use with this cartridge can be configured to break both ampoules in parallel, releasing each ampoule's contents into their respective reagent chambers. Alternatively, the reader can be configured to break the ampoules serially. The second approach has advantages when the reagents are used at different times in the assay process, allowing each reagent to be released when it is needed, and reducing the risk that a reagent may leak out of a reagent chamber prematurely.

**[0204]** A variety of different approaches are available for driving a hammer element to break an ampoule including directly coupling the hammer to a motor, solenoid or other active drive element for striking the ampoule with the hammer or, alternatively, by releasing a hammer held under a spring force (in which case an active drive element may be used to load a spring). One embodiment of an assay reagent release mechanism is assay reagent release mechanism **4200** shown in FIG. **42**, Hammer element **4210** is an elongated lever arm with a protruding striking face **4212**, which preferably has pointed striking surface (e.g., the striking face may be triangular in cross-section). Striking face **4212** is raised and lowered relative to an inserted cartridge by rotation of hammer element **4210** around hammer axle **4214**. Hammer element **4210** also comprises a control surface **4216** that rides on cam **4220** which is affixed to rotating control axle **4222**, thus raising and lowering striking face **4212**. Control surface **4216** may be, but is not required to be, at one end of the elongated lever arm; optionally, control surface **4216** and hammer axle **4214** are at opposite ends of the elongated lever arm. A force is applied to hammer element **4210**, pushing it against the cam and/or down towards the cartridge. This force may be supplied by a spring (e.g., spring element **4218** between hammer element **4210** and assay reagent release mechanism frame **4230**).

**[0205]** Cam **4220** has an asymmetric design that, on rotation of the cam (e.g., in response to a motor driving control axle **4222**), smoothly raises the hammer element, but on continued rotation, quickly releases the hammer allowing it to fall rapidly (preferably, unimpeded by the cam) under the spring force such that it strikes and breaks an ampoule in the cartridge. The extent of the travel of the hammer may be restricted and defined by a mechanical stop that can be provided by the cam surface itself or by a separate mechanical stop such as a different stopping surface, e.g., a surface of assay reagent release mechanism frame **4230**, as shown in the figure. A variety of suitable cam shapes are available that can achieve this effect. One suitable cam shape has (as illustrated by cam **4220** in FIG. **42**) a roughly circular cross-section except for a rounded tab that protrudes from the circle. The leading edge of the tab (assuming the cam is turning counter-clockwise in the figure) provides for gradual lifting of the hammer element (and is, preferably, roughly aligned with a diameter of the circle). The trailing edge of the tab is tangential to the circle, so that the hammer is released and falls unimpeded by the cam. As the cam continues to turn, the control surface of the hammer element will eventually reach the leading edge of the tab and the hammer element will once again be lifted.

**[0206]** Multiple ampoules may be broken in series or in parallel by using multiple ampoule breaking mechanisms as described above. In one alternate embodiment, a single motor may be used to control multiple hammer elements by coupling the motor to multiple cams, FIG. **42** shows a second hammer element **4250** (similar to hammer element **4210**) that is controlled by a second cam **4252** on control axle **4222** (the second cam is not hidden in the figure by optional spacer ring **4224** between the cams; for illustrative purposes, the relative rotation location of the tab on second cam **4252** is shown as a dotted line; the spacer ring may be used to define the distance between the hammer elements, which may be matched to the distance between the ampoules). As shown in the figure, the two cams are in different relative rotational positions, such that they engage their respective hammer elements at different times during the rotation of control axle **4222**. The figure shows the first hammer element at its highest position. Turning the control axle slightly counter clock-wise (e.g., by operating a motor driving the control axle) will release the first hammer element and break only one ampoule. When it is time to release the reagent in a second ampoule, the motor is turned on and the control axle is driven counter-clockwise until the second cam tab engages the second hammer element, lifting it and releasing it to break a second ampoule. By placing the two cams in the same relative rotational positions, the same basic design can also be used to break two ampoules in parallel. It will be readily apparent that the same basic design can be used to break more than two ampoules serially and/or in parallel by introducing additional hammer elements and cams.

**[0207]** FIG. **36** shows one embodiment of a cartridge having a cartridge body with two reagent chambers **3610** and **3620** defined therein, for holding reagent ampoules. The reagent chambers are wells within the cartridge body with outer openings that are roughly rectangular in shape and have lengths and widths greater than the length and width, respectively, of the roughly cylindrical ampoules they are designed to hold (see, e.g., ampoule **2121** in FIG. **21**, which is a cylindrical ampoule with rounded ends). As described above, a cover layer (not shown) may be sealed to the openings to prevent leakage of assay reagents after an ampoule is opened within a reagent chamber. Side walls **3622** of reagent chamber **3620** (i.e., the walls along the length of the chambers) are sloped such that the width of the chamber at the bottom is less than the width at the top. The width at the bottom of the well is selected, based on the width of the reagent ampoules, such that the ampoules rest on the sloping walls of the chamber.

**[0208]** Optionally, the ampoules rest in an ampoule cradle adapted to receive a cylindrical ampoule. The ampoule cradle, i.e., a reagent chamber, includes side walls and a plurality of support brackets protruding from the side walls, and the support brackets are configured to provide a multi-point cradle support for a cylindrical ampoule. The reagent chamber may include three, four or more support brackets (e.g., brackets **3624**), protruding from the side walls, at least one bracket being present on each side of the chamber. The brackets are, preferably, sloped inward such that the width of the reagent chamber becomes narrower with increased depth in the well (in which case, the side walls themselves do not need to be sloped). The brackets provide a multi-point cradle support for the ampoules (e.g., a three or four point cradle design) that allows for significant tolerance in the width and length of the ampoules. The surface of the supports that contact and support the ampoule may be slanted (as shown) or flat. The width of the brackets (i.e., the dimension along the length of the chamber) may be selected to be narrow (e.g., <5 mm or less than 2 mm) to focus forces on relatively small regions of the ampoule during ampoule breaking.

**[0209]** The reagent chambers include an outlet port (or drain), e.g., outlet **3626**, for transferring reagent out of the reagent chamber. As shown, the outlet may include a filter