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SEWAGE SAMPLING APPARATUS

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2 Sheets-Sheet 1

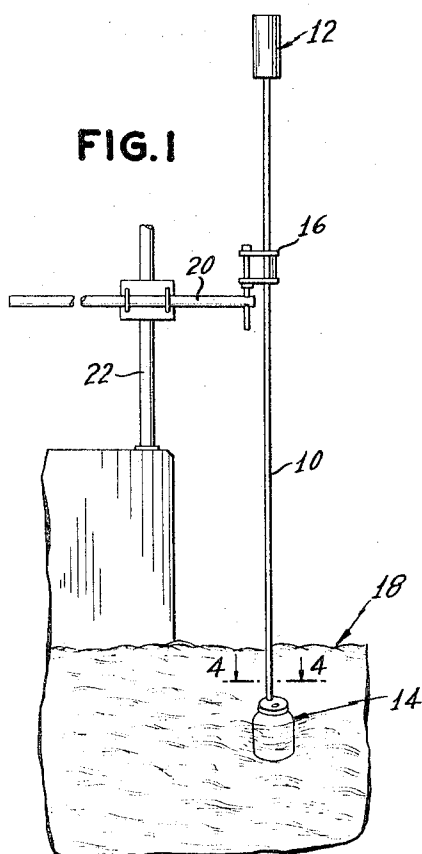


FIG. 1

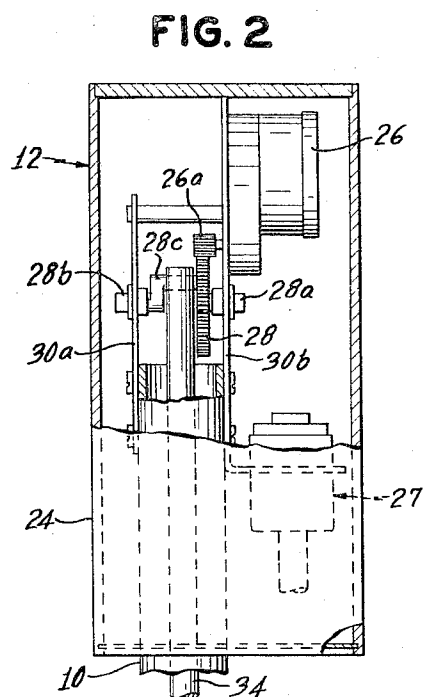


FIG. 2

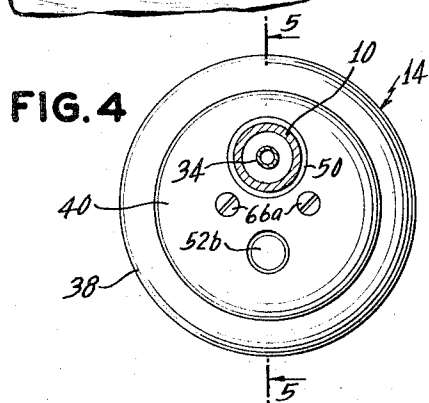


FIG. 4

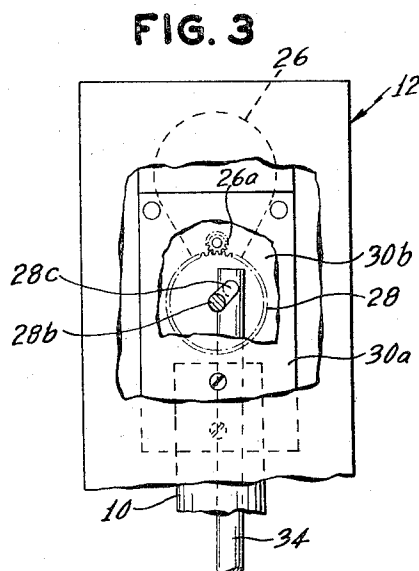


FIG. 3

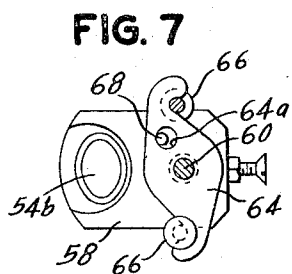


FIG. 7

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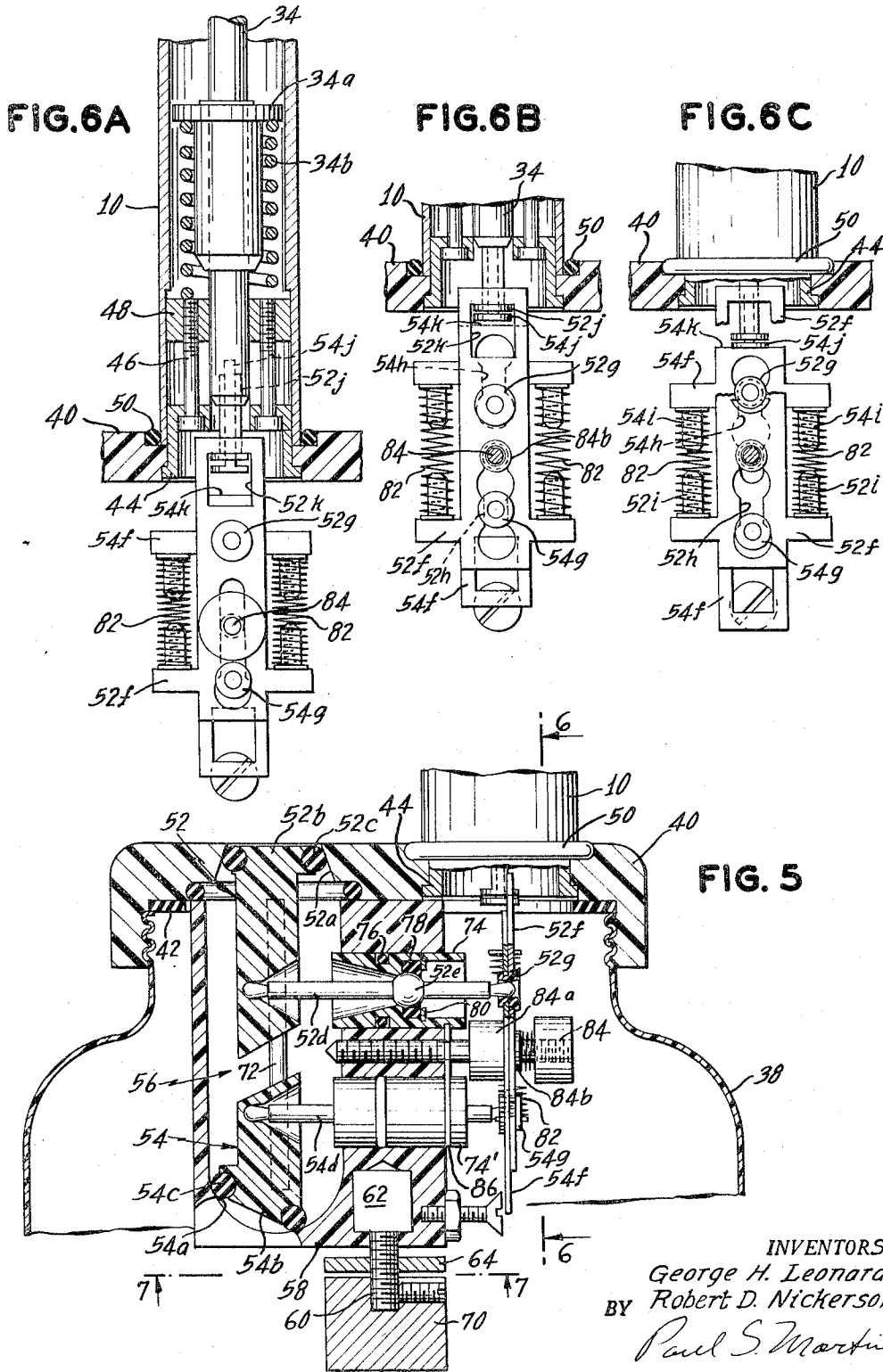
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## SEWAGE SAMPLING APPARATUS

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The present invention relates to apparatus for obtaining samples from a stream or channel of sewage or the like.

An object of the invention resides in the provision of sampling apparatus adapted to take and accumulate a succession of small samples of liquid as from a stream of sewage. A related object resides in provision of a sampling device adapted for remote-control operation.

