

the direction of their length with respect to each other backlash between the drive pinion **63** and plunger rack **66** may be 'taken up' at assembly time.

[0070] An alternative gearing scheme could be incorporated such as a worm gear driving a threaded rod. The plunger bar **65** would be driven by either threading the rod through a part of the plunger assembly or rigidly attaching the threaded rod to the plunger assembly **65** and threading the rod through the center of the worm gear. Either scheme requires mechanically constraining the plunger assembly to vertical translations. A worm gear configuration allows for a higher over all gear ratio to be achieved between the drive system **63** and the plunger assembly **64**. It also has the virtue of being un-back drivable, that is, the plunger assembly **64** would be self-locking and no torque would be required to hold the plunger assembly **64** in place.

[0071] In other embodiments of the invention, a rotary encoder **68** that is controlled externally **67** is attached to the drive gear axis **63** that drives the plunger assembly **64**. By using rotary encoder **68**, precise metering of the fluid can be achieved as it dispensed from the syringes. Additionally, a connector bar **69** may be used to position the syringe bank system **61**, as shown in **FIG. 6**.

[0072] The syringe bank component is modularized such that one may choose various methods of translating the syringe bank from the microtiter plates to the laminate. One possible configuration would be a 2-axis gantry that allows precise positioning in a plane. Additionally, in various embodiments of the invention, two syringe banks on a gantry could be utilized such that one bank could be collecting samples from a plate and dispensing while the other bank is being washed.

[0073] Reagent Addition Station(s)

[0074] In accordance with one embodiment of the invention, one or more reagent addition stations **3**, as shown in **FIG. 1**, can be placed anywhere along the moving surface **1**, but are typically placed downline of the Compound Reformatter **2**. Reagents may consist of buffers, reactant, substrates, beads, solids, slurries or gels. The reagents may be dispensed in drops by coordinating the timing of the dispensing with control of the moving surface **1** such that they are added to the same positions as other drops, thus causing reagents to mix and form a single, larger drop. Mixing occurs while each drop-holding domain remains spatially isolated from one another, each drop being a separate assay reaction. Reagent addition station(s) **3** may consist of a single microsyringe, an array of microsyringes as described above, or a piezo dispensing head that has a reservoir of reagent.

[0075] In various embodiments of the invention, a solid-phase synthesis is performed on laminate **6**. Analysis of desired properties can then be performed immediately, or laminate **6** may be rolled up and stored as a spool or cassette. Typically, to perform solid phase synthesis, a linker molecule is strongly attached to a solid support and presents a potentially reactive species to a reagent containing liquid that is contacted with the solid support. The linker may be attached directly to laminate **6**, to pores in laminate **6**, or to particles or gels attached to laminate **6**. As laminate **6** advances past various dispensing stations, reagents may be added to accomplish chemical synthesis. If each station is

capable of dispensing more than one type of reagent, a combinatorial synthesis may be accomplished. Such a combinatorial synthesis would be under control of a computer **9** that would create the pattern of chemical additions to create a useful chemical diversity. Reagents that may be added include any reagents typically used in a chemical synthesis including, but not limited to: monomers, catalysts, activators, blocking agents, de-blocking agents or polymers. Standard methods of synthesis of biopolymers such as peptide, nucleic acids and carbohydrates may be used. After synthesis, the product may be liberated from the surface of laminate **6** or other support by standard means such as the use of a chemically or photolabile linker. The properties of molecules synthesized may be determined by the output of functional assays performed directly on laminate **6**.

[0076] Additionally, many types of chemical assays require sample preparation and cleanup prior to chemical analysis. This cleanup can range from relatively simple operations such as desalting or complex procedures such as the removal of contaminants, impurities, or excess reagents. A common method for sample clean up and preparation is the use of solid-liquid extraction using an insoluble matrix with appropriate chemistry. Types of insoluble matrices may include beads or gels of an insoluble material such as sepharose, silica, cellulose, or polymeric matrices. The insoluble phases may or may not have a surface coating that may be of hydrophobic, hydrophilic, or ionic character depending on the necessary application. Additionally, the insoluble matrix may be conjugated to or incorporate a paramagnetic particle (eg: iron oxide). In accordance with one embodiment of the invention, sample clean-up and preparation prior to or as part of a chemical reaction or analysis is performed on laminate **6**. The appropriate insoluble matrix is added to the sample at one or more positions along the surface of laminate **6** in the form of a slurry or suspension. Sample impurities such as salts or other contaminants will then selectively bind to the insoluble matrix. In various embodiments of the invention, the impurities can be removed from the sample by allowing the matrix to settle onto laminate **6** while the liquid phase is interrogated with spectroscopic or spectrometric chemical analysis. Alternatively, the insoluble phase is conjugated to a paramagnetic bead that can then be selectively removed from the sample with the application of a magnetic field. In another embodiment of the invention, the sample of interest selectively binds the insoluble phase that incorporates a paramagnetic particle, while salts or impurities remain in the liquid phase. The insoluble phase with the adsorbed sample can be immobilized to laminate **6** with the application of a magnetic field. The liquid phase containing salts or contaminants can then be aspirated off of laminate **6** and the sample can be washed with an appropriate buffer or chemical. Finally, the sample can be desorbed from the immobilized matrix with the addition of yet another buffer of the appropriate type. Desorption of the sample from the insoluble matrix may include the addition of a variety of organic solvents or buffers with appropriate ionic strength, heating or cooling the sample, photochemistry, electrochemistry, or combinations of these methods.

[0077] Environmental/Delay Line/Incubation Chamber and Evaporation Control

[0078] In accordance with another embodiment of the invention, the droplet may be transported, via the moving