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Lederer

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[54] **SAMPLE COLLECTOR**

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[52] **U.S. Cl.** **141/284,** 23/259

[51] **Int. Cl.** **B67c 3/34**

[58] **Field of Search** ..... 23/253, 259; 73/421 B; 141/13, 130, 235, 236, 248, 250, 278, 284, 286, 340, 387, 388; 222/70, 144.5, 168, 168.5, 330

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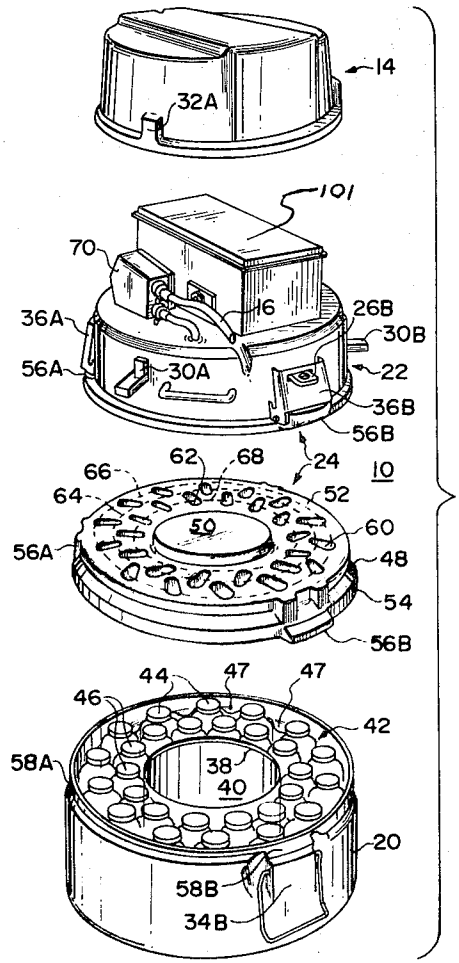
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Primary Examiner—Houston S. Bell, Jr.
Assistant Examiner—Frederick R. Schmidt
Attorney, Agent, or Firm—Vincent L. Carney

[57] **ABSTRACT**

To separate each of a plurality of samples of a fluid from a body of the fluid and deposit each sample into a different one of a plurality of bottles, the downwardly extending outlet of a funnel, being offset from a vertical axis of rotation of the funnel, orbits step-by-step in a circle around the vertical axis above a distributing plate as the funnel rotates to guide fluid into each of a plurality of separated inlets in the distributing plate as the fluid is pumped from the body of the fluid through intake and funnel hoses and into the large, circular upwardly extending inlet of the funnel, with the outlet of the funnel hose being positioned at a fixed location lying along an imaginary circle the downward projection of which lies within the inlet of the funnel. To guide the samples from the funnel outlet into separate bottles, the distributing plate includes a circle of inlets beneath the orbit of the funnel outlet to receive the samples and two concentric circles of outlets, with each outlet: (1) communicating with a different inlet through a passageway, which passageway extends in a different direction from the inlet than the two adjacent passageways, so that the the inlets are all in one central circle between the two circles of outlets; and (2) being positioned over the open end of a different bottle, with the bottles forming two circles of circumferentially spaced bottles.

