

rendering transport of the equipment to a remote site more convenient.

The invention also provides means for storing both sample collection and flow data for retrieval in hard copy form, which has heretofore been impossible with known devices.

The integrated apparatus of the invention includes computer control means for automatically computing flow rate, controlling sampling operations on the basis of the flow rate and/or time, and monitoring and storing flow and sample collection data. Access to flow and sample collection data can be had via an alphanumeric display mounted integrally to the unit itself. Unlike any other known system, the invention also provides a portable pocket-sized data transfer unit for retrieving data stored in the unit's computer control means for transfer to a remote output device such as a conventional printer and/or computer. As such, the invention provides convenient means for obtaining a hard copy of the data; storing the data in a remote computer data base; or manipulating the data for statistical analyses, spreadsheeting or the like by a conventional computer provided with a suitable software program.

### SUMMARY OF THE INVENTION

The present invention provides an apparatus for automatically measuring fluid flow through a channel and collecting samples from the channel on the basis of time or flow rate. The apparatus includes a fluid sampling assembly, a flow measuring assembly and a computer control means integrally incorporated within a unitary case. The sampling assembly has an inlet selectively connected to a sample intake conduit which is adapted to extend to the fluid in the channel. The flow measuring assembly has a sensing means selectively connected thereto for detecting a variable related to the fluid flow rate in the channel and outputting a signal proportional thereto. The flow measuring assembly includes means for processing signals from the sensing means for input to the computer control means. The computer control means is programmed to calculate the flow rate in the channel on the basis of processed signals from the flow measuring assembly, automatically control sampling operation of the sampling assembly in proportion to time or the calculated flow rate, and automatically collect and store data relating to operation of the apparatus.

The apparatus according to the invention may selectively be used only for collecting samples, only for monitoring flow rate, or for simultaneously collecting samples and monitoring flow rate, as desired.

In one preferred embodiment, a flow restricting device is disposed in an open flowing channel and the sensing means of the flow measuring assembly is operably disposed relative thereto. The sample intake conduit of the sampling assembly is disposed on the discharge side of the flow restricting device. The data stored by the computer control means includes data relating to operation of the sampling assembly and flow rate data. The data may be viewed by the user on display means provided on the case, or may be transferred via a portable external data transfer unit to a remote output device such as a computer and/or printer.

The invention also provides a method for automatically measuring fluid flow through a channel and collecting samples from the channel on the basis of time or flow rate. The method comprises the steps of: connecting a sensing means to a flow measuring assembly for

detecting a variable related to the fluid flow rate in the channel; connecting a sample intake conduit to an inlet of a sampling assembly; mounting the sensing means in a detecting position relative to the channel; lowering an intake end of the conduit into the fluid in the channel; and suspending an integral operating unit, including the fluid sampling assembly, the fluid flow measuring assembly and a computer control means, in a sewer manhole. The method further comprises the step of operating the computer control means to calculate the flow rate in the channel on the basis of signals received from the flow measuring assembly, automatically control sampling operation of the sampling assembly in proportion to time or the calculated flow rate, and automatically collect and store flow rate data and data relating to operation of the sampling assembly.

It is an object of the present invention to provide an integral and compact unitary structure embodying both a fluid sampling assembly and a fluid flow measuring assembly together with computer control means for automatically operating same. The case in which the components are housed is conveniently mountable in a sewer manhole, and the fluid intake conduit and sensor leading from the same case can be conveniently positioned relative to a channel.

A further object of the invention resides in the storage of flow rate data at user-selected intervals, and the storage of data relating to operation of the sampling assembly, such as times and dates of collected and/or missed samples and parameters of the sampling program such as the volume of the collected sample, the interval between samples, and time or flow units remaining until the next sample.

A related object of the invention is to permit display of stored flow rate and/or sampling data on a display mounted on the case of the apparatus, or transfer of the stored data to a remote output device. Transfer of stored data is accomplished by means of a portable pocket-sized data transfer unit which is connected via an external connector on the case of the apparatus with the computer control means of the apparatus to retrieve stored data as desired. The data transfer unit can be conveniently transported and connected to any desired remote output device, such as a computer and/or printer, to permit transfer of the stored data to such output device. Transfer of stored data may also be accomplished by direct connection of the apparatus of the invention to a computer or terminal.

The above and further objects, details and advantages of the invention will become apparent from the following detailed description, when read in conjunction with the accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a sampling and flow rate measuring apparatus according to a first embodiment of the invention, having a fluid intake conduit and a sensing means connected thereto and mounted in operative position relative to a channel.

FIG. 2 is a disassembled view of the apparatus according to the first embodiment of the invention, showing the interrelationship of various components thereof.

FIG. 3 is a block diagram of the various components of the first embodiment of the invention as controlled by the computer control means.

FIGS. 4, 4A and 4B together define a flow chart showing operational sequences of the apparatus according to various user commands.