Section **37** also triggers or enables a rinse and purge section **41**, which can be adjustably preset to cause repetition of steps **34**, **35**, **36** and **37** one or more additional times, thereby repeatedly to purge and rinse the section of tubing between the fluid supply **17** and the sensor S. Each time this rinsing and purging takes place, the time which it takes to draw fluid from the supply **17** to the sensor S is updated or averaged at **37**.

After the first tubing section has been purged the desired number of times, a signal is generated at the output of **41** to enable the calculation as at **42** of the overall time or total T_t that the pump P must be operated, in the light of the time $T_s - T_o$ as determined at **37**, in order to convey to container **18** at the exact quantity or volume of the sample of the liquid that is desired. Section **42** then generates an output signal which enables a purge repeat section **43**, which, as in the case of section **34**, initiates a purging operation to empty line **16**. When this purge has been completed, section **43** enables a begin pump forward section **44**, which then causes the pump to operate in its forward direction for time T_t. As noted above, the processor has already been preprogrammed, to compensate for the volume V_p of the fluid which it takes to fill the second tubing section, so that the time T_t will include the time that it takes to fill, both the first and second tubing sections, as well as the time required to pump the desired sample aliquot.

After the desired sample has been collected as determined by the time T_t the processor section **44** applies to section **45** a signal which causes the pump P again to be reversed in order to purge the entire tubing **16**. This purging takes place for a predetermined period of time after which the equipment generates as at **46** a cycle complete signal. This signal then generates at **47**, after a programmed time interval or amount of sample flow, a signal which can be applied to section **33** in order to commence another sampling cycle.

From the foregoing it will be apparent that the above-described apparatus has the advantage not only of isolating the liquid sample from the associated equipment—i.e. the sample contacts only the tubing **16** and the container **18**—it also enables the readjust spacing operator to select the desired number of rinse cycles effected as at **41**. Moreover, since the entire tubing **16** is purged following each sampling operation, and the first section of tubing **16** (from supply **17** to sensor S) is again purged immediately prior to the actual sample pumping step, the time required to fill the first section will be an accurate measurement because at the outset there will be no residual fluid remaining in the lower end of the tube, such as might be caused by excessive changes in the level of the fluid sampled. Additionally, this time interval is repeatedly measured when the first section of tubing is repeatedly purged prior to drawing a sample, and the average of these intervals can be used to insure the most accurate calculation of time T_t.

While this invention has been described in detail in connection with the use of a continuous piece of tubing **16**, it will be apparent that this has been done merely for ease of description, and that as a matter of fact the tubing could be in the form of several pieces coupled together. In this connection it will be apparent that the length and hence volume of the tubing **16** from the sensor S to the collector **18** usually remains fixed and may be preprogrammed while the section of tubing from the supply **17** to the sensor S may often differ in length depending upon the location of the input data at **25**. Moreover, this particular section of the tubing is critical, because any change in its length and hence overall volume, will impact on the value of the rate at which the fluid is being pumped. Therefore, it is possible to construct this section of the conduit from pieces of tubing or the like having different internal the supply **17**, and therefore may often require a change in diameters provided the overall internal volume of this section of the conduit (from supply **17** to sensor S) is made part of the program, as for example at **21**.

Furthermore, instead of purging the first section of the tubing prior to each pumping step in response to the output signal of sensor S, it would be possible to eliminate or skip sections **43** and **44**, and to program the microprocessor to cause the pump to continue operating in its forward direction immediately following the determination of $T_s - T_o$. In such case the time calculated at **42** would constitute the remaining time the pump would have to be operated in order to pump an additional volume of liquid equal to V_p plus the desired sample. In that case section **42** would enable section **45** directly.

While this invention has been illustrated and described in detail in connection with only certain embodiments hereof, it will be apparent that it is capable of still further modification, and that this application is intended to cover any such modifications as may fall within the scope of one skilled in the art, or the appended claims.

We claim:

1. A method of improving the quantitative accuracy of liquid sampling apparatus, comprising

connecting the inlet of a reversible, positive displacement pump to a supply of liquid by a first conduit having a known internal volume from its inlet end to a point axially spaced a predetermined distance along said first conduit from said inlet end thereof,

connecting the outlet of the pump by a second conduit to a collector disposed to receive as a sample a predetermined volume of said liquid,

determining a first volume (V_p) of liquid required to fill the pump and those portions of the conduits between said collector and said point in said first conduit,

operating said pump in a reverse direction to purge said pump and conduits of liquid,

operating said pump in a forward direction to commence pumping liquid from the supply thereof to said collector,

detecting a first interval of time ($T_s - T_o$) required for the liquid from said supply to appear at said point in said first conduit,

based on said first time interval, calculating the rate of flow of said liquid to said point, and the total pumping time (T_t) required to convey said predetermined volume of liquid from said supply to said collector, and

operating said pump in a forward direction for said total time (T_t).

2. The method as recited in claim **1**, including momentarily operating said pump in a reverse direction to purge said first conduit of liquid after detection of said first interval of time, and before operating said pump in its forward direction for said total time (T_t).

3. The method as recited in claim **1**, including continuing to operate said pump in its forward direction after detection of said first interval of time, and for an overall time equal to said total time (T_t).