A further object is to provide sewage sampling apparatus adapted to be submerged, and having electromechanical actuating means including an electric drive element such as an electromagnet or a motor above the surface of the liquid being sampled, and having purely mechanical elements below the surface of the stream. This feature avoids problems connected with other apparatus where electrically operated mechanism is contained in a submerged part of the apparatus and is vulnerable to water damage.

A feature of the novel sewage sampling apparatus, which has a container adapted to be submerged, is that the container has a removable water-tight closure, and a sampling mechanism is carried by the closure within the container. This feature facilitates periodic emptying of the container without disturbing the sampling mechanism.

A further feature of the novel apparatus is the provision of a sample-admitting valve that is disposed at a surface of the container, and where the valve when closed presents a smooth surface flush with the surrounding surface of the container for avoiding accumulation of solid matter at the valve exterior during times when the valve is closed. This feature provides assurance of obtaining typical samples of the stream of sewage that passes the sampler during the time that the valve is open.

A still further feature of the sampling apparatus is in the assembly of valve parts and actuating mechanism whose materials and arrangement renders the assembly easily taken apart for thorough cleaning, and in which the actuating mechanism is outside the sampling space but inside and above the liquid in the container.

An important feature of the novel apparatus is the incorporation of a small sampling chamber and valving mechanism in the submerged portion of the apparatus, where the sampling chamber discharges into a much larger accumulating container and where the container is vented. In this way, each new sample taken by the sampling chamber is freely discharged into the container.

An additional feature of the novel apparatus is the provision of a sampling device having a chamber with a top sample-admitting valve and a bottom sample-delivering valve, wherein the valves operate in alternation and wherein the bottom valve has a sloping seat that assures emptying of the sampling chamber when the bottom valve is open after the top valve has closed.

The nature of the invention and the foregoing and further objects and novel features will be more fully appreciated from the detailed description below of an illustrative embodiment shown in the annexed drawings.

In the drawings:

FIGURE 1 is a lateral elevation, partly in perspective, showing an illustrative embodiment of the invention in its normal condition of use, drawn to reduced scale;

FIGURE 2 is a greatly enlarged elevation of the top portion of the apparatus in FIG. 1, portions of the enclosure being broken away to show the interior;

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FIGURE 3 is a partial left-hand view of the apparatus in FIG. 2 drawn to smaller scale, portions of the enclosure being broken away to show internal mechanism;

FIGURE 4 is a transverse cross-section at the plane 4-4 in FIG. 1, showing a top plan view of the apparatus below the plane of the cross-section;

FIGURE 5 is a vertical cross-section of part of the apparatus in FIG. 4 as viewed at the plane 5-5, FIG. 5 being approximately full-scale;

FIGURE 6A is a vertical cross-section of part of the mechanism in FIG. 5, viewed from the plane 6-6, the parts in FIG. 6A being shown in the relative positions they occupy when the top valve of FIG. 5 is open and the bottom valve is closed;

FIGURE 6B is a fragmentary view similar to FIG. 6A, the parts appearing in the positions they occupy when both valves are closed;

FIGURE 6C is another fragmentary view similar to 6A, the parts being shown in the relative positions they occupy when the top valve of FIG. 5 is closed and the bottom valve is open; and

FIGURE 7 is a bottom plan view, partly in cross-section, of part of the apparatus in FIG. 5.

Referring now to the drawings, a long tubular metal member 10 carries an operating mechanism 12 at its top and a sewage sampling container 14 at its lower end. Tube 10 is suitably treated or is of a metal that resists corrosion, and tube 10 is advantageously of multiple segments. A clamp 16 engages tubular member 10 and fixes the position of tubular member 10 so as to submerge container 14 to a desired extent in a channel or stream 18 that is to be sampled. Arm 20 extends from a post 22, for supporting the apparatus at a position in the channel or stream at some point spaced substantially from the side of that channel. At such a position container 14 is exposed to a truly representative or typical composition of the stream.

