

head and also acts to prevent the swab head from being removed once the swab is fully inserted and broken. In one embodiment, the shelf is located at or near the sample chamber base in the second region, as defined. As shown, the shelf can be defined by a stepped discontinuity in an internal surface of the sample chamber where the radius of curvature transitions from a smaller to a larger radius. In one embodiment, the sample chamber is curved and the radius of curvature of the internal surface, as a function of increasing depth in the elongated cavity, steps from a first value to a second, higher value at the discontinuity. In another embodiment, the radius of curvature of the sample chamber in the first region is less than the radius of curvature of the sample chamber in the second region and the shelf is located on the longer of the curved surfaces defining the sample chamber such that when a swab shaft breaks in the chamber, the strain is released and the end of the swab fragment attached to the swab head is pushed against the longer curved surface and locked in place by the shelf. Therefore, the user inserts the applicator stick into the sample chamber and contacts the swab head of the applicator stick with the retention feature, i.e., the barb, the shelf or both, and the applicator stick is broken within the sample chamber. The swab head is retained within the second region of the sample chamber. The sample chamber also includes a recess to accommodate the swab handle protruding from the broken swab head.

[0290] Sample conduit 3224 is connected to collection component 3726 (which is shown in more detail in FIG. 37) where extraction buffer pulled through the sample chamber is collected and cleared of air bubbles. Further downstream, the collection component is connected through 4-channel fluidic junction 3728 and T-junction 3729 to conduits 3730a and 3730b leading to detection chambers 3731a and 3731b. Conduits 3730a and 3730b comprise dry reagent pill zones which may hold labeled binding reagents (e.g., labeled antibodies for use as detection reagents in sandwich immunoassays) and/or a neutralization reagent (e.g., a pH buffering component such as Tris, Hepes, phosphate and the like) as well as other assay reaction mixture components such as surfactants, salts, blocking agents, etc.

[0291] Detection chambers 3731a and 3731b, preferably, comprise immobilized binding reagents for analytes of interest, preferably an array of binding reagents, preferably an array of binding reagents supported on electrode arrays for conducting ECL measurements as described for other cartridge embodiments above. The two chambers may have the same arrays to allow for duplicate measurements to be carried out. Alternatively, the two channels have different arrays to expand the number of multiplexed assays that can be conducted and/or to segregate incompatible assays. In one embodiment, one detection channel may be processed and read prior to processing of the second detection channel,

[0292] In one embodiment, array elements in one channel are configured for detection and typing of influenza and includes array elements with antibodies against influenza A nucleoprotein, influenza B nucleoprotein and, optionally, negative and positive controls. The first channel may include additional array elements for other infectious agents including, but not limited to, influenza C, adenovirus, parainfluenza and human metapneumovirus. In this embodiment, the second channel is configured for subtyping of influenza A and includes array elements with antibodies for at least two different hemagglutinin subtypes (which may include common seasonal subtypes such as H and H3, H1 from swine origin

influenza virus (SOIV), and subtypes from atypical, potentially pandemic, subtypes for humans such as H2, H5, H7 and H9). Accordingly, conduits 3730a and 3730b include dry reagent pills with the appropriate labeled detection antibodies for conducting measurements for the target analytes of the array elements in the corresponding detection chambers (3731a and 3731b respectively). Optionally, the extraction reagent is an acidic extract for optimal presentation of hemagglutinin antigens (as described above) and the dry reagent pills include a dry neutralization buffer.

[0293] Detection chambers 3731a and 3731b are linked to waste chambers 3734a and 3734b through conduits 3733a and 3733b. The detection chambers are high aspect ratio chambers with higher hydrodynamic resistances relative to conduits 3730a and 3730b and Z-transitions 3732a and 3732b. To enable well controlled clearing of liquids from the detection chambers, conduits 3733a and 3733b are configured as matching resistance regions that are matched to the hydrodynamic resistances of the detection chambers (as described in FIG. 40 and the accompanying text).

[0294] Cartridge 3700 also comprises a wash buffer chamber 3740 for holding a wash buffer (which may be provided in an ampoule). The liquid wash reagent, may comprise an ECL coreactant such as TPA and may be used to both wash excess sample/reagents from the detection chamber and to provide an appropriate chemical environment for an ECL measurement. Wash buffer chamber 3740 is linked to the detection channels through 4-channel junction 3728 and T-junction 3729. Air vents for controlling movement of fluids in the cartridge are provided to collection component 3726, extraction buffer chamber 3710, 4-channel junction 3728, waste chambers 3734a and 3734b and wash buffer chamber 3740.

[0295] FIG. 39 shows a detailed view of 4-channel junction 3728 and illustrates one approach to forming multi-conduit junctions. Four co-planar conduits (e.g., conduits formed by sealing channels on one surface of an injection molded cartridge) are linked by Z-transitions to a different plane on the cartridge (e.g., the opposite surface of an injection molded cartridge). A conduit formed on this opposite surface links the Z-transitions and provides the 4-channel junction.

[0296] In one embodiment, FIG. 39 shows a distribution conduit interconnected to a plurality of fluid conduits comprising an outlet conduit, a detection chamber conduit connected to the detection chamber, and optionally one or more fluid conduits connected to one or more cartridge components selected from a wash buffer chamber, an air vent, detection chambers, and combinations thereof. In one embodiment, a connection between the distribution conduit and one of the plurality of fluid conduits comprises a Z-transition. In a specific embodiment, the cartridge includes an air vent and the one or more fluid conduits include an air vent conduit connected to the air vent, wherein the detection chamber conduit is distal from the air vent conduit. In another embodiment, the cartridge includes a wash buffer chamber and the one or more fluid conduits includes a wash buffer chamber conduit connected to the wash buffer chamber, wherein the wash buffer chamber conduit is proximal to the air vent conduit and distal to said detection chamber conduit. For example, the plurality of cartridge components includes an air vent and the plurality of fluid conduits include (a) a first fluid conduit connected to a detection chamber; (b) a second fluid conduit connected to a collection component; and (c) a third fluid conduit connected to the air vent, wherein the first fluid conduit is distal from the third fluid conduit. The plurality of cartridge com-