

may be included into the waste chamber vent conduits or vent ports to prevent release of liquid through these passages. Aerosol-prevention plugs are commonly used in pipette tips to prevent contamination of pipettors and include materials that allow the passage of air when dry but swell and seal up the passage when they come in contact with liquid (e.g., filter materials impregnated or coated with cellulose gum).

[0208] An additional measure for eliminating or substantially reducing foaming/bubbling of waste fluids as they are introduced into the waste chamber can be employed in particularly preferred embodiments. Such an additional anti-foaming/bubbling measure may include arranging/routing the waste chamber conduit such that it enters the waste chamber at a position that is located above the fill line and that intersects a vertical wall of the waste chamber, as illustrated by conduit segments **910** and **911** entering waste chambers **930** and **931** in the embodiment depicted in **FIGS. 9 and 10**. Such a configuration allows the waste fluid to be introduced into the waste chamber in a manner so as to allow the fluid to run along a vertical wall of the waste chamber. Advantageously, this substantially reduces or eliminates foaming/bubbling of the waste fluid as it is routed into the waste chamber.

[0209] Yet another anti-foaming/bubbling measure that may be employed in certain preferred embodiments comprises a vertical web, or partial wall, that can be included in the upper portion of the waste chamber. A particularly suitable embodiment for inclusion of such an anti-foaming/bubbling measure is the two-piece cartridge body design depicted in **FIG. 16**. The anti-foaming web/wall is preferably included in the upper portions of the waste chambers **1610, 1611** located in the upper cartridge component **1500**. Preferably the anti-foaming web is arranged between the waste chamber vent and the waste chamber input. The height of the anti-foaming web preferably extends the full depth of the upper portion of the waste chamber but may be less than the full depth as well. Alternatively, the anti-foaming web can extend beyond the depth of the upper portion of the waste chamber so that it protrudes into the lower portion of the waste chamber. Preferably the height of the anti-foaming web is selected to achieve optimum anti-foaming by allowing the flow of liquid under the web/wall but blocking the flow of bubbles above the surface of the liquid in the waste chamber.

[0210] Yet another anti-foaming/bubbling measure is to include an anti-foam agent in the waste chamber or in another conduit or chamber of the cartridge so that liquid entering the waste chamber has less propensity to foam and/or form bubbles.

[0211] The detection chambers are adapted for carrying out a physical measurement on the sample. The detection chamber is connected to an inlet conduit. Preferably, the detection chamber is also connected to an outlet conduit and is arranged as a flow cell. If the measurement requires illumination or optical observation of the sample (e.g., as in measurements of light absorbance, photoluminescence, reflectance, chemiluminescence, electrochemiluminescence, light scattering and the like) the detection chamber should have at least one transparent wall arranged so as to allow the illumination and/or observation. When employed in solid phase binding assays, the detection chamber preferably

comprises a surface (preferably, a wall of the chamber) that has one or more binding reagents (e.g., antibodies, proteins, receptors, ligands, haptens, nucleic acids, etc.) immobilized thereon (preferably, an array of immobilized binding reagents, most preferably an array of immobilized antibodies and/or nucleic acids). In an especially preferred embodiment, the detection chamber is an electrochemiluminescence detection chamber as described above, most preferably having one or binding reagents immobilized on one or more electrodes. In one preferred embodiment, the cartridge comprises a working electrode having an array of binding reagents immobilized thereon. In another preferred embodiment, the cartridge comprises an array of independently controllable working electrodes each having a binding reagent immobilized thereon. Preferably, in cartridges employing arrays of binding reagents, at least two elements of the array comprise binding reagents that differ in specificity for analytes of interest. Suitable detection chambers, electrode arrays and arrays of immobilized binding reagents for use in ECL-based cartridge systems are described in detail above and include the embodiments shown in **FIGS. 1-4**.

[0212] The detection chamber is, preferably, arranged in an elongated flow cell design with inlet and outlets at or near opposing ends of the elongated dimension. Depending on the application, manufacturing approach, sample size, etc., the flow cell dimensions can range from nanometers to tens of centimeters and the volume from picoliters to milliliters. Certain preferred embodiment have widths that can range from 0.05-20 mm, more preferably, 1-5 mm and heights (preferably, less than or equal to the width so as to increase, for a given volume, the surface area of the bottom of the detection chamber, especially when this surface is used to immobilize binding reagents) that range from 0.01-20 mm, more preferably, 0.05-0.2 mm. Preferably, the height is less than or equal to the width. Preferably, the detection chamber is designed to accommodate sample volumes between 0.1-1000 μL , more preferably, 1-200 μL , more preferably, 2-50 μL , most preferably, 5-25 μL . In embodiments that are limited by sample volume (e.g., cartridges measuring blood from finger pricks), especially preferred detection chamber volumes are less than 10 μL , more preferably 0.5-10 μL , even more preferably 2-6 μL . The flow cell preferably has a width greater than or equal to the height.

[0213] A cartridge may comprise one or more detection chambers. Cartridges comprising multiple detection chambers may comprise separate fluidic systems for each detection chamber (e.g., multiple sample chambers and/or reagent chambers and associated fluidic conduits) so that assays on multiple samples may be carried out in parallel. In certain preferred embodiments, multiple detection chambers are linked to a single sample chamber and may share the use of other fluidic components such as reagent chambers, waste chambers and the like. In these embodiments, the two detection chambers may be used to carry out different sets of assays, thus increasing the number of measurements that can be carried out on a sample relative to a cartridge with one detection chamber. Advantageously, the use of multiple detection chambers allows for carrying out in a single cartridge multiple incompatible measurements, that is measurements that can not be performed in a single reaction volume or benefit from being carried out in separate reaction