** and stagnates in the fuel gas flow field **92**, the liquid water in the fuel gas flow field **92** can be smoothly discharged by the fuel gas. Therefore, power generation can be stabilized.
(78) The protruding end surface of each first bypass stop protrusion **70** includes the first inner end surface **78** and the first outer end surface **80**. The first inner end surface **78** faces the outer periphery **29** of the cathode **28**. The first outer end surface **80** is located outside the cathode **28** in a state of being separated from the resin frame portion **24**. The first bypass seal members **83** are respectively attached to the first outer end surfaces **80**.
(79) There are cases where a gap may be formed between the outer surface **29***a* of the outer periphery **29** of the cathode **28** and the first inner end surfaces **78** of the first bypass stop protrusions **70** due to dimensional variation of the resin frame portion **24** and the first bypass stop protrusions **70**. According to such a configuration, even when such a gap occurs, the inflow of the oxygen-containing gas into the first bypass flow path **72** through the gap can be suppressed by the plurality of first bypass seal members **83**.
(80) The protruding end surface of each second bypass stop protrusion **108** includes the second inner end surface **116** and the second outer end surface **118**. The second inner end surface **116** faces the outer periphery **31** of the anode **30**. The second outer end surface **118** is located outside the anode **30** in a state of being separated from the resin frame portion **24**. The plurality of second bypass seal members **122** are attached to the plurality of second outer end surfaces **118**
(81) There are cases where a gap may be formed between the outer surface **31***a* of the outer periphery **31** of the anode **30** and the second inner end surfaces **116** of the second bypass stop protrusions **108** due to dimensional variation of the resin frame portion **24** and the second bypass stop protrusions **108**. According to such a configuration, even when such a gap occurs, the inflow of the fuel gas into the second bypass flow path **110** through the gap can be suppressed by the plurality of second bypass seal members **122**.
(82) Each first bypass seal member **83** is in contact with or adjacent to the cathode **28**. Each second bypass seal member **122** is in contact with or adjacent to the anode **30**.
(83) According to this configuration, the inflow of the oxygen-containing gas into the first bypass flow path **72** can be more effectively suppressed by the plurality of first bypass seal members **83**.

Further, the inflow of fuel gas into the second bypass flow path **110** can be more effectively suppressed by the plurality of second bypass seal members **122**.
(84) Each first bypass seal member **83** is located between the outer periphery **29** of the cathode **28** and the inner side portion **66***a* of the first seal bead portion **66**. Each second bypass seal member **122** is located between the outer periphery **31** of the anode **30** and the inner side portion **104***a* of the second seal bead portion **104**.
(85) According to this configuration, the inflow of the oxygen-containing gas into the first bypass flow path **72** can be more effectively suppressed by the plurality of first bypass seal members **83**. Further, the inflow of fuel gas into the second bypass flow path **110** can be more effectively suppressed by the plurality of second bypass seal members **122**.
(86) Each first bypass seal member **83** is made of a rubber material. Each of the second bypass seal members **122** is made of a rubber material.
(87) According to this configuration, the inflow of the oxygen-containing gas into the first bypass flow path **72** can be more effectively suppressed by the plurality of first bypass seal members **83**. Further, the inflow of fuel gas into the second bypass flow path **110** can be more effectively suppressed by the plurality of second bypass seal members **122**.
(88) Each first bypass seal member **83** is proximate to the outer surface **42***a* of the second frame-shaped sheet **42**. Each second bypass seal member **122** is adjacent to the outer surface **40***a* of the first frame-shaped sheet **40**.
(89) According to this configuration, the inflow of the oxygen-containing gas into the first bypass flow path **72** can be more effectively suppressed by the plurality of first bypass seal members **83**. Further, the inflow of fuel gas into the second bypass flow path **110** can be more effectively suppressed by the plurality of second bypass seal members **122**.
(90) The first flow field seal portion **64** includes the first resin seal member **68** attached to the protruding end surface of the first seal bead portion **66**. The material for the first bypass seal member **83** is the same as that for the first resin seal member **68**. The second flow field seal portion **102** includes the second resin seal member **106** attached to the protruding end surface of the second seal bead portion **104**. The material for the second bypass seal member **122** is the same as that for the second resin seal member **106**.
(91) According to this configuration, when a resin material constituting the first resin seal member **68** is attached to the protruding end surface of the first seal bead portion **66**, the resin material can also be attached to the first outer end surface **80**, so that the first bypass seal member **83** can be efficiently formed. When a resin material constituting the second resin seal member **106** is attached to the protruding end surface of the second seal bead portion **104**, the resin material can also be attached to the second outer end surface **118**, so that the second bypass seal member **122** can be efficiently formed.
(92) The plurality of first bypass stop protrusions **70** are arranged in the flow direction of the oxygen-containing gas in the oxygen-containing gas flow field **56**. The first bypass seal member **83** is attached to at least a first bypass stop protrusion **70** closest to the inlet of the oxygen-containing gas flow field **56** among the plurality of first bypass stop protrusions **70**. The plurality of second bypass stop protrusions **108** are arranged in the flow direction of the fuel gas in the fuel gas flow field **92**. The second bypass seal member **122** is attached to at least a second bypass stop protrusion **108** closest to the inlet of the fuel gas flow field **92** among the plurality of second bypass stop protrusions **108**.
(93) According to such a configuration, it is possible to effectively prevent the oxygen-containing gas from flowing into the first bypass flow path **72** from the upstream side of the oxygen-containing gas flow field **56**. Further, it is possible to effectively prevent the fuel gas from flowing into the second bypass flow path **110** from the upstream side of the fuel gas flow field **92**.
(94) The first bypass stop protrusions **70** extend so as to connect the first end flow field protrusion **58***a* and the inner side portion **66***a* of the first seal bead portion **66**. The first recessed portion **82** is