25 Claims, 5 Drawing Figures



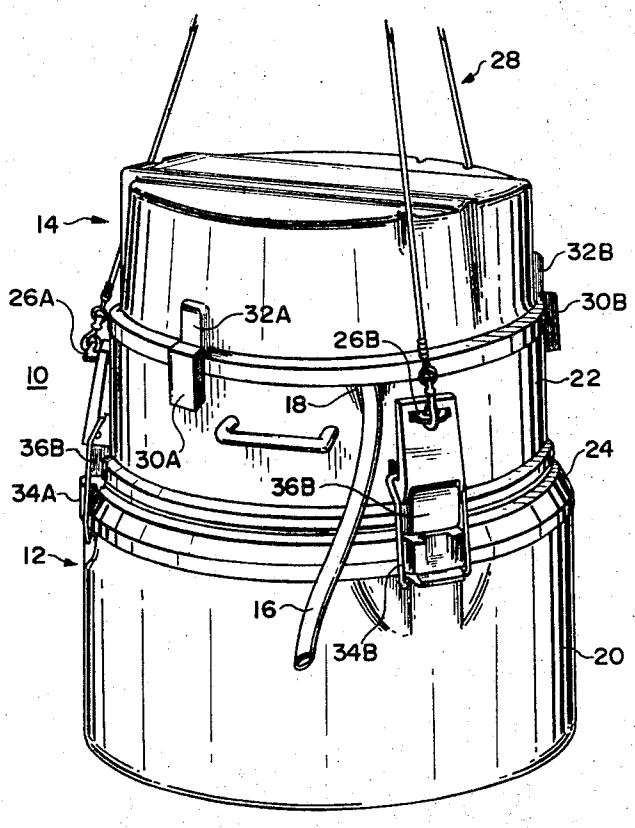

28
14
32B
26A
32A
30B
26B
10
22
18
36B
30A
24
34A
36B
12
16
34B
20

FIG. 1

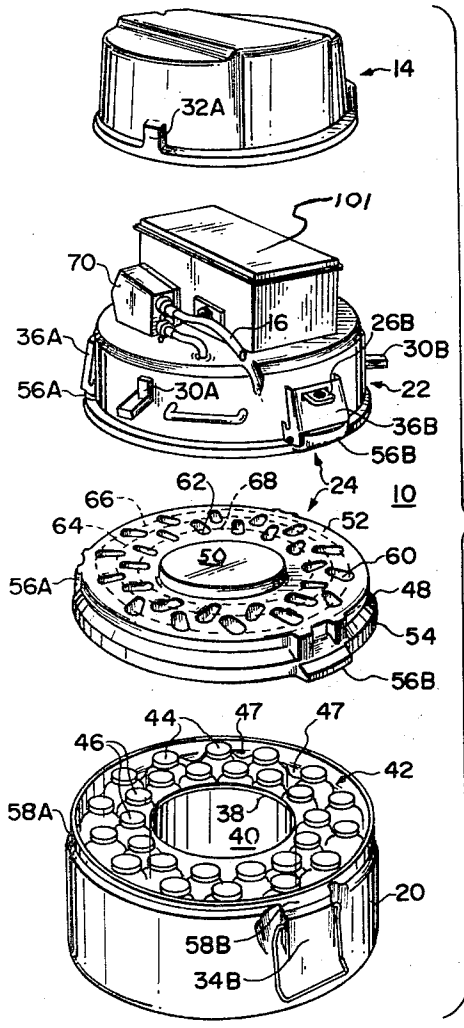

14
32A
101
70
16
26B
36A
30B
56A
30A
22
36B
56B
62
68
24
10
66
64
52
50
60
56A
48
54
56B
44
47
47
46
42
58A
38
40
20
58B
34B

FIG. 2

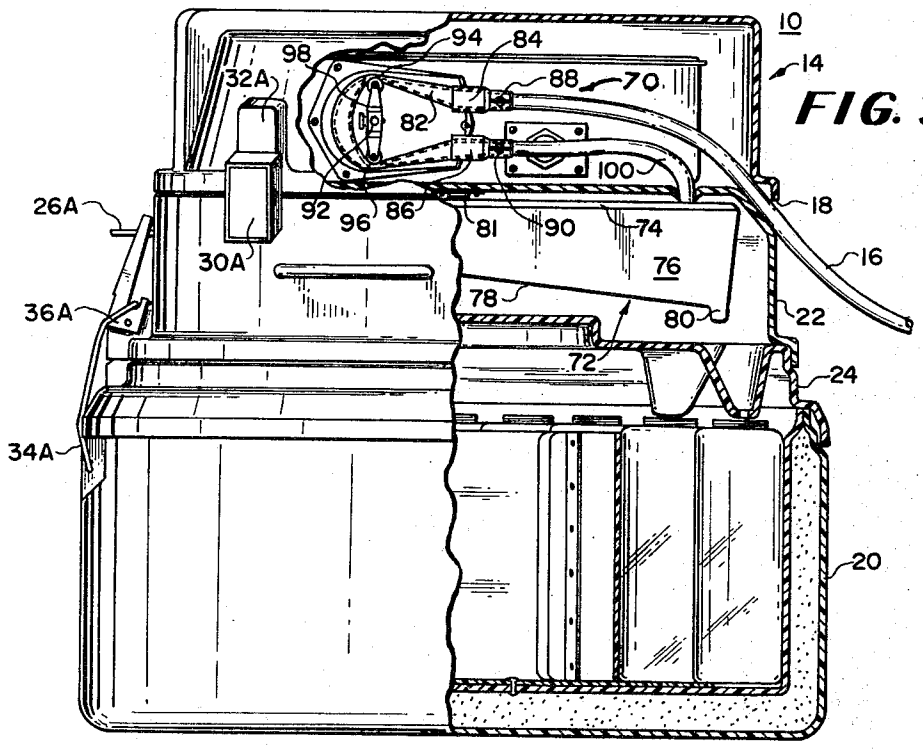


FIG. 3

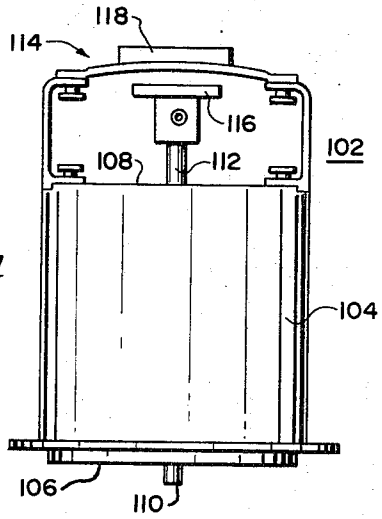
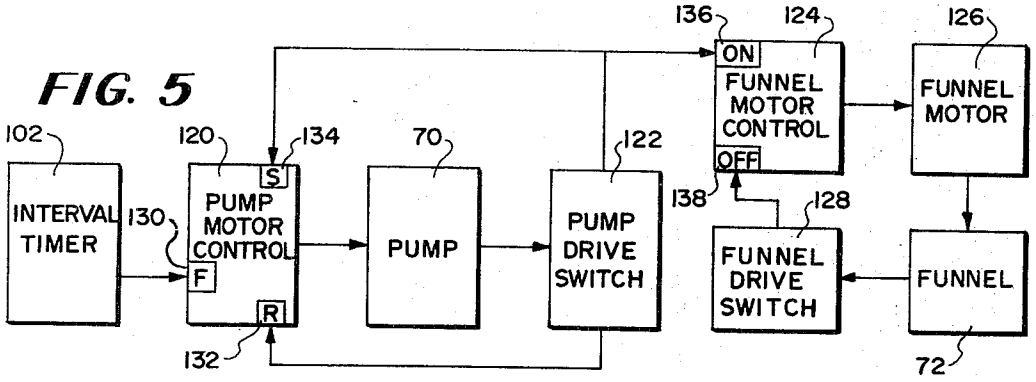


FIG. 4

FIG. 5



SAMPLE COLLECTOR

This invention relates to sample collectors and more particularly to apparatuses for removing fluid from a body of fluid and depositing portions of the fluid in different containers.

In one class of sample collectors, each of several different samples of fluid is pumped in succession through an intake hose and a funnel hose and deposited in a different container through a different passageway, with the pump reversing between samples to clear the sections of the hose of fluid, thereby avoiding cross-contamination.

In one type of prior art sample collector of this class, the outlet of the funnel section of hose is mechanically moved over the inlets to the passageways to deposit a different sample of the fluid into each bottle through the passageway communicating with that bottle. The inlets to the passageways are circumferentially spaced openings in an annular support and the passageways are hoses, each of which communicates at one end with a different one of the circumferentially spaced openings and at the other end with the interior of a different one of the bottles.