Unit 12 has an enclosure 24 suitably secured to tubular member 10. Within enclosure 24 a portion of tubular member 10 carries brackets 30a and 30b that support an operating mechanism including an electric motor 26 having internal reduction gearing and an external pinion 26a. Gear 28 meshes with pinion 26a. Brackets 30a and 30b support pivots 28a and 28b which carry gear 28. Gear 28 carries an eccentric or crank 28c that is received in a transverse bore in tubular rod 34 that reciprocates lengthwise within tubular member 10. Rod 34 also oscillates side-to-side as crank 28 rotates, but this oscillation is purely incidental. Motor 26 may be a continuously operated slow-speed clock motor, or it may be a motor that is turned on and off periodically by suitably controlled and timed contacts. The cycle of crank 28c may occupy an interval of a few seconds or many minutes, as desired. The mechanism in upper portion 12 of the apparatus in FIG. 1 thus includes a means for operating rod 34 continuously in slow vertical strokes or for periodically operating rod 34 in a vertical-stroke cycle that is normally relatively slow, lasting a few seconds or longer depending upon the speed of motor 26 and the ratio of the gearing. Member 27 is a connector for external remote-control wiring that energizes and controls electric motor 26. Where the operation is intermittent, the control is such as to leave rod 34 at its mean position in its vertical stroke, after completing a cycle starting with a rise, followed by a full downward stroke, and finally a return to the mean position.

The portion of the apparatus shown in FIG. 1 as being below the surface of the stream being sampled is shown in detail in FIGS. 4-7, inclusive. In FIG. 5, a container part 38 is shown having a screw-on cover 40 and sealing gasket 42. These parts may be of a suitable plastic that is readily cleaned, container 38 being conveniently of

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polyethylene and cover 40 being conveniently of nylon. Cover or closure 40 is of substantial thickness inasmuch as it forms the structural mount of the mechanism within the container, and it provides a means of connection of container 14 to tubular support 10. A flanged cup 44 is pulled upward by screws 46 tightly against a counter-bored seat formed in the inside surface of closure 40. Screws 46 are received in a plug 48 that is fixed in tubular member 10. Tubular member 10 is driven by screws 46 down against a shoulder in the upper surface of the closure, for providing a watertight seal between cover 40 and tubular member 10. An O-ring 50 in a counterbore in the top of cover 40 provides further assurance of the water-tightness of the connection.

In FIG. 5, closure or cover 40 has an inlet in the form of a valve seat 52a of a first valve 52. Poppet 52b has an O-ring 52c that provides a seal against valve seat 52a when the poppet is in its closed position. In that position, the upper surface of poppet 52b is flush with the surrounding upper surface of closure 40. This has the advantage of providing a virtually flat top surface for the flow of the stream across the top of closure 40 during the time that valve 52 is closed, thereby precluding accumulation of solid matter at the valve surface.

Valve 52 provides an entrance port for admission of samples into a chamber 56 formed in member 58. The latter is clamped tightly against closure 40 by an arrangement that is best shown at the bottom of FIG. 5 and in FIG. 7. Screw 60 is threaded through a bridge plate 64 and into a metal insert 62 in member 58. The hooked extremities of plate 64 are received in circular grooves in suspension rods 66 that depend from screws 66a in cover 40 (FIG. 4). Block 58 has grooves in its opposite lateral faces that receive rods 66 and prevent any twisting of block 58. A pin 68 that is received in a large hole in bridge member 64 allows this bridge member to swing out of engagement with rods 66 when block 58 is to be removed from cover 40. Finger piece 70 is fixed to screw 60 and causes screw rotation; and because the screw threads in plate 64 are of a different pitch than the threads in insert 62, rotation of screw 30 in the proper direction produces a powerful clamping force holding block 58 against cover 40. Screw 60 forces plate 64 away from block 58 and thereby drives the hooked ends of plate 64 against the lower lateral surfaces of the grooves in rods 66.

A second valve 54 in block 58 includes a valve seat 54a that is formed on an incline at the inside of chamber 56 in block 58. Valve 54 further includes a poppet 54b and an "O-ring" 54c which forms a seal between poppet 54b and valve seat 54a when valve 54 is closed.

Both poppets 52b and 54b are prevented from rotating about their common longitudinal axis and they are guided for lengthwise reciprocation by a pair of vertical rods 72 at diametrically opposite sides of the poppets. These rods are received partly in the wall of chamber 56 and partly in the lateral surfaces of poppets 52b and 54b.

