through the hose to the container via the check valve assembly. In this way a cartridge refill system can be retro fitted to facilitate partial refill of a non-empty cartridge.

[009] Whilst US 8,708,006 addresses the problem of liquid wastage resulting from refilling prior to depletion by allowing topping up of liquid in containers, it fails to adequately address the problem of contamination arising from the refill process itself, and in this sense may be thought of as providing one step forwards, two steps backwards. Mitigation against contamination is ultimately sacrificed in favour of a more practical means of refill.

[010] In keeping with the remaining prior art, US 8,708,006 fails to adequately address the problem of contamination of the liquid owing to exposure of the liquid to air during the refill process.

[011] Yet prevention of exposure of the liquid to air is a crucial factor in mitigating against contamination arising from the refill process.

[012] Embodiments of the present invention can provide partial refills without sacrificing mitigation against contamination.

[013] There is also a deficiency in the prior art in terms of providing filling hoses that are arranged to control a pump and thus the delivery of fluid to fluid dispensers from the refill process.

US 6,341,629 discloses a liquid dispenser for volatile liquids comprising a pressure sensor.

[014] Embodiments of the present invention can provide a smart plug and play filling hose that can provide control of the pump and hence the refill process.

Summary

[015] The invention is defined by the independent claims below. Dependent claims are directed to optional features and preferred embodiments.

[016] There is disclosed herein a liquid dispenser filling hose for use in filling a liquid dispenser with liquid from a liquid reservoir via a pump, comprising: a distal coupler for coupling the filling hose to the liquid dispenser; and a controller arranged to control the pump.

[017] The provision of a controller in the liquid dispenser filling hose arranged to control a pump renders the filling hose plug and play; the filling hose can be coupled to the fluid

CLAIMS

1. A liquid dispenser filling hose (17) for use in filling a liquid dispenser (9, 21) with liquid from a liquid reservoir (3) via a pump, comprising:
a distal coupler for coupling the filling hose to the liquid dispenser;
a controller arranged to control the pump; and
a fill-level module in communication with the controller and arranged to send a fill-level signal to the controller, the fill level module comprising a fill-level detector comprising a pressure sensor arranged to detect a change in pressure in the fluid that is being transferred to the liquid dispenser;
characterised in that the liquid is selected from soap, shampoo and/or conditioner, body lotion, alcohol based hand sanitiser, face wash or hair gel.

2. The liquid dispenser filling hose (17) of claim 1, further comprising a second liquid reservoir.

3. The liquid dispenser filling hose (17) of claim 2, wherein the second liquid reservoir is configured to contain a concentrate.

4. The liquid dispenser filling hose (17) of claim 2 or claim 3, wherein the second liquid reservoir is removably attached to the filling hose.

5. The liquid dispenser filling hose (17) of any of claims 1 to 4, wherein upon activation of the controller or upon connection of the filling hose to the liquid dispenser (9, 21), liquid flow through the filling hose from the liquid reservoir (3) to the liquid dispenser is activated.

6. The liquid dispenser filling hose (17) of claim 2 or claim 3, further comprising a liquid reservoir (3), wherein the second liquid reservoir is removably attached to the liquid reservoir.

7. The liquid dispenser filling hose (17) of any of claims 2 to 4, wherein the second liquid reservoir comprises a cartridge (26), wherein the cartridge is configured to be detachable.

8. The liquid dispenser filling hose (17) according to claim 1, wherein:
the pump is provided as part of a liquid supply station (4) and the liquid reservoir is mateable with the liquid supply station; and
a proximal coupler is arranged to couple the filling hose with the liquid supply station.

9. The liquid dispenser filling hose (17) according to any preceding claim, further comprising:
a distal coupling detector that provides a signal to the controller upon coupling between the liquid filling hose and the liquid dispenser (9, 21), wherein:
the controller is arranged to automatically initiate liquid transfer upon coupling of the filling hose with the liquid dispenser.

10. The liquid dispenser filling hose (17) according to any preceding claim, wherein:
the controller is arranged to provide transfer input means to allow an operator to manually activate transfer of the fluid.

11. A method of filling a liquid dispenser (9, 21), comprising:
providing a liquid reservoir, a pump, a controller arranged to control the pump, and a fill-level module in communication with the controller and arranged to send a fill-level signal to the controller, the fill-level module comprising a fill-level detector comprising a pressure sensor arranged to detect a change in pressure in the fluid that is being transferred to the liquid dispenser; and a filling hose (17) having a proximal end (18) and a distal end (19), the proximal end of the filling hose being coupled to the liquid reservoir;
coupling the distal end of the filling hose via a distal coupler to the liquid dispenser; and
transferring liquid from the liquid reservoir via the filling hose to an airless liquid container forming part of the liquid dispenser, characterised in that the liquid is

selected from soap, shampoo and/or conditioner, body lotion, alcohol based hand sanitiser, face wash or hair gel.

12. The method of claim 11, wherein there is further provided a second liquid reservoir containing a concentrate, wherein the concentrate is drawn from the second liquid reservoir into the flow of liquid within the filling hose and also transferred to the liquid dispenser.

13. The method of claim 12, wherein turbulent movement of the liquid within the filling hose (17) causes the concentrate to mix with the liquid, and wherein there is further provided a valve arrangement, said valve arrangement (32) being configured to control the extent of dilution of the concentrate with the liquid within the filling hose.

14. The method of claim 12 or claim 13, wherein the second liquid reservoir is configured to be removably attached to the filling hose (17), and further wherein the second liquid reservoir is detached from the filling hose upon the volume of concentrate contained therein reaching a predetermined minimum level.

15. The method of any of claims 11 to 14, wherein:
the filling hose is the filling hose (17) according to any of claims 1 to 10.

16. The method according to any of claims 11 to 15, further comprising:
a distal valve formed in the filling hose (17) in the vicinity of the distal end (19) of the filling hose.

17. The method according to any of claims 11 to 16, wherein:
the controller is for controlling filling operations.

18. The method according to claim 17, wherein:
the controller is arranged to provide transfer input means to allow an operator to activate transfer of the fluid.

19. The method according to any of claims 11 to 18, wherein:

the controller is arranged to cease transfer when the pressure sensor detects that the liquid dispenser (9, 21) is at full capacity.

20. The method according to any one of claims 17 to 19, wherein:
the controller is provided as part of the filling hose (17), as part of the reservoir (3), or as part of the liquid dispenser (9, 21).

21. The method according to any one of claims 17 to 20, wherein:
the controller is arranged to provide an discharge-state detector to detect how much liquid remains in the liquid reservoir.

22. The liquid dispenser filling hose (17) or method according to any preceding claim, wherein:
the liquid dispenser is a soap dispenser and the liquid is soap.

23. The liquid dispenser filling hose (17) or method of any of claims 3 to 10, or 12 to 21, wherein the liquid dispenser is a soap dispenser, the liquid is water and the concentrate is soap concentrate.

24. A system for filling a liquid dispenser (9, 21), comprising:
the liquid filling hose according to any of claims 1 to 10; and
the liquid reservoir and/or liquid supply station.