The prior art sample collectors of this type have several disadvantages, such as: (1) the hoses frequently become clogged with solid material from the body of fluid because the intake and funnel hoses are excessively long and, under some circumstances, include bent portions in the funnel hose which are formed as the funnel hose is positioned over certain of the inlets to the passageways; (2) it is difficult to clear the hose of fluid from one sample before drawing another sample because of its length and curved sections; (3) the passageways become clogged because they are long, curved and there is no pump pressure to clear the passageways; and (4) the funnel hose becomes worn after a relatively short period of use because of the frequent flexing of the hose in positioning it over the inlets to the passageways.

Accordingly, it is an object of the invention to provide a novel sample collector.

It is a further object of the invention to provide a fluid guiding system for a sample collector, which fluid guiding system is resistant to clogging.

It is a still further object of the invention to provide a sample collector in which the funnel hose is relatively short and relatively straight.

It is a still further object of the invention to provide a sample collector in which it is relatively easy to clear the sections of hose after a sample has been taken.

It is a still further object of the invention to provide a sample collector in which the path through which fluids are guided may be changed from leading to one container to leading to a different container without flexing any hose or moving any container.

It is a still further object of the invention to provide a fluid guiding section for a sample collector that is reliable and inexpensive.

In accordance with the above and further objects of the invention, a sample collector includes an intake hose, a pump, a rotatable funnel, a distributing plate and a compartment for a plurality of bottles.

To distribute the fluid from the distributing section of hose into different ones of the plurality of bottles, the funnel has a large, upwardly opening circular inlet and a small downwardly extending outlet that is offset from the vertical axis of rotation of the funnel so that it orbits about the vertical axis of rotation. The outlet of the funnel hose is always positioned above the rotating circular inlet of the funnel so that the pump forces samples of the fluid from the body of the fluid through the intake and funnel hoses and into the inlet of the funnel, with the outlet of the funnel orbiting about the vertical axis in step-by-step fashion to guide the fluid through the distributing plate into each of the plurality of different bottles below the distributing plate.

To enable samples to be deposited into two circles of bottles, the distributing plate includes: (1) a plurality of inlets positioned in a circle beneath the path of the orbiting outlet of the funnel to receive the fluid from the funnel; (2) a plurality of passageways, each having one end communicating with and a portion extending downwardly and in a generally radial direction from a different one of the plurality of inlets, with alternate passageways extending in different radial directions toward or from the vertical axis of the funnel; and (3) a plurality of outlets, each communicating with the other end of a different one of the plurality of passageways to form two circles of outlets concentric with each other and with the circle of inlets and located on both radial sides of the circle of inlets. The bottles have their open ends positioned under the outlets.

The sample collector of this invention has several advantages, such as: (1) it is resistant to clogging because the sections of hose are short, stationary and coupled directly to the pump so the pressure of the pump forces foreign material from the hose; (2) it is easier to clear of fluid after a sample is taken because the sections of hose are short; (3) it is simple and inexpensive because a molded plastic distributor plate enables multiple concentric circles of bottles to be filled without having to move the outlet of a hose in radial and circular directions; and (4) it is durable because the sections of hoses are not bent or flexed.

The above-noted and further features of the invention will be better understood from the following detailed description when considered with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of a sample collector including an embodiment of the invention;

FIG. 2 is an exploded perspective view of the sample collector shown in FIG. 1;

FIG. 3 is an elevational view, partly broken away and sectioned, of the sample collector shown in FIG. 1;

FIG. 4 is a simplified elevational view of an interval timer that is a portion of the sample collector of FIG. 1; and

FIG. 5 is a block diagram of a control section that is a part of the sample collector of FIG. 1.

GENERAL STRUCTURE AND OPERATION

In FIG. 1 there is shown, in a perspective view, a liquid sample collector **10**, having a generally cylindrical base **12**, a generally cylindrical cover **14** fitted to the base **12** and a tubular intake hose **16** extending through and depending downwardly from an opening **18** in the upper portion of the base **12**. The base **12** includes a sample bottle tub **20**, a control section **22** conformably fitting over the sample bottle tub **20** and receiving the cover **14**, and a liquid routing section **24**, conformably fitting between the sample bottle tub **20** and the control section **22**, with the control section **22** having three cable-harness attaching eyelets **26** mounted thereon two

of which are shown at **26A** and **26B** adapted to receive the hooks of a removable cable harness **28** by which the sample collector **10** may be lowered through a manhole.

The base **12** and cover **14** are of tough, chemical resistant plastic with external parts that fit tightly together and are latchable in place so that the entire sample collector **10** is able to withstand corrosive environments and even accidental submersion in a liquid for short periods of time.

To latch the cover **14** to the control section **22,** three upper plastic latches **30,** two of which are shown at **30A** and **30B** are flexibly mounted at one end to the control section **22** at three circumferentially spaced locations and each adapted to engage with a corresponding one of three upper latch abutments **32,** two of which are shown a circumferentially spaced locations **32A** and **32B** on the cover **14.**

To latch the bottle tub **20,** the liquid routing section **24** and the control section **22** together, three lower stainless steel latches **34,** two of which are shown at **34A** and **34B,** are provided at circumferentially spaced locations on the bottle tub **20** and adapted to engage with corresponding ones of the three latching plates **36,** two of which are shown at **36A** and **36B,** at circumferentially spaced locations on the control section **22.**

The sample collector **10** is used to collect a plurality of samples of a liquid into a group of different containers across a period of time from any body of liquid such as from a river, sewerage system, process vat or the like. Before operation, the containers are loaded into the bottle tub **20,** the bottle tub **20,** the liquid routing section **24,** and the control section **22** are latched together and the cover **14** and control section **22** are latched together.

