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Declarations under Rule 4.17:

— as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

[Continued on next page]

(54) Title: A SYSTEM AND METHOD FOR RECIRCULATING HYDROGEN AND BLEEDING OF IMPURITIES FROM FUEL CELL STACK

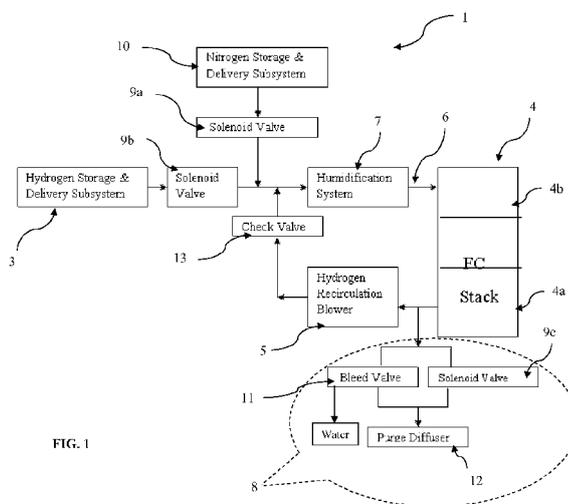


FIG. 1

(57) Abstract: The present disclosure provides a system for recirculating hydrogen and bleeding of impurities in hydrogen subsystem of polymer electrolyte fuel cell of a vehicle, said system comprises; an electronic control unit of the vehicle, a hydrogen storage and delivery subsystem interfaced with the electronic control unit to store and supply the hydrogen to a fuel cell stack through a solenoid valve and a humidification system; a hydrogen recirculation blower connected to the fuel cell stack and a hydrogen circulation line; a nitrogen storage and delivery sub system interfaced with the electronic control unit to store and supply the nitrogen to a fuel cell stack through a solenoid valve and the humidification system; a hydrogen purging and diffusing system provided in between the fuel cell stack and hydrogen recirculation blower, wherein said hydrogen purging and diffusing system facilitates removal of condensed water and other impurities from the fuel cell stack.

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AMENDED CLAIMS

received by the International Bureau on 18 September 2012 (18.09.2012).

1. A system (1) for recirculating hydrogen and bleeding of impurities in hydrogen subsystem of polymer electrolyte fuel cell of a vehicle, said system comprises;
 - an electronic control unit (2) of the vehicle;
 - a hydrogen storage and delivery subsystem (3) interfaced with the electronic control unit (2) to store and supply the hydrogen to a fuel cell stack (4) through a solenoid valve (9b) and a humidification system (7);
 - a hydrogen recirculation blower (5) connected to the fuel cell stack (4) and a hydrogen circulation line (6);
 - a nitrogen storage and delivery sub system (10) interfaced with the electronic control unit (2) to store and supply the nitrogen to a fuel cell stack (4) through a solenoid valve (9a) and the humidification system (7);characterized in that,
 - a hydrogen purging and diffusing system (8) provided in a bypass path placed between the fuel cell stack (4) and hydrogen recirculation blower (5) for removal of condensed water and other impurities from the fuel cell stack (4) using gravity, wherein the hydrogen purging and diffusing system comprises;
 - a bleed valve (11) for continuously removing the condensed water during operation of the hydrogen subsystem of the polymer electrolyte fuel cell; and
 - a solenoid valve (9c) for removing the accumulated impurities in the fuel cell stack (4) through a purge diffuser (12) provided with fan.
2. The system as claimed claim 1, wherein a check valve (13) is provided in between the hydrogen recirculation blower (5) and the hydrogen circulation line (6) to increase the pressure of recirculating hydrogen and to allow the unidirectional flow of the recirculating hydrogen.
3. The system as claimed in claim 1, wherein plurality of pressure transducers are provided in the fuel cell stack (4) for measuring a pressure of hydrogen in the stack (4).

4. The system as claimed in claim 1, wherein plurality of thermal and humidity sensors are provided at predetermined locations, and said sensors are interfaced with the electronic control unit (2) to provide level of temperature and humidity of the fuel cell stack (4).
5. A method for recirculating hydrogen and bleeding of impurities in hydrogen subsystem of polymer electrolyte fuel cell of a vehicle, said method comprising acts of;
 - checking a mode of operation of a vehicle by means of driver input; wherein said mode comprises startup mode, run mode, emergency mode and shut down mode;
 - opening a solenoid valves (9a and 9c) to flush out entrapped air from a fuel cell stack (4) when start up time measured by an electronic control unit (2) during the startup mode is less than preset time limit;
 - opening a solenoid valves (9b and 9c) when the start up time is more than the preset limit and voltage of fuel stack (4) measured by the electronic control unit (2) is less than preset voltage limit to supply hydrogen to a fuel cell stack (4) to prevent starvation of hydrogen during the run mode;
 - opening the solenoid valves (9a and 9c) flush out hydrogen from a fuel cell stack (4) when a temperature of the stack (4) measured by the electronic control unit (2) during the shutdown mode is less than preset temperature level;wherein an excess hydrogen is recirculated from a fuel cell stack (4) through a humidification system (7) using a hydrogen recirculation blower (5) for improving an efficacy of hydrogen;
characterized in that,
 - draining condensed water prevent in the fuel cell stack (4) continuously through a bleed valve (11) using gravity, wherein the draining of the condensed

water is performed during operation of the hydrogen subsystem of the polymer electrolyte fuel cell.

6. The method as claimed in claim 5, wherein opening of solenoid valve (9a and 9c) to flush out hydrogen from the fuel cell stack (4) during the emergency mode.
7. The method as claimed in claim 5, wherein the preset limits of startup time, fuel cell stack (4) voltage and fuel cell stack temperature are stored in the electronic control unit (2).
8. A vehicle comprising a system (1) for recirculating hydrogen and bleeding of impurities in hydrogen subsystem of polymer electrolyte fuel cell as claimed in claim 1.
9. A system (1) for recirculating hydrogen and bleeding of impurities in hydrogen subsystem of polymer electrolyte fuel cell of a vehicle and a method for recirculating hydrogen and bleeding of impurities in hydrogen subsystem of polymer electrolyte fuel cell of a vehicle are substantially as herein above described and as illustrated in accompanying drawings.