means cooperates with sensor **30** such that short pulses from a high-energy, high-frequency source are amplified and directed toward the fluid surface by sensor **30**, and weak echo signals are reflected back and amplified. Timing circuitry in the interface means clocks the amount of time for the echo signals to return. This value is then input to the computer control means for calculating the flow rate therefrom.

It will be understood that the only differences between the first and second embodiment reside in the type of depth sensor used and the interface electronics therefor. In this respect, a skilled technician could convert the fluid measuring assembly of the apparatus from one type to the other by replacing the circuit board containing the sensor interface electronics and thereby adapting the apparatus for use with the other type of sensor.

It will also be understood that the invention is not limited to the two types of sensors described, and other suitable known flow rate sensing means may alternatively be employed, including both means for measuring head in an open channel arrangement with a flow restricting device and any other means for measuring flow without employing a flow restricting device.

In FIG. **8**, the sensing means comprises an ultrasonic sensor **40** using an echo range measurement through liquid technique to measure the distance from the bottom of the channel to the fluid surface. The fluid depth is thus measured by timing the sound reflections from the surface of the fluid in the channel. Suitable interface means are provided for sensor **40**, similar to those described with reference to sensor **30**.

A float type sensor **50** such as shown in FIG. **9** may also be used for the sensing means of the invention. The fluid depth in the channel is indicated by the position of the float **50**, with a counterweight **51** being provided to improve accuracy by offsetting part of the weight of float **50**. Suitable interface electronics for the float type sensor **50** are connected with the microprocessor of the apparatus.

FIG. **10** depicts a dipper type sensor **60** which may alternatively be employed as the sensing means of the invention. The sensor **60**, operating on a conductivity principle for example, is repeatedly raised and lowered to locate the surface of the fluid in the channel, from which the depth of fluid in the channel can be calculated. Suitable interface electronics for the dipper type sensor **60** are connected with the microprocessor of the apparatus.

Another alternative type of sensing means is shown in FIG. **11** in the form of a bubbler type sensor **70**. The sensor **70** comprises a tube having the outlet end thereof disposed below the fluid surface. An indication of the fluid depth in the channel is obtained by measuring the pressure inside the tube required to maintain a steady stream of air to the outlet thereof. As in the preceding embodiment, suitable interface electronics for sensor **70** are connected with the microprocessor of the apparatus.

FIG. **12** depicts yet another type of sensing means in the form of a sensor **80** having a predetermined electrical property, such as the capacitance or resistance thereof, which varies according to the sensor area in contact with the fluid in the channel or the length of tape flattened by fluid pressure in the channel. The fluid depth in the channel may be determined by the variation in capacitance or resistance. Hereagain, suitable interface electronics for sensor **80** are connected with the microprocessor.

The invention contemplates that a variety of other sensors may alternatively be employed as the sensing means of the invention, with the interface electronics being modified as needed.

In use, the apparatus according to any of the embodiments of the invention can be conveniently transported to remote sites for mounting in sewer manholes, or to other remote sites for use in other types of applications. When used in a sewer manhole, the apparatus can be conveniently mounted as a single unitary structure above an open flowing sewer passage. The apparatus is mounted for use by: connecting the sensor with one of the connectors **16** and the fluid intake conduit **9** with the pump **8**; appropriately mounting the sensor relative to the fluid in the channel; positioning the weighted strainer **12** at the end of conduit **9** within the fluid in the channel; and suspending the unit from the upper end of the manhole (FIG. **5**).

The integral unit includes all the electronics, computer programming, and hardware required for fully automatic sampling and flow rate measurement, as well as storage of sampling and flow rate for later retrieval. The unit can be user-programmed to operate according to desired modes of operation, e.g., to collect samples at desired time intervals, after the passage of specified volumes of fluid, or on the basis of some combination of both criteria. The stored data will reflect the time and date of each sample, the flow rate at user-selected intervals, as well as the various other parameters described above. The user can call the data up for display on the alphanumeric display integrally provided on the unit, and/or can transfer the data to a remote output device via the portable data transfer unit. Transfer of the data via the data transfer unit permits recording of the data in a hard copy form via a printer, permanent storage of the data in a database, and/or manipulation of the data for statistical analyses, etc., via a conventional software program.

It will be still further understood that the integral fluid sampling and flow measuring apparatus of the invention may be selectively employed for use for sampling and flow rate measurement both, for sampling only, or for flow rate measurement only, as desired. The independent operation of either the sampling assembly or the flow measuring assembly can be effected via user input to the computer control means according to the invention.

While there have been described hereinabove what are at present considered to be the preferred embodiments of the invention, it will be understood that various modifications may be made therein without departing from the spirit and scope of the invention. The present embodiments are therefore to be considered in all respects as illustrative, and not restrictive. The scope of the invention is indicated by the appended claims rather than by the foregoing description.

We claim:

1. An apparatus for automatically collecting samples from a fluid channel and for measuring a fluid flow-related variable, according to modes of operation selected by a user, said modes of operation including sampling on the basis of time and/or said fluid flow-related variable, comprising:

means for controlling said apparatus;

a fluid sampling assembly having an inlet for receiving fluid from said channel;