To operate the sample collector **10,** the tubular intake hose **16** is inserted into the body of liquid that is to be sampled and the sample collector is started by pressing the start button. In operation, liquid is drawn through the tubular intake hose **16** at timed intervals and routed to one of th different containers within the bottle tub **20** by the liquid routing section **24** in a manner to be described hereinafter.

FLOW SYSTEM STRUCTURE

In FIG. **2,** there is shown, in an exploded perspective view, the interior of the bottle tub **20** having a hollow cylindrical separating wall **38** defining in its interior a cylindrical ice section **40** coaxial with the bottle tub **20** and defining a cylindrical bottle section **42** between its outer side and the wall of the bottle tub **20.** Within the bottle section **42** are an outer circle of a first plurality of circumferentially located, open bottles **44** and an inner circle of a second plurality of circumferentially located, open bottles **46,** with the bottles of the outer plurality being held in position by a plurality of circumferentially spaced bottle positioning members **47** attached to the inner wall of the bottle tub **20.**

Above the bottle tub **20** is the fluid distributing section **24,** one part of which is a generally disc-shaped perforated plastic distributing plate **48** shown in FIG. **2,** the remainder of the fluid distributing section **24** being within the control section **22** where it is not visible in the view shown in FIG. **2.** The distributing plate **48** includes a solid, flat cylindrical raised central section **50** that covers the ice compartment **40** of the bottle tub **20,** a perforated circular section **52** that overlies the bottle compartment **42** of the bottle tub **20** and a rim **54** that overlies the outer rim of the bottle tub **20,** forming a seal therewith.

To position the distributing plate **48** with respect to the bottle tub **20,** the bottom rim of the distributing plate **48** includes three circumferentially spaced top aligning sections **56,** two of which are shown in FIG. **2** at **56A** and **56B,** and along the top rim of the wall of the bottle tub **20** are three corresponding bottom aligning sections **58,** two of which are shown in FIG. **2** at **58A** and **58B,** with the bottom aligning sections **58** being formed integrally with the base for the three bottom latches **34.** The top and bottom aligning sections **56** and **58** have interfitting portions that cause the distributing plate **48** to assume a fixed relationship with the bottle tub **20** so that each location on the distributing plate **48** is always above a certain location of the bottle tub **20** when the distributing plate **48** is in place over the bottle tub **20.**

To distribute the sampled liquid into the outer and inner plurality of bottles **44** and **46,** the perforated circular section **52** of the distributing plate **48** includes an outer circle of a first plurality of distributing recesses or passageways **60** and an inner circle of a second plurality of distributing recesses **62,** with each distributing recess including an inlet recess joined to an outlet recess by a passageway, the inlet recesses of all of the distributing recesses lying in a central circle **64** between an outer circle **66** of the outlet recesses of the first plurality of distributing recesses **60** and an inner circle **68** of the outlet recesses of the second plurality of distributing recesses **62.** Each of the outlet recesses is perforated to permit a liquid to flow through the distributing plate **48** into a different one of the bottles in the bottle container **42** of the bottle tub **20,** with the perforations lying in the outer circle **66** of the outlet recesses being aligned with the openings of the outer plurality of bottles **44** and with the perforations lying in the inner circle **68** of the outlet recesses being aligned with the openings of the inner plurality of bottles **46.**

The bottles in the outer and inner plurality of bottles **44** and **46** are of such a size with respect to the bottle container **42** that they fit snugly together in the two rows, with their openings being radially offset so that a line extending around the bottle container **42** from one bottle opening to the other zigzags between the bottles in the outer plurality **44** of bottles and the bottles in the inner plurality of bottles **46.** Each of the bottles in the outer plurality of bottles **44** is held in place between two positioning members **47** and each of the bottles in the inner plurality of bottles **46** is held between two bottles of the outer plurality of bottles **44** in the bottle container **42** so that the openings of the bottles are always under the perforations in the outlet recesses of the first and second plurality of the distributor recesses **60** and **62.**

To distribute the liquid into the inlet recesses of the first and second distributing recesses **60** and **62,** the control section **22** includes a peristaltic pump **70** that draws liquid through the intake hose **16** (FIG. **1**) and pumps it into a rotating funnel (not shown in FIG. **2**) which is part of the liquid distributing section **24** that is within the control section **22.** The rotating funnel includes a rotating downspout that deposits the liquid into the inlet recesses of the first and second plurality of distributor recesses, being arranged to rotate above the center circle **64** for this purpose.

The control section **22** also includes the controls and the motor for rotating the funnel and for starting and stopping the peristaltic pump **70.** These controls are settable for different periods of operation and different modes of operation as will be explained more fully hereinafter.

In FIG. **3,** there is shown an elevational view, partly broken away and sectioned to reveal a portion of the control section **22** and the liquid distributing section **24** and the manner in which they are arranged to control the flow of fluid from the intake hose **16** to the bottles in the bottle tub **20.**

As best shown in FIG. **3,** the liquid distributing section **24** includes a rotatable funnel **72** having a horizontal circular rim **74** forming the top edge of a vertical, frustroconical wall **76** defining a funnel inlet, which wall is integrally formed with a sloping funnel bottom portion **78** having a downspout **80** at its lowest point defining a funnel outlet. The funnel **72** is rotatably mounted within the control section **22** and attached by a key to drive shaft **81** which is driven by a funnel motor (not shown) within the control section **22.**

While a specific peristaltic pump **70** is shown in FIG. **3,** the type of pump is not critical to the invention, there being many suitable types of pumps available. The pump **70** includes a section of plastic tube **82,** first pump tube guide **84,** a second pump tube guide **86,** a first hose clamp **88,** a second hose clamp **90,** a central shaft **92,** a first roller **94,** a second roller **96,** and a pump arm **98.**

The central pump tube **82** is curved about the pump shaft **92** so as to be contacted and pressed by the two rollers **94** and **96** on the opposite ends of the shaft **98** as the shaft **92** is rotated by a pump motor (not shown) in either of two directions, a counterclockwise direction of rotation (as seen in FIG. **3**) pumping liquid from the intake tube **16** into the funnel **72** and a clockwise direction of rotation pumping liquid in the opposite direction.

