

designed/selected so that the swab has a weak point (shown as weak point **2937**) at the same location (preferably, the swab is scored at that location).

[**0193**] In an especially preferred embodiment, the sample chamber is configured to cause an applicator stick to bend upon insertion thus promoting fracture of the shaft. **FIG. 30** shows sample chamber **3010**, an especially preferred adaptation of sample chamber **2810** that has a bend or angle **3015** along its length such that the sample chamber has a first elongated region (on one side of the bend or angle) oriented in one direction and a second elongated region (on the other side of the bend or angle) oriented in second direction, the two regions being oriented at an angle relative to each other. As shown in the **FIG. 30**, insertion of swab **3030** leads to contact between a location on the shaft of the swab and a site on the inner surface of the angle or bend. This contact focuses force on that location and promotes breakage of the shaft at that location (to form head segment **3071** and shaft segment **3072**). Preferably, the width of the sample chamber is designed to fit the swab head snugly but not so tightly that insertion of the swab requires excessive force. Most preferably, the swab and sample chamber are designed/selected so that the swab has a weak point (shown as weak point **3037**) at or near the location of contact (preferably, the swab is scored at that location). Applicants have found that this arrangement allows for concurrent insertion and breaking of the swab in one simple operation. Advantageously, the breakage is extremely reproducible and occurs without any violent motion that can lead to expulsion of sample from the cartridge. Preferred angles or degrees of curvature are 20-90 degrees, more preferably 30-70 degrees, even more preferably 40-50 degrees, most preferably 45 degrees. While **FIGS. 28, 29** and **30** illustrate embodiments employing swabs, the techniques are applicable to other types of application sticks.

[**0194**] The reagent chambers are chambers adapted to hold liquid reagents used during the course of assays carried out in a cartridge. The reagent chamber design considerations for preferred embodiments of a cartridge depend, in part, upon the particular assay(s) to be performed by the cartridge. For example, a cartridge may have one, two or more reagent chambers depending on the number of reagents required by the assay format. Liquid reagents that may be held in a reagent chamber include buffers, assay diluents, solutions containing binding reagents (e.g., proteins, receptors, ligands, haptens, antibodies, antigens, nucleic acids and the like), solutions containing enzymes and/or enzyme substrates, solutions containing control reagents, ECL read buffers containing ECL coreactants (e.g., tertiary amines such as piperazine-N,N'-bis(2-ethanesulfonic acid) and tripropylamine), wash solutions, anti-foam agents, extraction reagents (e.g., solutions containing detergents, acids, bases, nitrous acid, nitrate salts, etc.) and the like. A cartridge may have one, two or more reagent chambers depending, e.g., on the number of reagents required by the assay format. The reagent chamber design considerations for preferred embodiments of a cartridge depend, in part, upon the particular assay(s) to be performed by the cartridge. The reagent chamber is connected to a reagent conduit for transferring reagent from the chamber to other fluidic components in the cartridge. The reagent chamber is, preferably, also connected to a reagent vent port (optionally, through a reagent vent conduit). The arrangement of the conduit connections to the chamber falls under

similar design considerations as those described for the sample chamber, sample conduit and sample port; preferably, the reagent conduit intersects the chamber at or near the bottom and the reagent vent/vent conduit intersects the chamber at or near the top (relative to the orientation of the cartridge during use). Optionally, a filter element is placed before or in the reagent conduit, e.g., if the reagent solution is expected to contain particles that may clog the cartridge fluidics or otherwise negatively affect assay performance.

[**0195**] In one embodiment of the invention, a cartridge has one or more reagent compartments that are empty or contain only dried reagents. Prior to conducting an assay, the user or cartridge reader dispenses liquid reagents into the these chambers (e.g., through reagent vent ports or through reagent introduction ports similar to the sample introduction port described above) which, optionally, reconstitute any dried reagent present in the chambers; the reagents are thus prepared for use in the assay. Sealable closures may be used to prevent leakage of the reagents after their addition.

[**0196**] Preferably, where an assay requires the use of liquid reagents, some or all of these liquid reagents are stored in liquid form in reagent chambers so as to minimize the number and complexity of the operations that must be carried out by a user or cartridge reader. In one preferred embodiment the reagent chamber(s) can be filled with the requisite assay reagent(s) at the time of cartridge manufacture and subsequently sealed. When used to store liquid reagents, the reagent chambers should be designed so as to prevent leakage and or evaporative loss of the reagents from the chambers during storage. In a particularly preferred embodiment the assay reagents are incorporated into assay reagent modules that can be assembled into the cartridge's assay reagent chambers during manufacture. By designing the assay modules to have desired properties such as resistance to leakage and evaporative loss, the design and manufacture of the rest of the cartridge is greatly simplified. In such a preferred embodiment, an assay reagent release mechanism would preferably be incorporated within the cartridge reader for releasing the assay reagent from the reagent module. The assay reagent release mechanism is preferably adapted and configured to engage the reagent module and release/recover its contents.

[**0197**] The reagent module is a container such as an ampoule (e.g., glass, plastic, or the like), a pouch (e.g., plastic, metal foil, plastic/metal foil laminates, rubber, or the like), a blister pack, a syringe, or the like, or any other container that can be filled with fluid, sealed and dropped into the cartridge for subsequent fluid delivery. Preferred materials include glass, plastics with good water vapor barrier properties (e.g., cyclic olefin copolymers such as copolymers of ethylene and norbornene, nylon **6**, polyethylene naphthalate, polyvinylidene chloride and polychlorotrifluoroethylene) and metal foil/plastic laminates because of their chemical inertness and their resistance to evaporative losses, other suitable materials will be apparent to the skilled practitioner. Ampoules, preferably, comprise a material that can be made to shatter or break on impact such as glass or hard plastic. Embodiments incorporating breakable ampoules preferably also include filters to ensure that substantially all of the fragments that may result upon rupturing the ampoules are not permitted to enter the fluidic network and possibly obstruct/block fluid flow. **FIG. 19** depicts a cutaway top view of a cartridge showing filters **1515, 1516** at