Sept. 9, 1969 J. R. TANSONY 3,465,595

LIQUID SAMPLING DEVICE

Filed March 21, 1968

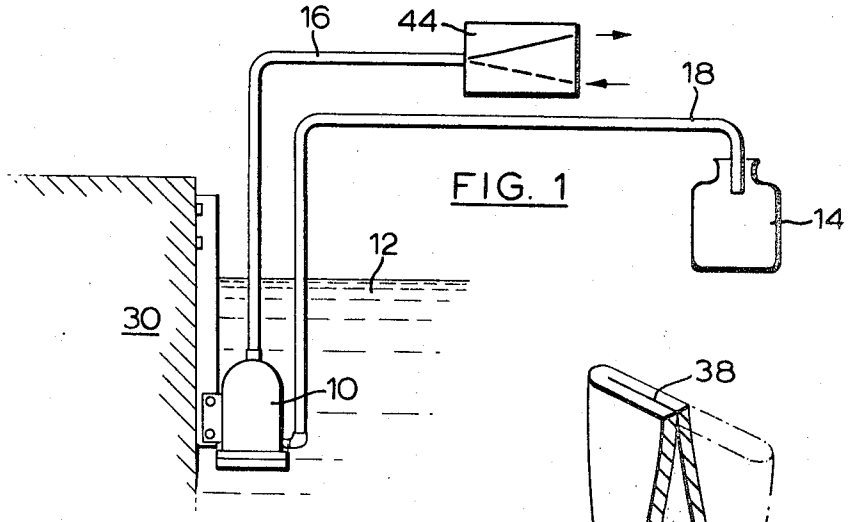


FIG. 1

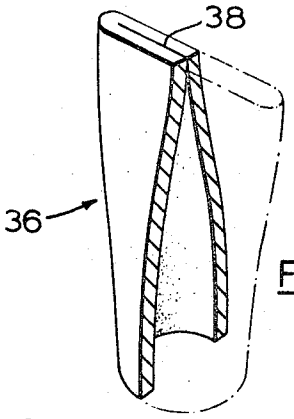


FIG. 3

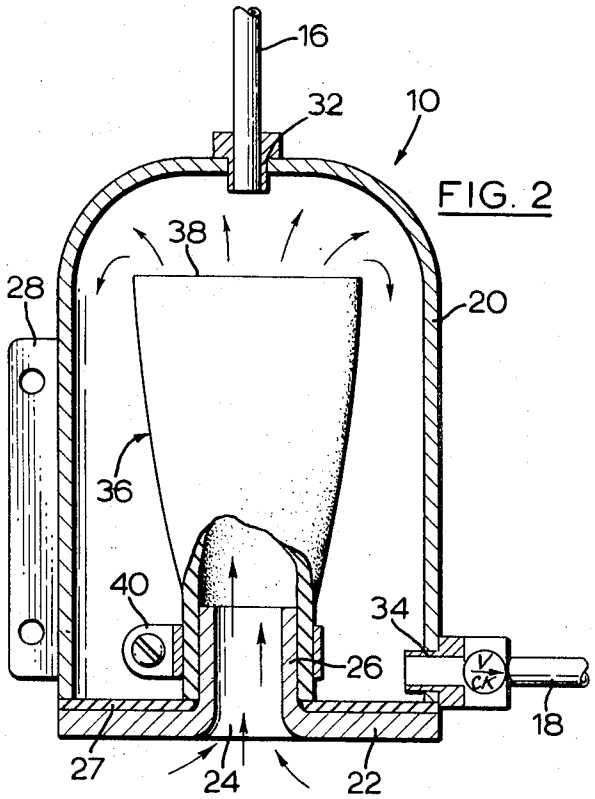


FIG. 2

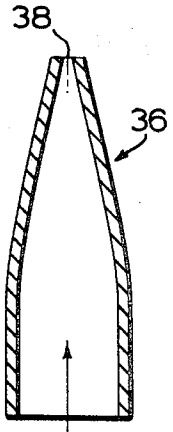


FIG. 4

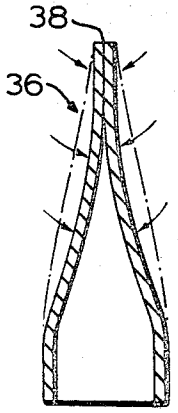


FIG. 5

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LIQUID SAMPLING DEVICE

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ABSTRACT OF THE DISCLOSURE

A liquid sampling device including a submersible container for receiving samples of liquid from a bath thereof for transmission to a testing station situated externally of the bath; the container having a duckbill-shaped hose inlet for the liquid functioning both as a one-way check valve and also as a screen to prevent entry of undesirable lumps of solids into the container.

This invention relates to a liquid sampling device with a submersible element whereby successive samples may be taken from a bath of sewages, for example, at predetermined depths therein and at predetermined times; such samples then being removed automatically from the submersible element or sampler to a remote testing or analysis station without the need for withdrawing the sampler from the liquid.