To hold the pump tube **82** in place, one end of the pump tube **82** is held by the first pump tube guide **84** and the other end by the second pump tube guide **86.** The intake hose **16** is connected to the one end of the pump tube **82** by the first pump tube clamp **88.** A funnel hose **100** is held at one end by the second pump tube clamp **90** and has its other end within the recess of the funnel **72** so as to guide liquid from the pump **70** into the rotatable funnel **72,** with the downward projection of the funnel hose **100** falling on a circle within the funnel inlet.

FLOW SYSTEM OPERATION

Before samples are taken, the outer plurality and the inner plurality of bottles **44** and **46** are loaded into the bottle compartment **42** of the bottle tub **20,** with the outer plurality of bottles **44** being circumferentially positioned by the bottle positioning members **47** and with the inner plurality of bottles **46** being circumferentially positioned by the outer plurality of bottles **44.** Ice may be loaded into the ice compartment to cool the liquid in the bottles when this is desired.

The fluid distributing plate **48** is positioned over the bottle tub **20** with the interfitting parts of the top and bottom aligning sections **56** and **58** together so as to align the outlets of the distributing recesses **60** and **62** of the distributing plate **48** with the openings in the bottles **44** and **46** within the bottle tub **20.** Next, the control section **22** is placed over the distributing plate **48,** with the funnel **72** and other parts of the liquid distributing section **24** that are within the control section **22** being positioned over the fluid distributing plate.

With the bottle tub **20,** the fluid distributing section **24** and the control section **22** positioned together, the stainless steel latches **34** are engaged with the stainless steel latching plates **36** to hold the bottle tub **20,** the distributing section **24** and the control section **22** together. To protect the control section, the cover is placed over the control section and latched with the latches **30** and **32.** The intake hose **16** extends through the opening **18** to receive the liquid.

In operation, the control section **22** starts the peristaltic pump at fixed time intervals, causing it to run in one direction for a fixed period of time or until a fixed volume of liquid has been drawn, reversing it until the intake hose **16** has been cleared of liquid and them stopping the pump motor. Between periods of pumping action, the control section moves the funnel **72** into position to channel the fluid into a selected bottle.

To deposit the fluid into a selected bottle, the peristaltic pump **70** rotates counterclockwise, drawing the fluid into the intake hose **16** and forcing it through the funnel hose **100** into the recess of the funnel **72.** Since the funnel **72** has a circular rim that extends beyond the funnel hose **100** and reaches almost to the wall of the control section **22,** it may rotate without disturbing the funnel hose **100** and receive the fluid from the funnel hose while in any position of rotation.

As the funnel **72** rotates, the downspout **80** is aligned with the center circle **64.** It is stopped by the control section **22** over each one of the inlet recesses of the distributing recesses **60** and **62** in which position the fluid pumped into the funnel flows from the downspout **80** into the inlet recess and then to the outlet recess. If the distributing recess into which the fluid flows is one of the first plurality of distributing recesses **60,** the fluid flows to the outer side of the distributing plate **48** and into one of the outer plurality of bottles **44** aligned with the outlet recess; if the distributing recess into which the fluid flows is one of the second plurality of distributing recesses **62,** the fluid flows down and toward the center of the distributing plate **48** and into one of the inner plurality of bottles **46** aligned with the outlet recess.

STRUCTURE OF THE CONTROL SECTION

The control section **22** in the preferred embodiment is relatively complicated. However, since the function of the control section is merely to coordinate the timing of the different operations and the timing of the sampling it could have been extremely simple. For example, the peristaltic pump could be started by hand and stopped by hand when a sample is taken. Moreover, the funnel could be moved from position to position by hand so that no automatic equipment is required and substantially no control section is necessary.

In the preferred embodiment described herein, circuitry for operating the sample collector **10** in one mode is described—an automatic mode for taking a series of samples of certain volume, each at predetermined time intervals. However, it can be readily understood that the circuitry for such an automatic mode is to be combined with the equipment for operation in simpler modes such as by hand or in semi-automatic modes wherein the volume of the fluid deposited in a

single bottle is controlled in the manner described herein but the stepping of the funnel **72** from position to position is accomplished by hand or by depressing a start button for a funnel motor that is stopped by a cam operated switch at the next position or by any other of the many known techniques for controlling such step-by-step operations. Similarly, while the preferred embodiment described herein includes an interval timer to determine the time of each sample, an automatic programmer may be included that controls the timing of the samples by other means such as by sensing the flow of a stream of the fluid and actuating the sample collector to take a sample at certain flow volume intervals.

Generally, the structure of the control section **22** is conventional, with the circuitry therefor being located in the tightly sealed enclosure **101** shown in FIG. **2.** One unique feature is an interval timer **102** shown in FIG. **4** which generates pulses that provide an initiating signal every half hour for obtaining a sample when the control section is set for automatic operation.

As best shown in FIG. **4,** the interval timer **102** includes a standard D.C. clock **104** having a front face **106,** a rear panel **108,** a timer set knob **110** and a center shaft **112.** The front face **106** has appropriate timing markers on a dial (not shown) with the timer set knob **110** extending transversely therefrom by which the center shaft **112** and the hands of the clock are adjusted in position. The center shaft **112** extends in a direction perpendicular to the face **106** and the rear panel **108,** extending therethrough. Suitable d.c. clocks are obtainable from Kienzle Co. and are identified as Model No. 86/7504. A d.c. operated clock is preferable to an a.c. operated clock because the entire sample collector should preferably be operable from a storage battery power supply in order to provide the advantage of portability.

