CLAIMS

1. A method of producing hydrogen gas, the method comprising:

mixing a first liquid and a second liquid to form a liquid mixture having a predetermined mix ratio, wherein the mixing includes apportioning a preselected volume of liquid from a liquid source by:

(i) dispensing the liquid from the liquid source into a containment volume;

(ii) during the dispensing the liquid, monitoring a pressure of the liquid within the containment volume as a function of time;

(iii) during the dispensing the liquid, and when a volume of the liquid within the containment volume is equal to the preselected volume, automatically discharging an overflow stream of the liquid from the containment volume;

(iv) during the discharging the overflow stream, detecting a transition region in the pressure of the liquid within the containment volume as the function of time; and

(v) responsive to detecting the transition region, ceasing the dispensing the liquid, wherein the liquid is the first liquid, the liquid source is a first liquid source, and the preselected volume is a first preselected volume of the first liquid, and further wherein the mixing includes providing the first preselected volume of the first liquid to a mix tank;

wherein the mixing includes repeating the apportioning, wherein, during the repeating, the liquid is the second liquid, the liquid source is a second liquid source, and the preselected volume is a second preselected volume of the second liquid, wherein the method includes providing the second preselected volume of the second liquid to the mix tank to generate the liquid mixture having the predetermined mix ratio, wherein the first liquid is one of methanol and water, and further wherein the second liquid is the other of methanol and water;

providing the liquid mixture to a reforming region; and

reforming the liquid mixture to generate a mixed gas stream that includes hydrogen gas and other gasses.

2. The method of claim 1, wherein, during the apportioning, the containment volume is a first containment volume, wherein, during the repeating the apportioning, the containment volume is a second containment volume, and further wherein the second containment volume is at least partially coextensive with the first containment volume.

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3. The method of claim 2, wherein:

(i) during the apportioning, the discharging includes discharging a first overflow stream via a first overflow port associated with the first containment volume; and

(ii) during the repeating the apportioning, the discharging includes discharging a second overflow stream via a second overflow port associated with the second containment volume.

4. The method of claim 3, wherein at least one of:

(i) the second overflow port is positioned vertically above the first overflow port, and further wherein, subsequent to the apportioning and prior to the repeating the apportioning, the method further includes closing a first overflow port valve to restrict fluid flow through the first overflow port; and

(ii) the first overflow port is positioned vertically above the second overflow port, and further wherein, subsequent to the apportioning and prior to the repeating the apportioning, the method further includes opening a second overflow port valve to permit fluid flow through the second overflow port.

5. The method of claim 1, wherein the apportioning and the repeating the apportioning are performed entirely sequentially.

6. The method of claim 1, wherein, during the apportioning, the containment volume is a first containment volume, wherein, during the repeating the apportioning, the containment volume is a second containment volume, and further wherein the second containment volume is a separate containment volume that is spaced-apart from the first containment volume.

7. The method of claim 1, wherein the apportioning and the repeating the apportioning are performed at least partially concurrently.

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8. The method of claim 1, wherein the discharging the overflow stream includes discharging the overflow stream from an upper region of the containment volume, wherein the upper region of the containment volume is vertically above a lower region of the containment volume within which the monitoring is performed.

9. The method of claim 1, wherein at least one of:

(i) the detecting the transition region includes detecting a slope change in the pressure of the liquid within the containment volume as the function of time;

(ii) the detecting the transition region includes detecting a local maxima in the pressure of the liquid within the containment volume as the function of time;

(iii) the detecting the transition region includes detecting an inflection point in the pressure of the liquid within the containment volume as the function of time; and

(iv) the detecting the transition region includes detecting a discontinuity in the pressure of the liquid within the containment volume as the function of time.

10. The method of claim 1, wherein the pressure of the liquid within the containment volume as the function of time defines a monotonically increasing region, which precedes the transition region, and further wherein the detecting the transition region includes detecting that the pressure of the liquid within the containment volume as the function of time is no longer monotonically increasing.

11. The method of claim 1, wherein, subsequent to the ceasing the dispensing the liquid and prior to the providing the first preselected volume of the first liquid to the mix tank, the method further includes waiting a first threshold stabilization time, wherein the waiting includes waiting until the discharging at least substantially ceases.

12. The method of claim 1, wherein the predetermined mix ratio includes at least 66 volume percent (vol%) methanol and at most 74 vol% methanol, and further wherein the predetermined mix ratio includes at least 26 vol% water and at most 34 vol% water.

13. The method of claim 1, wherein the method further includes:

(i) determining that a flow of the first preselected volume of the first liquid to the mix tank has ceased; and

(ii) determining that a flow of the second preselected volume of the second liquid to the mix tank has ceased.

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14. The method of claim 13, wherein the transition region is an upper transition region, and further wherein at least one of the determining that the flow of the first preselected volume of the first liquid to the mix tank has ceased and the determining that the flow of the second preselected volume of the second liquid to the mix tank has ceased includes detecting a lower transition region in the pressure of the liquid within the containment volume as the function of time.

15. The method of claim 1, wherein the method is further a method of operating a fuel cell system, and wherein the method further comprises:

providing the hydrogen gas to an anode of a fuel cell assembly;

providing an oxidant to a cathode of the fuel cell assembly; and

reacting the hydrogen gas and the oxidant, within the fuel cell assembly, to generate an electric current.