located in a portion of the first outer end surface **80** adjacent to the first seal bead portion **66**. The second bypass stop protrusions **108** extend so as to connect the second end flow field protrusion **94***a* and the inner side portion **104***a* of the second seal bead portion **104**. The second recessed portion **120** is located at a portion of the second outer end surface **118** adjacent to the second seal bead portion **104**.
(95) According to such a configuration, since the rigidity of the inner side portion **66***a* of the first seal bead portion **66** can be reduced as compared with the case where the first recessed portion **82** is not provided, the first seal bead portion **66** can be easily elastically deformed by a compressive load. Further, since the rigidity of the inner side portion **104***a* of the second seal bead portion **104** can be reduced as compared with the case where the second recessed portion **120** is not provided, the second seal bead portion **104** can be easily elastically deformed by a compressive load.
(96) The present embodiment is not limited to the configuration described above. In the power generation cell **10**, the plurality of first bypass seal members **83** or the plurality of second bypass seal members **122** may be omitted. In other words, the power generation cell **10** may have only the plurality of first bypass seal members **83** or only the plurality of second bypass seal members **122**.
(97) The present invention is not limited to the above-described embodiments, and various configurations may be adopted without departing from the scope of the present invention.
(98) The embodiment described above can be summarized in the following manner.
(99) According to the above embodiment, there is provided a power generation cell (**10**) including: a membrane electrode assembly (**22**) including an electrolyte membrane (**26**) and two electrodes (**28**, **30**) arranged on both sides of the electrolyte membrane; a resin frame portion (**24**) arranged on an outer periphery of the membrane electrode assembly so as to project outward from the outer periphery; and two separator members (**16**, **18**) arranged on both sides of the membrane electrode assembly, wherein: each of the two separator members includes a separator main body (**54**, **90**) in a form of a metal plate; the separator main body includes: a reactant gas flow field (**56**, **92**) through which a reactant gas flows along a power generation area (**46**) of the electrode from one end of the separator main body toward another end thereof; and a flow field seal portion (**64**, **102**) that surrounds the reactant gas flow field in a state of being in contact with the resin frame portion in order to prevent leakage of the reactant gas; the flow field seal portion includes a seal bead portion (**66**, **104**) protruding from the separator main body and formed integrally with the separator main body so as to be elastically deformed by a compressive load in a separator thickness direction; the separator main body includes a bypass stop protrusion (**70**, **108**) formed integrally therewith so as to protrude toward the membrane electrode assembly, the bypass stop protrusion being configured to prevent the reactant gas from flowing in between an end portion (**58***a*, **94***a*) of the reactant gas flow field in a flow field width direction and the flow field seal portion; and a bypass seal member (**83**, **122**) is provided on a protruding end surface of the bypass stop protrusion so as to be positioned outside the electrode.
(100) In the power generation cell, the protruding end surface of the bypass stop protrusion may include: an inner end surface (**78**, **116**) facing an outer periphery of the electrode; and an outer end surface (**80**, **118**) positioned outside the electrode in a state of being separated from the resin frame portion; and the bypass seal member may be provided on the outer end surface.
(101) In the power generation cell, the bypass seal member may be in contact with or in proximity to one of the two electrodes.
(102) In the power generation cell, the bypass seal member may be located between the outer periphery of one of the two electrodes and an inner side portion (**66***a*, **104***a*) of the seal bead portion.
(103) In the power generation cell, the bypass seal member may be made of a rubber material.
(104) In the power generation cell described above, the bypass seal member may be close to the outer surface (**40***a*, **42***a*) of the resin frame portion.
(105) In the power generation cell, the flow field seal portion may include a resin seal member (**68**,

106) provided on a protruding end surface of the seal bead portion, and a constituent material for the bypass seal member may be the same as a constituent material for the resin seal member.
(106) In the power generation cell, the plurality of bypass stop protrusions may be provided in a flow direction of the reactant gas in the reactant gas flow field, and the bypass seal member may be provided on at least a bypass stop protrusion, among the plurality of bypass stop protrusions, that is closest to an inlet of the reactant gas flow field.
(107) In the power generation cell, the bypass stop protrusion may extend so as to connect the end portion of the reactant gas flow field in the flow field width direction and an inner side portion of the seal bead portion, and a portion of the protruding end surface that is adjacent to the inner side portion of the seal bead portion may include a recessed portion (**82**, **120**).

