COMPACT REACTANT GAS PLUMBING SERVING DUAL IDENTICAL FUEL CELL STACKS

TECHNICAL FIELD

This invention relates to providing reactant gas inlet and exhaust plumbing to two identical fuel cells in a compact manner, with flexibility to allow for tolerance variation, with uniform flow distribution to each fuel cell stack.

BACKGROUND ART

The utilization of fuel cell power plants to operate electric vehicles, particularly private passenger vehicles, requires that the fuel cell power plant be able to fit within space that is available in the vehicle. To help maximize the fuel cell stack volume that can be accommodated in smaller vehicles, the use of two fuel cells mounted side by side is one plausible solution. However, if there are two separate fuel cell stacks in a power plant, then the amount of external plumbing required to supply the fuel and oxidant reactant gases and carry off the exhaust thereof must be doubled, one set for each fuel cell.

DISCLOSURE OF INVENTION

Objects of the invention include: providing supply and exhaust plumbing which need not be duplicated for two fuel cells disposed together in a single fuel cell power plant; compact fuel reactant gas plumbing for fuel cell power plants; fuel cell reactant gas plumbing which is easily disposed on dual fuel cell stack power plants despite tolerance variations; improved fuel cell reactant gas plumbing; and simple, compact fuel cell reactant gas plumbing.

According to the invention, two identical fuel cells are mounted adjacent to each other in the same orientation, thereby providing a reactant gas inlet on the same-handed side (e.g., the right side in the disclosed embodiment) of both fuel cell stacks; each reactant gas inlet manifold has the ability to both receive and exhaust reactant gas on either the right side of the manifold or the left side of the manifold, as seen in the disclosed embodiment, whereby a single configuration of reactant gas inlet and outlet plumbing can feed and exhaust one reactant gas of one stack from its left side and feed and exhaust the reactant gas of the other stack from its right side, being disposed between the stacks.

According further to the invention, a single set of reactant gas inlet and outlet plumbing includes, between inlets and outlets of two separate reactant gas inlet/outlet manifolds, flexible tubing which accommodates variations in exact positioning and/or dimensions of the inlet/outlet manifolds from one fuel cell power plant to the next.

According to the invention, an inlet transition piece, between the fuel reactant gas supply pipe and the fuel reactant gas inlet tubing, connects the fuel reactant gas inlet tubing to a fuel reactant gas supply pipe which is normal to the tubing, thereby improving the distribution of fuel reactant gas within the tubing as it approaches the respective inlet/outlet manifolds.

Other objects, features and advantages of the present invention will become more apparent in the light of the following detailed description of exemplary embodiments thereof, as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a pair of fuel cell stacks having reactant gas plumbing in accordance with the present invention.

FIG. **2** is a partial perspective view of an end of a fuel inlet/outlet manifold.

FIG. **3** is a detailed perspective view of the plumbing of FIG. **1**.

MODE(S) FOR CARRYING OUT THE INVENTION

Referring now to FIG. **1**, the invention is embodied in a fuel cell power plant having two fuel cell stacks **12**, **13** which are, for all purposes relevant to the invention, essentially identical. The two fuel cell stacks **12**, **13** are laid out edge to edge, each in the same orientation (or handedness) as the other. A fuel inlet/outlet manifold **15** is on the right side of the fuel cell stack **12** as seen in FIG. **1**, and the fuel inlet/outlet manifold **16** is on the right side of the fuel cell stack **13** as seen in FIG. **1**. Similarly, the fuel turn manifold **18** is on the left side of the fuel cell stack **12**, and the fuel turn manifold **19** is on the left side of the fuel cell stack **13**, as seen in FIG. **1**. A respective air turn manifold **20** may be on the top of each fuel cell stack **12**, **13**. Each fuel cell stack has a pressure plate **22** at either end thereof, only the pressure plates **22** being visible in the foreground.

Referring to FIG. **2**, the fuel inlet/outlet manifold **15** is shown; the fuel inlet/outlet manifold **16** is identical thereto. The fuel inlet/outlet manifold **15** has a seal plate **25** disposed on the right hand side thereof as seen in FIGS. **1** and **2** so as to seal off the fuel inlet **26** and the fuel outlet **27** from ambient. For clarity of illustration, the fuel inlet **26** is shown communicating with each of the fuel cell's fuel reactant gas flow fields through a chamber **28**, and the fuel outlet **27** is shown communicating with each of the fuel cells through a chamber **29**. Because the electricity producing process in each fuel cell stack **12**, **13** is totally independent of the like process in the other fuel cell stack, it is irrelevant that the intersection piece **43** is closer to the stack **12** than it is to the stack **13**, since inlet fuel need not reach both stacks simultaneously as is the case for the individual cells in either one of the stacks. The details of the manner of communication with the fuel flow fields of each fuel cell are conventional, and form no part of the invention.

In FIG. **1**, the fuel inlet/outlet manifold **16** also has a seal plate **32**, but that is disposed on the left side of the inlet/outlet manifold **16**. This arrangement allows the fuel inlet/outlet plumbing **33** to be disposed adjacent to one of the fuel cell stacks, in this case stack **12**, yet serve both fuel cells at the same time. This is an important aspect of the present invention. Each seal plate **25**, **32** in this embodiment is attached, by bolts **30** or other known means through the corresponding fuel inlet/outlet manifold **15**, **16**, to a corresponding flange **34**, **35** on the opposite side of the related inlet/outlet manifold **15**, **16** from the seal plate **25**, **32**. Although not shown, for clarity, o-ring or similar, conventional seals are required around the fuel inlets and outlets **26**, **27** of both manifolds **15**, **16**.

The flanges are interconnected with each other through transition pieces **37** and metal tubing, including flexible metal tubing **38**, **39** and corresponding intersection pieces **42**, **43**, the intersection piece **42** feeding a fuel exhaust **45** and the intersection piece **43** being fed by a fuel supply pipe **46** as shown in FIGS. **1** and **3**. The intersection piece **42** is tall and the lower portion of it is thin enough to allow the tube **39** to pass behind it. The intersection piece **43** is short so that the tube **38** may pass over it. The flexible tubing **38**, **39** accommodates variations in dimensions and/or positioning between the inlet/outlet manifolds of different fuel cell power plants of the same design.