As is known in the prior art, a liquid sampling device according to the present invention may include a receptacle or container immersible in liquid to be sampled; the container including only one inlet for the liquid governed by a one-way check valve to allow liquid to enter the container under the hydrostatic pressures obtaining in the bath. The container also includes a vent connectable to an air line for venting the air displaced by the entering liquid and through which, alternately, the container may be pressurized to close the check valve and to expel all or part of the contained liquid through an outlet of the container connectable by a conduit to a testing or analysis station usually situated externally of the liquid bath.

It is accordingly a broad object of the invention to provide an improved liquid sampler offering certain advantages over the prior art samplers.

For example, it may be desired to obtain liquid samples for analysis from a bath of liquid wherein certain solids are present, as, for example, in sewage, which may interfere with the obtaining of the sample and/or the operation of the sampling device.

Thus, it is a further object to provide a liquid sampler in the form of a submersible container wherein liquid may enter freely therein but wherein undesirable lumps of solid matter are excluded from entry.

It is a still further object to provide a sampler having an inlet for liquid from a bath thereof wherein the inlet is so shaped as to resist entry of undesirable solids as aforesaid and which is also readily closeable to prevent escape of the contained liquid through the inlet.

It is a still further object to provide a sampler having such an inlet wherein closure thereof tends to expel any solids seeking to enter the sampler back into the bath.

It is a yet further object to provide a sampler wherein the inlet is readily collapsible under air pressure within the sampler to prevent escape of the contained liquid as aforesaid and wherein the inlet is also limitedly expansible under hydrostatic pressure of the liquid, upon venting of said interior, to permit liquid to enter the sampler from the bath.

It is a still further object to provide a sampler, the interior of which is readily connectable to venting and pressurizing means as aforesaid and having an outlet

connectable to a receptacle for receiving sample liquid from the sampler. Such receptacle may conveniently be located remote from the sampler such as, for example, adjacent apparatus for venting air from and pumping air into the sampler.

Accordingly the invention provides a submersible liquid sampler in the form of a container having an inlet for admitting liquid to be sampled to the interior of the container, an air venting and pressurizing connection, and an outlet for sample liquid displaced from the interior of the container to a remote testing station upon air pressurization within the container; the inlet having a substantially slit-shaped resilient orifice normally biased towards a substantially closed position and being expansible to a limited extent under hydrostatic pressure of the liquid to admit it to the container interior, when vented, and being also readily collapsible to close the orifice under air pressurization of the container interior substantially to seal said inlet.

Other objects of the invention, more or less broad than the foregoing, will become apparent from the following description of the parts, principles, and elements constituting the invention given herein solely by way of example and with reference to the accompanying drawings wherein:

FIG. 1 is a schematic view of the instant sampler positioned in a bath of liquid showing ancillary venting and pumping means together with a remote testing or analysis station;

FIG. 2 is an enlarged transverse cross-sectional view of the sampler;

FIG. 3 is a perspective part-broken view of the inlet forming part of the instant sampler;

FIG. 4 is a side cross-sectional view of the inlet with its orifice open;

FIG. 5 is a side cross-sectional view of the inlet with its orifice closed and showing progressive collapsing thereof under the effect of increasing air pressure.

The instant invention provides a liquid sampler for obtaining samples of liquid from a desired location within a bath of liquid. It should be understood that the expression "bath of liquid" is only used for the sake of clarity to indicate a form of containment for the liquid. The liquid in question may, thus, be contained within an artifically constructed receptacle such as a sewage tank or reservoir or it may be within a naturally bounded container such as in a river, canal, lake, or sea. In any event, the invention is particularly concerned with the obtaining of samples of liquid from a bath of liquid which contains lumps of solids in suspension, such as sewage, although it will be apparent that the instant liquid sampler may also be utilized in liquids not containing any suspended lumps of solids.

The instant liquid sampler **10** is shown schematically in FIG. 1 of the drawings as being suspended at a predetermined depth and location below the surface of the liquid **12** to be sampled.

In order to obtain samples without withdrawing the sampler from the liquid, facilities are provided at a convenient location to enable samples to be transmitted from the sampler to a testing or analysis station **14** remote from the sampler; such facilities including an air pumping and venting line **16** to the sampler **10** together with a further line **18** for conducting samples from the sampler to the aforesaid testing station **14**.

The sampler **10** itself illustrated in more detail in FIG. 2 comprises a container having a liquid inlet opening including a check valve which functions in a manner more fully explained herein. In the embodiment illustrated, the container is of bell-shaped configuration cast of a suitable metal. More specifically, the container comprises a bell-shaped cover **20** detachably and hermetically

clamped to a co-operating base **22**, the base being provided with an opening **24** surrounded by a circular collar **26** having inturned edges and forming part of the aforesaid inlet. Sealing ring **27** is located about the collar **26** between the base **22** and the cover **20** of the container. The cover is provided with an integral apertured flange **28** for connecting the assembled container to suitable means, such as the wall **30** shown in FIG. 1, whereby the container may be positioned at a desired predetermined depth and location within the liquid to be sampled.