Claims

1. A power generation cell comprising: a membrane electrode assembly including an electrolyte membrane and two electrodes arranged on both sides of the electrolyte membrane; a resin frame portion arranged on an outer periphery of the membrane electrode assembly so as to project outward from the outer periphery; and two separator members arranged on both sides of the membrane electrode assembly, wherein: each of the two separator members includes a separator main body in a form of a metal plate; the separator main body includes: a reactant gas flow field through which a reactant gas flows along a power generation area of the electrode from one end of the separator main body toward another end thereof; and a flow field seal portion that surrounds the reactant gas flow field in a state of being in contact with the resin frame portion to prevent leakage of the reactant gas; the flow field seal portion includes a seal bead portion that protrudes from the separator main body and is formed integrally with the separator main body so as to be elastically deformed by a compressive load in a separator thickness direction; the separator main body includes a bypass stop protrusion formed integrally therewith so as to protrude toward the membrane electrode assembly, the bypass stop protrusion being configured to prevent the reactant gas from flowing in between an end portion of the reactant gas flow field in a flow field width direction and the flow field seal portion; a bypass seal member is provided on a protruding end surface of the bypass stop protrusion so as to be positioned outside the electrode; the protruding end surface of the bypass stop protrusion includes an inner end surface facing an outer periphery of the electrode, and an outer end surface positioned outside the electrode in a state of being separated from the resin frame portion; and the bypass seal member is provided on the outer end surface.
2. The power generation cell according to claim 1, wherein: the bypass seal member is in contact with or in proximity to one of the two electrodes.
3. The power generation cell according to claim 1, wherein: the bypass seal member is located between the outer periphery of one of the two electrodes and an inner side portion of the seal bead portion.
4. The power generation cell according to claim 1, wherein: the bypass seal member is made of a rubber material.
5. The power generation cell according to claim 1, wherein: the bypass seal member is close to an outer surface of the resin frame portion.
6. The power generation cell according to claim 1, wherein: the flow field seal portion includes a resin seal member provided on a protruding end surface of the seal bead portion; and a constituent material for the bypass seal member is same as a constituent material for the resin seal member.
7. The power generation cell according to claim 1, wherein: the bypass stop protrusion comprises a plurality of bypass stop protrusions provided in a flow direction of the reactant gas in the reactant gas flow field; and the bypass seal member is provided on at least a bypass stop protrusion, among the plurality of bypass stop protrusions, that is closest to an inlet of the reactant gas flow field.
8. The power generation cell according to claim 1, wherein: the bypass stop protrusion extends so

as to connect the end portion of the reactant gas flow field in the flow field width direction and an inner side portion of the seal bead portion; and a portion of the protruding end surface that is adjacent to the inner side portion of the seal bead portion includes a recessed portion.

9. The power generation cell according to claim 1, wherein: the bypass seal member is attached to an entirety of the outer end surface.

10. A power generation cell comprising: a membrane electrode assembly including an electrolyte membrane and two electrodes arranged on both sides of the electrolyte membrane; a resin frame portion arranged on an outer periphery of the membrane electrode assembly so as to project outward from the outer periphery; and two separator members arranged on both sides of the membrane electrode assembly, wherein: each of the two separator members includes a separator main body in a form of a metal plate; the separator main body includes: a reactant gas flow field through which a reactant gas flows along a power generation area of the electrode from one end of the separator main body toward another end thereof; and a flow field seal portion that surrounds the reactant gas flow field in a state of being in contact with the resin frame portion to prevent leakage of the reactant gas; the flow field seal portion includes a seal bead portion that protrudes from the separator main body and is formed integrally with the separator main body so as to be elastically deformed by a compressive load in a separator thickness direction; the separator main body includes a bypass stop protrusion formed integrally therewith so as to protrude toward the membrane electrode assembly, the bypass stop protrusion being configured to prevent the reactant gas from flowing in between an end portion of the reactant gas flow field in a flow field width direction and the flow field seal portion; a bypass seal member is provided on a protruding end surface of the bypass stop protrusion so as to be positioned outside the electrode; the bypass stop protrusion extends so as to connect the end portion of the reactant gas flow field in the flow field width direction and an inner side portion of the seal bead portion; and a portion of the protruding end surface that is adjacent to the inner side portion of the seal bead portion includes a recessed portion; and the bypass seal member is attached to a bottom surface of the recessed portion.

11. The power generation cell according to claim 10, wherein: the bypass seal member is spaced from the inner side portion.