To provide signals every half hour, a switching mechanism **114** is attached to the d.c. clock **104,** which switching mechanism includes an elongated permanent magnet **116** and a reed switch **118.** The elongated permanent magnet **116** and the reed switch **118** are both mounted in positions parallel to the rear panel **108** and to each other, with the reed switch being fastened to the d.c. clock in a fixed position and with the elongated permanent magnet **116** being fastened to the center shaft for rotation therewith, whereby the elongated permanent magnet **116** is brought into a position alinged with and adjacent to the reed switch **118** to close the reed switch twice during each complete revolution of the center shaft. The closing of the reed switch closes a circuit including a source of electrical potential to actuate a sampling cycle of the fluid sampler **10.**

In FIG. **5,** there is shown a block diagram of the control section **22** having the interval timer **102,** a pump motor control **120,** the pump **70,** a pump drive switch **122,** a funnel motor control **124,** a funnel motor **126,** and a funnel drive switch **128.**

To start, stop, and control the direction of rotation of the peristaltic pump motor, the pump motor control **120** includes a switching arrangement having: (1) a first position into which it is switched by a signal from the interval timer **102** to the forward drive terminal **130** of the pump motor control **120** and in which position it applies power to the pump motor in a direction that causes the pump **70** to draw fluid into the intake hose **16** (FIGS. **1** and **3**); (2) a second position into which it is switched by a signal from the pump drive switch **122** to the reverse drive terminal **132** and in which position it stops the pump motor and applies power to the pump motor in a direction that causes the pump **70** to force fluid out of the inlet of the intake hose **16** to clear the hose of fluid before another sample is taken; and (3) a third position into which it is switched by a signal from the pump drive switch **122** to the stop terminal **134** and in which position it stops the pump motor. This signal is also applied to the on terminal **136** of the funnel motor control **24** for a purpose to be described hereinafter.

To generate the signals that are applied to the reverse input terminal **132,** the stop input terminal **134,** and the on terminal **136,** the pump drive switch **122** includes a cam-operated revolution-sensing switch that is controlled by the rotation of the pump motor, and a stepping switch that counts operations of the cam-operated switch. The stepping switch produces a contact closure to provide a signal to the reverse input terminal **132** of the pump motor control **120** when the pump has rotated a predetermined number of revolutions in the forward direction to draw a certain volume of fluid into the intake hose **16** and then produces another contact closure which provides a signal to the stop input terminal **134** of the pump motor control **120** and to the on terminal **136** of the funnel motor control **124** when the pump has rotated a predetermined number of revolutions in the reverse direction to clear the intake hose **16.**

The funnel motor control **124** includes a switching arrangement having an on position in which it applies power to the funnel motor **126** to rotate the funnel **72** into which position it is switched by a signal to its on terminal **136** from the pump drive switch **122** and an off position into which it is switched by a signal applied to its off input terminal **138** in which position it stops the rotation of the funnel motor **126** to stop the funnel **72** with an outlet of the distributing recesses over the opening of a bottle. To generate the signal that is applied to the off terminal **138** of the funnel motor control **124,** a funnel drive switch **128,** which may be a cam-operated switch, is positioned to be depressed each time the funnel **72** is rotated the distance between two successive inlets of the distributing recesses of the distributing plate.

OPERATION OF THE CONTROL SECTION

The sample collector **10** may be operated in any of several modes of operation. For example, in one mode of operation the funnel **72** is manually moved to a position over an inlet of one of the plurality of distributing recesses **60** and **62** and the pump **70** started by hand, after which the pump is stopped and reversed to clear the intake hose **16.** The pump is stopped by hand and the funnel **72** moved to another position to take another sample. In another mode of operation, the sample collector operates semi-automatically. In this mode the funnel motor **126** is started by depressing a button and stopped by a cam-operated switch when it is properly positioned over an inlet recess. The motor is then started by hand, and then reversed and stopped by cam-operated switches actuated by the pump motor itself.

In fully automatic operation, the control system for which is shown in the block diagram in FIG. **5,** the interval timer **102** is set for a starting time at which time the first sample is taken and samples are taken thereaf-

ter at regular intervals starting with the time set on the interval timer **102** until the prescribed number of samples has been taken.

To set the time of the first sample on the interval timer **102,** the timer set knob **110** is depressed and set to a position ahead of the position in which the permanent magnet **116** is aligned with the reed switch **118.** In one embodiment, the reed switch **118** and the permanent magnet **116** are arranged during assembly to be aligned with each other on the half hour and hour. In this embodiment, the timer clock **104** is set to the correct time and the timer switch **114** provides a signal to the pump motor control **120** on the half hour and hour.

In one embodiment the signal from the interval timer **102** actuates the pump motor control **120** to start the pump **70** each time that it is applied to the terminal **130.** In another embodiment, the signal from the interval timer **102** steps a stepping switch (not shown) within the pump motor control **120** and power is applied to the pump motor when certain selected contacts of the stepper switch are made, which contacts are selected to cause the pump to start at certain intervals that are multiples of half hours.

When the pump motor is started by the signal from the interval timer **102,** it draws fluid through the intake hose **16** into the funnel **72,** which guides it into the inlet of one of the plurality of distributor recesses **60** and **62.** The fluid flows from the inlet recess to the outlet recess and into one of the sample bottles **44** or **46** in the bottle compartment **42.**

As the pump motor rotates, it drives the pump drive switch **122** through reducing gears (not shown), until a camming surface on the reducing gear train depresses the actuating arm of a switch to apply a signal to the reverse terminal **132** of the pump motor control **120.** The reducing transmission and the camming surface are set so that the actuating arm is depressed when a predetermined amount of fluid has been pumped into the funnel **72.**

When this actuating arm is depressed, the pump motor is stopped and reversed. As the pump motor rotates in the reverse direction, it drives the pump drive switch **122** until a camming surface again depresses the actuating arm of a switch, which applies signals to the stop terminal **134** of the pump motor control **120** and to the on terminal **136** of the funnel motor control **124** to stop the pump motor and to actuate the funnel motor control **124.**

When the funnel motor control **124** is actuated, the funnel motor **126** is started and rotates the funnel **72.** When the downspout of the funnel **72** reaches the next inlet recess of the plurality of distributor recesses **60** and **62,** a camming surface on the funnel depresses the actuating arm of a switch in the funnel drive switch **128,** which applies a signal to the off terminal **138** of funnel motor control **124** to stop the funnel motor **126.**

Each time the interval timer generates a signal, this process is repeated until the funnel reaches a reset switch after the last bottle has been filled at which time the power to the interval timer is cut off.