A lever 52b extends into a socket in poppet 52b and through a water-tight swivel or pivotal mounting in the wall of chamber 56. This mounting includes a cylindrical member 74 having an external O-ring 76 that seals member 74 in a close-fitting bore in block 58. A further cylindrical member 78 is received tightly in a bore in member 74. Portions of members 74 and 78 are shaped complementary to an enlarged spherical middle portion 52e of lever 52d. A snap-ring retainer 80 holds member 78 tightly against spherical portion 52e which, in turn, is held tightly against the complementary portion of member 74, thus forming a sealed swivel mount for lever 52d. Valve 54 has a lever 54d that extends through a like swivel mount and seal construction 74' in block 58.

When both valves are closed, as is illustrated in FIG. 5, levers 52d and 54d are essentially parallel to each other. For opening valve 52, lever 52d is forced to slope downward to the left; and for opening valve 54, lever 54d

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is forced to slope upward to the left. The mechanism for achieving this actuation is shown in FIGS. 5 and 6A, 6B and 6C.

The valve-actuating mechanism includes an actuating plate 52f for valve 52 and another actuating plate 54f, for valve 54. As best shown in FIG. 6C, actuating plate 52f overlies actuating plate 54f. A part which may be loosely called a grommet 52g receives the right-hand end of lever 52d within its bore. Grommet 52g is received snugly in a round hole in plate 52f and has a lateral flange extension overlying plate 52f. Grommet 52g also extends through plate 54f and has a flange overlying the back surface of plate 54f. For this purpose, grommet 52g has a groove that receives opposite parallel edges 54h of a slot in plate 54f. By like token, grommet 54g has a flange that overlies the inside surface of plate 54f, and grommet 54g has a groove or undercut that receives parallel opposite edges 52h of a slot in plate 52f.

Plate 52f has projections 52i that extend into the hollows of a pair of compression coil springs 82. Plate 54f also has a pair of projections 54i that are similarly received in the respective hollows of the same coil springs 82. Plates 52f and 54f are thus biased in opposite directions by coil springs 82, this bias tending to hold valves 52 and 54 closed.

Plates 52f and 54f are slidably supported on block 58 by means of a screw 84. Enlarged body portion 84a of screw 84 provides a sliding surface for plate 54f. Spring-biased shouldered sleeve 84b that is slidable along screw 84 bears against the opposite or outward surface of plate 52f. The slots in plate 52f and 54f defined by edges 52i and 54i are extended to accommodate screw 84, and these slots have circular enlargements to facilitate assembly of the parts of the valve-actuating mechanism.

The parts associated with valve-actuating plates 52f and 54f are illustrated in FIGS. 5 and 6B in the positions they assume when both valves are closed. In order to open valve 52, plate 52f is lifted as illustrated in FIG. 6A. While this occurs, poppet 54b is biased downward against its seal by lever 54d and springs 82 acting on actuating plates 54f. Conversely (see FIG. 6C), when plate 54f is forced down and lever 54d is forced to a position slantwise upward toward the left, valve 54 opens. At this time springs 82 act on plate 52f for biasing lever 52d in its valve-closing direction.

Two members 52j and 54j are threaded into bores in the lowermost end of tubular rod 34 (see FIG. 6A). Member 52j has a bore that freely accommodates or clears part 54j. The vertically adjusted position of member 52j is established for controlling the closing time of valve 52. The closing and opening of valve 54 is determined by the adjusted position of part 54j. When the headed parts of members 52j and 54j are tightened against each other, they lock each other in their positions of adjustment. The headed portions of parts 52j and 54j operate in a rectangular cut out 52k in plate 52f. The headed portion of member 52j acts against the top edge of cutout 52k when rod 34 is lifted, thereby forcing plate 52f upward. Correspondingly, when rod 34 is driven downward, member 54j is forced downward against the top edge of portion 54k of plate 54f (FIG. 6C).

As may be seen in FIG. 6B, the normal adjustment of parts 52j and 54j is such that when part 52j just leaves the coating top edge of cutout 52k, there is a clearance space between part 54j and the top edge of part 54k. By virtue of this clearance, there is a dwell during which valves 52 and 54 both remain closed. In reverse, when part 54j is lifted out of contact with plate 54f, there is a dwell before part 52j drives plate 52f upward, both valves remaining closed during this dwell.

