contact Z is open and contact Y is closed. Closure of contact Y assures the direct energization of relay R39, which closes switch 64/65 and thus entrains motor M24 of pump P1 in a clockwise direction. With contact Z open, the relay R38 is not energized so that switch 56/57 of supply circuit line C remains closed. Therefore, the pump rotor is rotated clockwise as long as switch 48 remains in this position.

The pump rotor is permitted to continue to rotate clockwise until diluent pumped thereby from reservoir 84 begins to run through nozzles 77. At this point, principal switch 48 is thrown to open contact Y and close contact Z. The pump rotor is thus stopped at an angular position determined by one of the blades 71, 72 or 73 establishing contact between contact elements 69, 70. This energizes relay R38 and interrupts the power supply to motor M24 because of the opening of switch 57/56. Therefore, the tubes 13 are completely filled with liquid diluent received from reservoir 84.

This preparatory stage of operation takes place while the selector switch SL is in an angular position wherein cam follower 46 is operated by cam 42. The selector is automatically stopped in this position when switch 54 is open. The nozzles 77 are now immersed in the liquid to be diluted which is contained in the first containers 80 carried by mobile carriage 75, the immersion of the nozzles being effected manually by lowering support 76. This position is indicated at 1 in FIG. 9, the nozzle full of diluent liquid D being plunged into the liquid L to be diluted which is contained in test tube 80.

At this point, switch 54 positioned on support 76 is operated, which may be done easily by a movement of the thumb while the operator's hand grips handle 96, which permits selector cam 42 to resume its forward rotation and to actuate cam follower 47 controlling switch 55. Opening switch 55 causes the pump rotor to rotate one step backwards so that samples E1 of a predetermined and controlled volume of the liquid to be diluted are removed from containers 80 through nozzles 77, as shown at II in FIG. 9. This operating stage is signaled by illumination of lamp 68. Rotation of cam 42 stops as soon as it reaches operative contact with cam follower 42, due to the opening of switch 50.

The carriage 75 is now displaced to the left after the nozzles have been lifted out of test tubes 80, and the nozzles are placed into the succeeding series of test tubes 81, which are empty, as can be seen at stage III in FIG. 9.

At this point, button 49, which is also located on support 76, is briefly depressed to initiate the forward rotation cycle of rotor 1 of pump P1. Lamp 67 again lights up and rotor 1, turning two 120° steps forward, first discharges the samples E1 into test tube receptacles 81 and then discharges an equal amount D1 of diluent thereinto, as shown at IV in FIG. 9. The two liquid portions are intimately mixed in test tubes 81 by the simultaneous discharge of air biased onto the surface of the fluid through nozzles 79, see stage V in FIG. 9.

Switch 54 being closed, the following sample E2 is now removed from test tubes 81 by the opening of switch 55, which stops air pump P40 and causes a reversal in the rotary movement of the pump rotor, and the selector SL is stopped when cam 42 operates cam follower 43 opening switch 50 (stage VI of FIG. 9). As previously described, the nozzles 77 are now displaced into the next series of empty test tubes 82, as shown at VII in FIG. 9, switch button 49 is again depressed momentarily and a new complete operating cycle begins with the deposit of sample E2 therein and, subsequently, and equal amount of diluent D2 (stage VIII in FIG. 9).

Thus, dilutions of the liquid to be diluted are obtained in a geometric series of the factor 2, which factor may be modified at will by operation of the adjustable timing device 87.

The above-described apparatus has the following advantages:

1. A single peristaltic pump assures not only the evacuation of a liquid sample from a test tube but also its redistribution in a mixture with an additional dose of an equal amount of diluent.

2. The two liquid portions are dosed in the same tube so that a very precise dilution in geometric proportion is easily obtained. Changes in the cross section of the tubes or in other parameters have no influence on the accuracy of the dilution rate of the liquids. The reproducibility of the results is almost absolute.

3. Since the tubes are rinsed by the dose of diluent which follows the distribution of a sample, all contamination of successive samples is avoided. Thus, the pump is ready immediately for the removal of the following sample.

4. Since the control circuit stops the rotor in exact predetermined angular positions, each tube is always compressed at the same places by the same number of pressure rollers after each operational step so that the doses distributed during each rotational step are rigorously identical.

As already explained, the pump may also be controlled by timing device 87, during its forward or backward rotation, to increase the number of operating steps so as to modify the rate of progression of the dilution or the working volume. Also, the pump may comprise more than three pressure rollers.

An apparatus of this type is particularly useful to

a. meter accurately reproducible doses of liquids, for instance to remove a predetermined quantity from a first receptacle and to distribute it in another receptacle;

b. remove samples of a constant quantity from a first liquid product, and add to these samples a diluent of a predetermined quantity; and

c. prepare dilutions in an accurate geometric progression.

What is claimed is:

1. A method of geometrically diluting a liquid in a series of successive containers in twofold increasing dilutions with a diluent liquid, comprising the combination of steps of peristaltically pumping accurately metered doses of the diluent liquid through a flexible tube from an upstream end of the tube in communication with a supply of the diluent liquid to a downstream end of the tube in successive communication with each of the successive containers, the downstream tube end holding selected number of the metered doses of the diluent liquid, immersing the downstream tube end in a first one of the successive containers containing the liquid to be diluted, peristaltically pumping an accurately metered dose of the liquid from the first container, withdrawing the downstream tube end holding the accurately metered dose of the liquid to be diluted and the selected number of the metered doses of the diluent liquid from the first container, immersing the downstream tube end in a second one of the successive containers, peristaltically pumping the metered dose of