From the above description, it can be understood that the sample collector of this invention has many advantages such as: (1) the sections of hose are short, connected directly to the pump, and are relatively straight and stationary during the operation of the sample collector so that clogging is reduced; (2) the hoses last longer and are easier to clear of fluid after a sample is drawn because they are not flexed; (3) one moving part, the funnel, distributes the samples in a circular direction and a stationary plastic part, the distributing plate, distributes the fluid radially through inlets, passageways and outlets that are molded into it, thus permitting the sample collector to be simple in construction, inexpensive and durable; and (4) the tolerances provided by the distributor plate and its ability to be accurately positioned, eliminates spillage of the fluid.

Although a preferred embodiment of the invention has been described with some particularity, many variations and modifications in the preferred embodiment are possible in the light of the above teachings. Accordingly, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A fluid control system for guiding the fluid from a body of fluid through a sample collector into a plurality of containers, comprising:

channel-inlet means having internal wall portions defining a plurality of channel inlets;

channel-outlet means having internal wall portions defining a plurality of channel outlets;

channel means for guiding fluid applied to at least one of said channel inlets to at least one of said channel outlets;

certain of said channel outlets being adapted to be positioned directly over a different one of said containers, whereby fluid applied to one of said channel-inlets is guided into one of said containers without passing through any curved lengths of tubes;

sample-collector inlet means having internal walls defining at least one sample-collector inlet;

pump outlet means having internal walls defining, at least one pump outlet;

pump means for pumping fluid between said sample-collector inlet and said pump outlet;

fluid-guide outlet means having internal walls defining at least one fluid-guide outlet;

rotatable fluid-guide means for receiving fluid from said pump outlet and guiding said fluid to different ones said channel inlets;

said pump outlet means being stationary and communicating with said fluid-guide means;

said rotatable fluid-guide means including fluid-guide inlet means for communicating with said stationary pump outlet while said movable fluid-guide means rotates, whereby said pump outlet assumes different positions with respect to said rotatable fluid-guide means while remaining in communication with the interior thereof;

said rotatable fluid-guide means having a vertical axis of rotation;

said rotatable fluid-guide means including drive means for rotating said rotatable fluid-guide means about said vertical axis of rotation;

said fluid-guide inlet means having internal walls defining a fluid-guide inlet;

said channel means including a distributor plate;

said distributor plate including a plurality of recesses and perforations;

said recesses defining said channel-inlet means and said perforations defining said channel-outlet means.

2. A fluid control system according to claim 1 in which:
said rotatable fluid-guide means includes a funnel means having a funnel inlet and a funnel outlet;
said funnel means includes a tubular rim defining said funnel inlet;
said tubular rim being lower and larger than said pump outlet; and
said pump outlet being positioned so that its vertical projection downward lies within said rim, whereby said rim may rotate without said vertical projection falling outside of said rim.

3. A fluid control system according to claim 2 in which:
said funnel outlet is lower than said rim; and
said funnel outlet is offset from said vertical axis of rotation, whereby said funnel outlet orbits about said vertical axis of rotation to assume different positions above different ones of said channel inlets.

4. A fluid control system according to claim 3 in which:
the pump outlet is located a substantial radial distance from said vertical axis of rotation; and
said fluid control system further includes timing means for periodically energizing said pump means and said funnel drive means;
said timing means includes adjustable interval-timer means for adjusting the start of the first time interval at which said pump means and funnel drive means are energized.

5. A fluid control system according to claim 4 in which:
said sample-collector-inlet means includes a first section of hose adapted to receive said fluid drawn from said body of fluid;
said pump outlet includes a second section of hose; and
said second section of hose has one end positioned above said funnel inlet.

6. A fluid control system according to claim 3 in which:
said channel-inlet means are in a line; and
said channel-outlet means are offset from said line, whereby said containers are offset from said line.

7. A fluid control system according to claim 6 in which said channel-outlet means are offset into at least a second and a third line of channel-outlet means, whereby said containers may be staggered.

8. A fluid control system according to claim 7 in which:
said first-mentioned line forms a circle, whereby said funnel outlet passes over each distributor recess when said funnel means rotates one complete revolution; and
said second and third lines are circles with said second line being on the opposite side of said first-mentioned line as said third line, whereby said containers may be arranged into two side-by-side circles of containers.

9. A fluid control system according to claim 7 in which the said pump outlet is located a substantial radial distance from the said vertical axis of rotation.