A sleeve 34a is secured to rod 34 near its lowermost extremity (FIG. 6A) and around this sleeve there is a relatively strong compression spring 34b acting against fixed plug 48, mentioned previously. Spring 34b thus drives rod 34 upward, and it also drives parts 52j and

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54j upward, to an extent allowed by rod 34 and the motor mechanism at the top of tubular member 10. This spring is considerably stronger than both springs 82 combined, so that when rod 34 is moved upward by the electric motor mechanism 12, valve-control parts 52j and 54j are moved upward with rod 34 as a unit, and valve 52 is opened. Downward drive of rod 34 by the motor mechanism forces parts 52j and 54j down and opens valve 54.

The operation of the apparatus described above may now be reviewed. It has been shown that rod 34 is operated up and down by the action of the motor-driving mechanism 12 and spring 34b. When rod 34 is lifted by the motor mechanism, spring 34b lifts sleeve 34a and part 52j, thus lifting plate 52f and forcing valve lever 52d to open valve 52. At the same time, parts 52i and the associated portions of plate 52f increase the compression of springs 82. At this time springs 82 merely act on plate 54f and bias lever 54d in its valve-closing direction.

As rod 34 is driven downward slowly, part 52j moves out of contact with plate 52f. This occurs as valve 52 closes. There is a short idle stroke of rod 34 after valve 52 closes and before valve 54 opens. Part 54j then engages the upper edge 54k of plate 54f and further downward movement of rod 34 forces plate 54f downward and operates lever 54d so as to open valve 54.

Upward movement of rod 34 which follows causes valve 54 to close. Valves 52 and 54 remain closed during a short dwell time; and as rod 34 completes its upward stroke, valve 52 opens once again, in continued cycles. In intermittent-cycle operation, the control of clock motor drive unit 26 is such that operation is interrupted in the dwell part of the stroke, or while valve 54 is open.

In the configuration of the parts in FIG. 5 (valve 52 closed), it is clear that there is no tendency for any solid matter to collect on the upper surface of poppet 52b, because this poppet is flush with the upper surface of cover or closure 40. In due course, when valve 52 is opened, the water of the stream crossing the top of cover 40 enters and fills chamber 56. Rod 34 is then moved down to close valve 52, at which time chamber 56 has been filled and contains a measured sample of the stream. Continued downward movement rod 34 causes valve 54 to open, and the measured liquid sample in chamber 56 is released for discharge into the much larger space in container 38. It has been discovered that horizontal exit port of chamber 56 might on occasion fail to release the liquid from chamber 56 despite the opening of valve 54. When the lower valve-seat slants there is no tendency for the liquid in chamber 56 to be trapped and thus fail to discharge into the large container 38.

If there were no way for the air originally filling container 14 to escape to the exterior, then a further difficulty would arise inhibiting the discharge of samples from chamber 56. A buildup of pressure would occur as container part 38 is progressively filled. However, in the apparatus described, tubular member 10 extends upward from container 38, which is thereby freely vented. Each new sample can readily transfer into the container part 38.

The volume of the container part 38 is vastly larger than that of chamber 56, so that many samples can be delivered by the valved chamber 56 into container part 38. The cycled operation is interrupted before the liquid level reaches the discharge port of chamber 56, and thus the valve-operating mechanism is always above the accumulated-sample liquid in container part 38.

In an exemplary form of the apparatus, container part 38 is of polyethylene, parts 40, 52b, 54b, 52g, 54g, 58, 74 and 74' are of nylon, and parts 42, 52c, 54c and 78 are of synthetic rubber, for example, and each is thus readily cleaned. All the metal parts are anti-corrosion treated or of stainless steel. Plate 86 is laterally notched from alternate edges and conforms to grooved portions of cylindrical member 74, screw 84 and cylindrical member

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74'. When screw 84 is tightened, plate 86 is moved against the exterior of body 58 and acts as a stop that locates levers 52d and 54d in proper position between poppets 52b and 54b at the left and plates 52f and 54f at the right, as viewed in FIG. 5. By removing screw 84, the valves are readily disassembled completely, and periodic thorough cleaning is rendered easy.

The foregoing embodiment of the invention as described in detail and shown in the drawings is naturally subject to varied changes and varied application, as will be appreciated by those skilled in the art. Consequently, the invention should be interpreted broadly, consistent with its full spirit and scope.