16. A method of mixing a first liquid and a second liquid to form a liquid mixture having a predetermined mix ratio, the method comprising:

apportioning a preselected volume of liquid from a liquid source by:

(i) dispensing the liquid from the liquid source into a containment volume;

(ii) during the dispensing the liquid, monitoring a pressure of the liquid within the containment volume as a function of time;

(iii) during the dispensing the liquid, and when a volume of the liquid within the containment volume is equal to the preselected volume, automatically discharging an overflow stream of the liquid from the containment volume;

(iv) during the discharging the overflow stream, detecting a transition region in the pressure of the liquid within the containment volume as the function of time; and

(v) responsive to detecting the transition region, ceasing the dispensing the liquid;

wherein the liquid is the first liquid, the liquid source is a first liquid source, and the preselected volume is a first preselected volume, and further wherein the method includes providing the first preselected volume to a mix tank; and

repeating the apportioning, wherein, during the repeating, the liquid is the second liquid, the liquid source is a second liquid source, and the preselected volume is a second preselected volume, and further wherein the method includes providing the second preselected volume of the second liquid to the mix tank to generate the liquid mixture having the predetermined mix ratio.

17. The method of claim 16, wherein, during the apportioning, the containment volume is a first containment volume, wherein, during the repeating the apportioning, the containment volume is a second containment volume, and further wherein one of:

(i) the second containment volume is at least partially coextensive with the first containment volume; and

(ii) the second containment volume is a separate containment volume that is spaced-apart from the first containment volume.

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18. The method of claim 16, wherein during the apportioning, the monitoring includes monitoring with a first pressure detector, and further wherein, at least one of:

(i) during the repeating the apportioning, the monitoring includes monitoring with the first pressure detector; and

(ii) during the repeating the apportioning, the monitoring includes monitoring with a second pressure detector that is distinct from the first pressure detector.

19. The method of claim 16, wherein the discharging includes discharging via an overflow port, wherein:

(i) during the apportioning, the overflow port is a first overflow port; and

(ii) during the repeating the apportioning, the overflow port is a second overflow port that is spaced-apart from the first overflow port.

20. The method of claim 16, wherein at least one of:

(i) the detecting the transition region includes detecting a slope change in the pressure of the liquid within the containment volume as the function of time;

(ii) the detecting the transition region includes detecting a local maxima in the pressure of the liquid within the containment volume as the function of time;

(iii) the detecting the transition region includes detecting an inflection point in the pressure of the liquid within the containment volume as the function of time; and

(iv) the detecting the transition region includes detecting a discontinuity in the pressure of the liquid within the containment volume as the function of time.

21. The method of claim 16, wherein the pressure of the liquid within the containment volume as the function of time defines a monotonically increasing region, which precedes the transition region, and further wherein the detecting the transition region includes detecting that the pressure of the liquid within the containment volume as the function of time is no longer monotonically increasing.

22. The method of claim 16, wherein the method further includes:

(i) determining that a flow of the first preselected volume to the mix tank has ceased; and

(ii) determining that a flow of the second preselected volume to the mix tank has ceased.

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23. The method of claim 16, wherein the first liquid is one of methanol and water, and wherein the second liquid is the other of methanol and water.

24. The method of claim 23, wherein the predetermined mix ratio includes at least 66 volume percent (vol%) methanol and at most 74 vol% methanol, and further wherein the predetermined mix ratio includes at least 26 vol% water and at most 34 vol% water.

25. The method of claim 23, wherein the method is a method of producing hydrogen gas, and further wherein the method further comprises:

providing the liquid mixture to a reforming region; and

reforming the liquid mixture to generate a mixed gas stream that includes hydrogen gas and other gasses.

26. The method of claim 25, wherein the method is further a method of operating a fuel cell system, and wherein the method further comprises:

providing the hydrogen gas to an anode of a fuel cell assembly;

providing an oxidant to a cathode of the fuel cell assembly; and

reacting the hydrogen gas and the oxidant, within the fuel cell assembly, to generate an electric current.

27. A liquid mixing system configured to mix a first liquid and a second liquid at a predetermined mix ratio, the system comprising:

a containment structure defining:

(i) a first containment volume configured to receive the first liquid; and

(ii) a second containment volume configured to receive the second liquid;

an overflow structure including:

(i) a first overflow port extending from the first containment volume and positioned to emit a first overflow stream from the first containment volume when a first liquid volume of the first liquid within the first containment volume equals a first preselected volume;

(ii) a second overflow port extending from the second containment volume and positioned to emit a second overflow stream from the second containment volume when a second liquid volume of the second liquid within the second containment volume equals a second preselected volume;

a pressure detection structure configured to:

(i) measure a first pressure of the first liquid as a function of time within the first containment volume; and

(ii) measure a second pressure of the second liquid as a function of time within the second containment volume;

a mix tank configured to receive and to mix the first preselected volume of the first liquid and the second preselected volume of the second liquid to form a liquid mixture at the predetermined mix ratio;

an outlet structure configured to selectively provide:

(i) the first preselected volume of the first liquid to the mix tank; and

(ii) the second preselected volume of the second liquid to the mix tank; and

a controller programmed to control the mixing system according to the method of claim 16.

28. The system of claim 27, wherein the first liquid is one of methanol and water, and wherein the second liquid is the other of methanol and water.

29. The system of claim 28, wherein the predetermined mix ratio includes at least 66 volume percent (vol%) methanol and at most 74 vol% methanol, and further wherein the predetermined mix ratio includes at least 26 vol% water and at most 34 vol% water.

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30. The system of claim 27, wherein the system further includes a fuel processor configured to receive the liquid mixture and to generate a mixed gas stream that includes hydrogen gas and other gasses.

31. The system of claim 30, wherein the system further includes a purification assembly configured to separate the mixed gas stream into a product hydrogen stream, which includes at least substantially pure hydrogen gas, and a byproduct stream, which includes the other gasses.

32. The system of claim 31, wherein the system further includes a fuel cell configured to receive the hydrogen gas and to generate an electric current therefrom.

33. Non-transitory computer-readable storage media including computer-executable instructions that, when executed, direct a mixing system to perform the method of claim 16.