Title: BARRIER DENSIFIED FLUID CLEANING SYSTEM

Abstract: A densified fluid barrier cleaning system (100) is disclosed in which a pressure vessel (110) encases a movable basket (120) positioned so as to cross a barrier (210) such that one opening (220) of the pressure vessel resides in a first environment (230) and a second opening (230) of the pressure vessel resides in a second environment (235). A tubular basket (120) within the pressure vessel is positioned such that its central longitudinal axis is aligned with both the first (220) and second (230) opening of the pressure vessel (110). Responsive to the successful completion of a cleaning cycle, soiled articles that are introduced to the basket (120) via the first opening from the first environment can be removed through the second opening and into the second environment thus bridging the barrier without fear of introducing contaminants from the first environment to second environment.

**Published:**
- with international search report (Art. 21(3))
- with amended claims (Art. 19(1))

**Date of publication of the international search report:**
17 October 2013

**Date of publication of the amended claims:**
21 November 2013

**Declarations under Rule 4.17:**
- of inventorship (Rule 4.17(iv))
1. A densified fluid barrier cleaning system, comprising:
   a pressure vessel operable to hold a densified fluid having a first sealable opening that interfaces with a first environment and a second sealable opening that interfaces with a second environment, the first environment and the second environment being separated by a barrier;
   an agitation basket positioned within the pressure vessel, wherein the agitation basket is operable to create a mechanical interaction with the densified fluid within the agitation basket apart from the pressure vessel.

2. The densified fluid barrier cleaning system of claim 1, further comprising a drive mechanism operable to manipulate the agitation basket within the pressure vessel and wherein the drive mechanism exits in a secondary pressure environment such that a leak of the densified fluid into the secondary environment is non-detrimental to the drive mechanism.

3. The densified fluid barrier cleaning system of claim 1, wherein the pressure vessel is substantially cylindrical.

4. The densified fluid barrier cleaning system of claim 3, wherein the agitation basket includes two or more outer rings wherein each outer rings includes a plurality of wheels mounted about an outer circumference of the agitation basket operable to support rotation of the agitation basket on a fixed axis.

5. The densified fluid barrier cleaning system of claim 1, wherein the pressure vessel is substantially spherical.

6. The densified fluid barrier cleaning system of claim 1, wherein access to an interior region of the agitation basket can be gained through the first sealable opening and the second sealable opening.
7. The densified fluid barrier cleaning system of claim 1, further comprising at least one rotatable engagement mechanisms that can engage the agitation basket and rotate the agitation basket around a fixed axis.

8. The densified fluid barrier cleaning system of claim 7, wherein the first sealable opening and the second sealable opening can be configured to align respectively with a first agitation basket opening and second agitation basket opening.

9. The densified fluid barrier cleaning system of claim 7, wherein each rotatable engagement mechanism includes a basket interface for engagement of the agitation basket.

10. The densified fluid barrier cleaning system of claim 9, wherein the basket interface engages the agitation basket and aligns the agitation basket with the fixed axis.

11. The densified fluid barrier cleaning system of claim 9, wherein the basket interface includes one or more beveled surfaces that engage with corresponding one or more reciprocal beveled surfaces on the agitation basket so as to align the agitation basket with the fixed axis.

12. The densified fluid barrier cleaning system of claim 7, further comprising a drive system that rotates at least one of the actuators about the fixed axis.

13. The densified fluid barrier cleaning system of claim 1, further comprising a drive system that rotates the agitation basket about a fixed axis.

14. The densified fluid barrier cleaning system of claim 1, wherein the densified fluid includes liquified carbon dioxide.

15. The densified fluid barrier cleaning system of claim 1, wherein the densified fluid includes supercritical carbon dioxide.

16. The densified fluid barrier cleaning system of claim 1, wherein the first environment is a dirty environment and wherein the second environment is a clean environment.
17. The densified fluid barrier cleaning system of claim 1, wherein the pressure vessel includes a heat exchanger apart from the basket.

18. The densified fluid barrier cleaning system of claim 1, further comprising a distillation unit coupled to the pressure vessel, wherein the distillation unit is operable to distill the densified fluid.

19. The densified fluid barrier cleaning system of claim 18, wherein the distillation unit includes a boiling vessel operable to hold the densified fluid in a two phase (gas, liquid) state.

20. The densified fluid barrier cleaning system of claim 19, wherein the pressure vessel includes a heat exchanger submerged in the densified fluid.

21. The densified fluid barrier cleaning system of claim 1, wherein the agitation basket rotates about a fixed axis within the pressure vessel.

22. A method for densified fluid article processing, comprising:

   interfacing with a pressure vessel wherein the pressure vessel spans across a barrier and separates a first environment and a second environment and wherein the pressure vessel includes a first sealable opening that interfaces with the first environment, a second sealable opening that interfaces with the second environment, and an agitation basket positioned within the pressure vessel;

   introducing to the agitation basket from the first environment through the first sealable opening one or more soiled articles;

   transforming the one or more soiled articles to one or more processed articles using a densified fluid wherein transforming includes manipulating the agitation basket within the pressure vessel; and

   responsive to a completed article process cycle, removing the one or more processed articles from the agitation basket through the second sealable opening into the second environment.
23. The method for densified fluid article processing according to claim 22, wherein the first environment is a dirty environment and the second environment is a clean environment.

24. The method for densified fluid article processing according to claim 22, wherein the pressure vessel is substantially cylindrical.

25. The method for densified fluid article processing according to claim 22, further comprising moveably mounting the agitation basket within the pressure vessel using a plurality of wheels mounted about an outer circumference of the agitation basket operable to rotate the agitation basket within the pressure vessel on a fixed axis.

26. The method for densified fluid article processing according to claim 22, wherein the first sealable opening and the second sealable opening each include a rotatable actuator that can rotate around an actuator fixed axis.

27. The method for densified fluid article processing according to claim 26, wherein the agitation basket includes an agitation fixed axis and wherein positioning includes aligning the agitation fixed axis with the actuator fixed axis.

28. The method for densified fluid article processing according to claim 27, further comprising driving the agitation basket about the agitation fixed axis.

29. The method for densified fluid article processing according to claim 22, further comprising creating within the agitation basket a mechanical interaction between one or more soiled articles and the densified fluid.

30. The method for densified fluid article processing according to claim 22, wherein the pressure vessel includes a drive mechanism operable to manipulate the agitation basket within the pressure vessel and wherein the drive mechanism exits in a secondary pressure environment such that a leak of the densified fluid into the secondary environment is non-detrimental to the drive mechanism.
31. The method for densified fluid article processing according to claim 22, wherein the densified fluid includes supercritical carbon dioxide.

32. The method for densified fluid article processing according to claim 22, wherein the densified fluid includes liquified carbon dioxide.

33. The method for densified fluid article processing according to claim 22, wherein transforming includes particle removal and reduction, electro-static charge reduction, bacterial inactivation, disinfection or sterilization.

34. The method for densified fluid article processing according to claim 22, further comprising inhibiting opening of the second sealable opening into the second environment prior to the completed article process cycle.