What is claimed is:

1. Apparatus for obtaining sewage samples, including a container, an elongated tubular support opening into said container and adapted to locate the container in the sewage with the space of the container vented to the atmosphere, means defining a sampling chamber having an inlet to the sewage and an outlet to the space in the container, said sampling chamber being small relative to said container, valve means operable alternately to open said inlet while said outlet is closed and to open said outlet while said inlet is closed, and means for so operating said valve means.

2. Apparatus in accordance with claim 1, wherein said operating means includes valve-actuating mechanism in said container, an electrical driving device on said tubular support at a place normally above the sewage, and a mechanical coupling between said driving device and said valve-actuating mechanism.

3. Apparatus in accordance with claim 1, wherein said inlet is formed in an external laterally extending surface of the container and wherein said valve means includes a poppet having a portion substantially flush with said external surface when said inlet is closed.

4. Apparatus in accordance with claim 1, wherein said sampling-chamber means includes a wall within said container, and wherein said valve means includes an inlet-valve poppet and an outlet-valve poppet, elements extending through said wall for operating said poppets, and actuating means for said elements in said container but outside said sampling chamber.

5. Apparatus in accordance with claim 1, wherein said valve means includes an inlet poppet and an outlet poppet in said chamber and respective poppet-operating levers extending through a wall of the container, and wherein said valve operating means includes a pair of plates in said container coupled to said levers and spring means acting on said plates individually so as to bias said poppets normally into their respective closed positions, said operating means further including an operator extending from said plates via said tubular support to a location above the surface of the sewage.

6. Apparatus in accordance with claim 1, wherein said container has a closure, and wherein both said tubular support and said chamber defining means are affixed to said closure.

7. Apparatus in accordance with claim 1, wherein said container includes a top closure in which said inlet is formed and wherein said chamber-defining means depends from said closure.

8. Apparatus in accordance with claim 1, wherein said chamber-defining means depends from the top of said container, wherein the inlet to the chamber is formed in the top of the container, and wherein said valve means includes a poppet having an inclined seat that forms the outlet of the sampling chamber.

9. Apparatus in accordance with claim 1, wherein said valve means includes respective poppets operable in said sampling chamber, operating levers engaging said poppets and extending outside said chamber defining means, and respective cylindrical water-tight swivel bearings for said levers slidably received and sealed in a wall forming part of said chamber-defining means.

10. Apparatus for obtaining sewage samples, including a container having a removable top closure, a long upright tubular support secured at its lower end to said closure and opening into said container so as to enable the container to be submerged in sewage to be sampled while the upper end of said tubular support is disposed above the surface of the sewage and so that said container is vented to the atmosphere via said tubular support, means forming a sampling chamber depending from said closure, a first valve including an opening in said closure formed to define a valve seat and providing an inlet part to said sampling chamber, a first poppet in said sampling chamber and engageable with said seat to close the valve, said poppet being formed to present a surface flush with the outside surface of said closure when the poppet is seated, a first valve-actuating lever for said first poppet extending laterally through a wall of said chamber-forming means, a second valve including a second valve seat disposed slantwise at the bottom of said chamber-forming means and providing an exit part of said chamber so as to open into said container, said second valve including a poppet disposed in said chamber and operable for opening and closing said exit port and a second valve-actuating lever extending laterally through said wall and generally parallel to said first actuating lever, each of said actuating levers having a sealed pivotal mounting in said wall of the

chamber-forming means, first and second valve actuating plates disposed in said container adjacent said chamber-forming means and cooperable individually with said levers, spring means acting oppositely on said actuating plates so as to bias both said poppets against their seats, respectively, a vertically reciprocable operator having driving engagements alternately with said valve-actuating plates during the terminal parts of its reciprocable stroke, respectively, for overcoming said oppositely acting bias and for operating said poppets in alternation, said operator having a lost-motion middle part of its stroke during which it is free of driving engagement with either of said plates, spring means biasing said operating member in the direction to open said first valve, the latter spring means having greater strength than first valve closing bias of said oppositely acting spring means to overcome the latter in opening said first valve, said operator including a rod extending within said tubular support and having an upper end portion in the space above the sewage being sampled, and operating means including a motor for at times driving said upper end portion of the rod down and thereby causing opening of the second valve and closing of said first valve.

No references cited.

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