10. A fluid control system for guiding the fluid from a body of fluid through a sample collector into a plurality of containers, comprising:
a distributor plate having internal walls defining a plurality of distributor inlets, a plurality of distributor outlets and a plurality of distributor passageways;
said distributor inlets opening upwardly from said distributor plate;
said distributor outlets being perforations through said distributor plate;
each of certain ones of said distributor passageways being channels opening upwardly from said distributor plate and connecting a different one of said distributor inlets to a different one of said distributor outlets, whereby fluid entering one of said distributor inlets is guided by said distributor passageway to one of said distributor outlets;
each of said distributor outlets being adapted to be positioned over a different one of said containers, whereby fluid applied to one of said distributor inlets from the top of said distributor plate is guided to one of said containers beneath said distributor plate;
each of said distributor inlets being in one line;
sample-collector-inlet means having internal walls defining at least one sample collector inlet;
pump outlet means having internal walls defining at least one pump outlet;
pump means for pumping fluid between said sample-collector-inlet and said pump outlet;
fluid-guide inlet means having internal walls defining a fluid-guide inlet;
fluid-guide outlet means having internal walls defining at least one fluid-guide outlet; and
movable fluid-guide for receiving fluid from said pump outlet and guiding said fluid to different ones of said distributor inlets, whereby said fluid is guided to different ones of said containers;
said distributor outlets being offset from said line of distributor inlets into at least second and third lines, whereby said containers are staggered into two lines of containers;
said second line being on the opposite side of said first-mentioned line from said third line, whereby said containers may be arranged into side-by-side lines of containers; and
said first-mentioned line being a circle, whereby said fluid-guide outlet may apply fluid to said distributor inlets by moving in a circle.

11. A fluid control system for guiding fluid from a body of fluid through a sample collector into a plurality of containers, comprising:
sample collector inlet means having internal walls defining at least one sample collector inlet;
sample collector outlet means having internal walls defining a plurality of sample collector outlets;
each of said sample collector outlets being adapted to be positioned over a different container;
flow means for guiding fluid applied to said sample collector inlet to at least one of said sample collector outlets at a time, whereby a plurality of said containers may have fluid applied to them through different ones of said sample collector outlets at different times;
said flow means including movable means for assuming different positions each of which guides said fluid from said sample collector inlet to a different one of said sample collector outlets;

control means for moving said movable means from one position to another upon receiving an internal signal, whereby different ones of said containers are filled;

said control means including switch means for providing an interval signal to said control means upon being actuated and a d.c. clock means for periodically actuating said switch means;

said d.c. clock means including a d.c. clock having first and second sides, an hour hand on said first side and a central shaft extending through said d.c. clock from said first side to said second side;

means for driving said hour hand from said central shaft;

said switch means being attached to said central shaft near the second side of said d.c. clock, whereby said switch means is actuated by the rotation of said central shaft.

12. A fluid control system according to claim **11**, in which:

said switch means includes a reed switch and a magnet;

one of said reed switch and said magnet being mounted to said central shaft for rotation therewith in a plane parallel to said second side; and

the other of said reed switch and said magnet being mounted such that said magnet actuates said reed switch during one portion and reactuates said reed switch during another portion of the revolution of said central shaft.

13. A fluid control system for guiding the fluid from a body of fluid from a sample collector into a plurality of removable containers, comprising:

sample-collector-inlet means having internal walls defining at least one sample-collector-inlet and at least one discharge opening;

pump means for causing fluid to flow between said sample-collector-inlet and said discharge opening;

fluid-guide outlet means having internal walls defining at least one fluid-guide outlet;

fluid-guide means having internal walls with a substantially tubular rim defining a fluid-guide inlet, for guiding fluid between said fluid-guide inlet and said fluid-guide outlet means;

said tubular rim being larger than said discharge opening;

said discharge opening being positioned so that its vertical projection downward lies within said rim;

said discharge opening being stationary and communicating with said fluid-guide inlet, whereby fluid is guided from the stationary discharge opening into said fluid-guide means without passing through any curved, movable tubes;

said fluid-guide outlet means including internal walls communicating with the interior of said fluid-guide means;

said containers being arranged side-by-side in at least one closed path;

said closed path having a center;

an ice compartment within said closed path; and

drive means for moving said internal walls of said fluid-guide outlet means in a circular path about said center to bring the interior of said fluid-guide means into communication with the interior of said containers through a plurality of different open paths without confining tubes, whereby said fluid flows from said fluid-guide outlet means into said containers without passing through any long, curved tubes.

14. A fluid control system in accordance with claim **13** in which said internal walls of said fluid-guide means slope inwardly and downwardly between said fluid-guide inlet and said fluid-guide outlet means, whereby said fluid flows along said walls between said fluid-guide inlet and said fluid-guide outlet means under the influence of gravity.

15. A fluid control system in accordance with claim **13** further including a tightly sealed compartment; at least a portion of said drive means being in said tightly sealed compartment.

16. A fluid control system in accordance with claim **13** further including a tightly sealed compartment; at least a portion of said pump means being in said tightly sealed compartment.

17. A fluid control system in accordance with claim **13** further including volume control means for controlling the volume of fluid pumped by said pump means.

18. A fluid control system according to claim **17** in which said volume control means includes a volume measuring means for measuring the volume of fluid pumped by said pump means independently from the speed of the pump means.

19. A fluid control system according to claim **18** in which said measuring means is in a location separated from said fluid.

20. A fluid control system in accordance with claim **13** further including:

timing means for periodically energizing said pump and said drive means;

said timing means including adjustable interval-timing means for adjusting the start of the first timed interval at which said pump and drive means are energized.

21. A fluid control system in accordance with claim **20** further including a tightly sealed compartment; at least a portion of said timing means being in said tightly sealed compartment.

22. A fluid control system according to claim **20** in which said timing means includes means for resetting said timing means.

23. A fluid control system according to claim **20** in which said timing means includes means for shutting off the power to said timing means when the last bottle is filled.

24. A fluid control system according to claim **13** in which:

said pump means includes means for pumping fluid under pressure and a plurality of tubes for guiding fluid from said body of fluid into and through at least a portion of said fluid control system;

all of said tubes being directly connected to said pressure, whereby fluid is guided within said fluid control system without passing through any tubes not under pressure.

25. A fluid control system according to claim **13** further including means for stopping said drive means when said internal walls of said fluid-guide outlet means are positioned with the interior of said fluid-guide outlet means in communication with the interior of one of said containers.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,838,719 Dated October 1, 1974

Inventor(s) Louis Franklin Lederer

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 13, line 28, "reactuates" is changed to--deactuates--.

Column 14, line 49, "bottle" is changed to--container--.

Signed and sealed this 31st day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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