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(54) **RAPID START FUEL REFORMING SYSTEMS AND TECHNIQUES**

(75) Inventors: **Greg A. Whyatt**, West Richland, WA (US); **Christopher M. Fischer**, Yakima, WA (US); **James M. Davis**, Richland, WA (US)

(73) Assignee: **Battelle Memorial Institute**, Richland, WA (US)

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(51) **Int. Cl.**

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- B01J 8/00** (2006.01)

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(58) **Field of Classification Search** 48/197 R, 48/61; 423/644, 648.1, 650; 422/625
See application file for complete search history.

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Primary Examiner — Matthew Merkling

(74) *Attorney, Agent, or Firm* — Klarquist Sparkman, LLP

(57) **ABSTRACT**

An on-board fuel processor includes a microchannel steam reforming reactor (30) and a water vaporizer (40) heated in series with a combustion gas. The reformer (30) and the vaporizer (40) are both of a cross-flow panel configuration that allows for low combustion side pressure drop. Fuel is directly injected into the steam, and during a rapid cold start, both the combustion gas flow rate and the steam to carbon ratio are substantially increased relative to their steady state operating values. A rapid cold start can be achieved in under 30 seconds with a manageable amount of electric power consumption, removing impediments to use in automotive fuel cell applications.

12 Claims, 18 Drawing Sheets

