

4720 and 4740 as being in the same plane, this arrangement is not a requirement and, e.g., some or all of these components may be angled into or out of the plane of the diagram.

[0187] In one embodiment of the sample chamber, a separate vent port and vent conduit are omitted and the sample introduction port also provides a vent port, e.g., the sample introduction port aperture also acts as a vent port. The vent port may also be provided through the top of the sealing/capping mechanism by, e.g., incorporating a vent hole in the top surface of the sealing/capping mechanism. An alternative embodiment may employ a scheme whereby the cartridge reader itself can include a piercing/venting mechanism that is adapted and configured to pierce through the top surface of the flexible sealing/capping mechanism. In a particularly preferred embodiment, the sealing/capping mechanism is adapted and configured to be self-sealing upon withdrawal/removal of the piercing/venting mechanism, e.g., via the use of a septum preferably comprising an elastomeric material. The advantage of a self sealing cap mechanism is that the sample cannot escape from the sample chamber once the piercing/venting mechanism has been removed.

[0188] The sample chamber may also include a filter for, e.g., removing particulate matter that may be present within the sample itself or that may be present as a result of using a swab or the like to introduce sample into the sample chamber. A preferable embodiment may employ a filter that not only removes any particulate matter but that is also designed to separate red blood cells (RBC) from blood plasma; e.g., where the particular assay/assay format requires blood plasma as the sample. Such a filter can be an integral cross-flow filter, in-line filter or the like. Preferably, the filter is arranged at or near the entrance of the sample conduit.

[0189] In a preferred embodiment for extracting analytes from a solid matrix or a matrix that comprises solids (e.g., for extracting analytes from an absorbent material (e.g., a cotton ball, piece of filter paper, etc.), an applicator stick, dirt, food, sludge, feces, tissue, etc.) the sample chamber is connected to a reagent chamber (e.g., via a reagent conduit) comprising an extraction reagent, e.g., an extraction reagent disclosed in U.S. Provisional Patent Application 60/436,591, filed Dec. 26, 2002, entitled Methods Compositions and Kits for Biomarker Extraction, hereby incorporated by reference. Applicator stick is used herein to refer to a sample collection device comprising an elongated handle (preferably a rod or rectangular prism) and a sample collection head (preferably comprising an absorbent material or, alternatively, a scraping blade) configured to collect sample from a surface or biological tissue) and includes sample collection swabs and tissue scrapers. The reagent conduit and sample conduit are, preferably, arranged to intersect the sample chamber at or near opposing ends of the chamber so that reagent introduced through the reagent conduit is drawn through the sample before passing into the sample conduit. More preferably, the sample chamber has an elongated shape with the two conduits being arranged to intersect at or near the opposing ends of the length. The sample chamber may also include a filter, as described above, for removing solid material. Extraction of analytes from solid materials and, in particular, porous meshes such as may be found in swab heads may lead to the introduction of bubbles and air gaps into the resulting fluid stream. Preferably, the sample chamber or the downstream fluidic components (e.g., the sample conduit) include a bubble trap to remove air introduced during an extraction step.

[0190] FIG. 28 shows a cross-sectional view of one exemplary embodiment of a sample chamber for extracting analyte from a solid or solid-containing matrix. Elongated sample chamber 2810 has a sample introduction port 2820 equipped with a sealable closure as described above. The sample chamber is shown holding an applicator stick, specifically swab 2830 having absorbent swab head 2835. Reagent conduit 2840 and sample conduit 2845 are arranged to intersect sample chamber 2810 on opposing sides of swab head 2835 so that extraction reagent introduced through reagent conduit 2840 passes through swab head 2835 before entering sample conduit 2845. Optionally, a filter element 2848, may be included to remove particulates from the extracted sample. Preferably, the width of sample chamber 2810 in the region that surrounds the head of an inserted applicator stick is less than two times (more preferably less than 1.5 times, even more preferably less than 1.2 times, most preferably equal to or less than 1.0 times) the width of the widest region of the applicator stick that needs to pass through that region during insertion of the applicator stick. Alternatively, the cross-sectional area of sample chamber 2810 in the region that surrounds the head of an inserted applicator stick is less than four times (more preferably, less than two times, most preferably less than or equal to 1.0 times the cross-sectional area of the widest region of the applicator stick that needs to pass through that region. When used to extract sample from porous compressible materials (e.g., a swab having a porous compressible head), the width of the sample chamber is selected so that the width is narrow enough around the applicator stick head so that the material fills most or all the width of the chamber (ensuring the most efficient flow of extraction buffer through the material) but wide enough so that material can be easily inserted without the need for excessive force and without causing leakage of fluid in the material onto the outside surfaces of the cartridge (optionally, both properties may be achieved by use of a chamber that, with respect to a seated applicator stick is narrower in the region that surrounds the head than in the region that surrounds the shaft). Advantageously, sealing sample port 2820 prevents the release of air from that end of sample chamber 2810 and prevents the wasteful flow of extraction reagent away from sample conduit 2845. Optionally, swab 2830 and/or chamber 2810 are designed so that swab 2830 fits completely into chamber 2810. Alternatively (as shown), an applicator stick is too long to fit in chamber 2810 (e.g., the length of swab necessary to collect a mucous sample from the throat or nasal cavity may be too long to fit within the desired form factor of a cartridge) but is cleaved (e.g., broken, fractured, cut or otherwise detached) prior to or, preferably, after its introduction into chamber 2810 so as to produce a shortened stick fragment comprising the sample collection head. The shortened fragment is short enough to fit in chamber 2810 and allow closure 2825 to be sealed. In certain embodiments, the swab is designed to allow for easy detachment by having, e.g., a reversibly detachable head or by including a weak point in the shaft that allows for facile fracture of the shaft.

[0191] One method of introducing an applicator stick such as swab 2830 to sample chamber 2810 comprises i) introducing it into chamber 2810; ii) cleaving the swab shaft to form a head segment (comprising the head) and a shaft segment and iii) sealing the head segment in chamber 2810 by sealing closure 2825. The method may further comprise iv) introducing an extraction reagent through reagent conduit 2840; v) extracting analyte from swab head 2830 by passing extraction