The cover **20** is also provided with an air vent **32** in the apex thereof connectable by a suitable coupling to air line **16** for venting air displaced from the interior of the container by liquid entering through the inlet and also for pumping air into the container. The cover **20** also includes an outlet **34** located adjacent the lower edge of the cover connectable by a suitable coupling to line or conduit **18** for conducting liquid expelled from the interior of the container to the testing station **14** when air is pumped into the container.

The liquid inlet opening referred to above comprises the opening **24** in the container base together with the aforesaid check valve.

It should be appreciated that, since the sampler is particularly advantageously utilized in the obtaining of liquid samples from a bath of liquid containing suspended solids, means must be provided not only to act as a check valve closeable when the sample is being transmitted under air pressure to the testing station but also to act as a screen to prevent the entry of undesirable solids into the interior of the container.

Accordingly the check valve forming part of the liquid inlet is also designed to function as a screen for the purposes aforesaid. Specifically, the inlet includes a funnel-shaped tapered tube **36** narrowed to a resilient slit-shaped orifice **38** at its downstream end and, preferably, the whole tube is formed of an elastomeric material such as natural or synthetic rubber. The tube **36** is secured at its upstream end about the collar **26** by means of a clamping clip **40**.

From the foregoing description of the tube **36** and as clearly shown in the drawings, it will be seen to resemble a short length of hose which has a basic cylindrical conformation but is flattened at its downstream end; the cylindrical form being retained at its upstream end where it is secured to the collar **26**. The flattening aforesaid imparts a duckbill configuration to the downstream end of the tube **36** narrowing its bore to the slit-shaped orifice **38** which is limitedly expansible under the hydrostatic pressure of liquid entering the container but is readily collapsible under the influence of air pressure within the container to seal the inlet.

Moreover, the tapered or "duckbill" configuration of the downstream end of the inlet enables the orifice **38** to be progressively collapsed under increasing air pressure within the container as illustrated in FIG. 5. It will also be readily apparent from the foregoing description that the orifice remains in its slit-shaped configuration between open and closed positions thereof whereby the entry of undesirable solids to the interior of the container through said orifice is prevented even when the orifice is open.

Thus, the provision of a resilient orifice in the liquid inlet passage serves both as a screen and a check valve. Furthermore, the tapered configuration of the inlet adjacent the orifice enables a squeezing action to be imparted between the interior surfaces of the side walls of the tube, under closing air pressure within the container, to tend to expel any solids back towards the upstream end of the tube should any such solids enter the tube.

Operation of the sampler is carried out in the following manner in respect of the obtaining of a liquid sample from a bath of liquid, for example, sewage; the apparatus ancillary to the sampler itself being as shown schematically in FIG. 1 of the drawings.

Referring to the apparatus as shown schematically in FIG. 1, it should be appreciated that some convenient switching or valve means **44** is provided at the end of the air line **16** remote from the sampler **10** whereby said line may be selectively vented to atmosphere or connected to a pump for pressurizing the interior of the container. Such valve or switching means may, for example, comprise a solenoid-operated valve or a simple mechanical three-way valve.

Consider as an initial condition that the aforesaid valve **44** is switched to vent the air line **16** to atmosphere at which time the interior of the container will be full of liquid. The valve **44** is then switched to the air pump to force air into the interior of the container through the air vent **32** in the apex of the cover **20** thereof. This pressurization of the container interior achieves two results; firstly, the increasing pressure within the container progressively collapses the side walls of the inlet tube **36** adjacent the orifice **38** thereof thereby sealing the orifice whilst at the same time the liquid entrapped within the container interior is forced through the outlet **34** to the remote testing or analysis station **14** via the associated conduit **18**. Further increase in air pressure further seals the inlet orifice **38** whilst expelling all of the contents of the container to the testing station whilst at the same time the squeezing action of the "duckbill" portion of the inlet serves to expel any solids back towards the upstream end of the inlet should any such solids have entered into the tube. Thus, during this step of the cycle, the inlet is sealed to prevent any of the entrapped liquid within the container from being expelled through the inlet and ensuring that all of such entrapped liquid is conducted to the testing station.

After all of the entrapped liquid has been expelled from the interior of the container as aforesaid, the valve **44** is switched from the pumping means to vent the air line **16** to atmosphere. Release of the air pressure within the container interior to atmosphere will enable liquid to enter the interior of the container under hydrostatic pressure thereof through the inlet. As explained hereinbefore, the inlet orifice **38** is limitedly expansible under such hydrostatic pressure to admit liquid from the bath of liquid whilst still retaining its substantially slit-shaped configuration and thereby preventing any undesirable solids from entering into the container interior. After a short period of time, the container interior will have completely refilled with liquid at which time the cycle of operations may be repeated as aforesaid to expel the contents to the testing or analysis station.

It will be appreciated that the sampling procedure outlined above may be repeated automatically at any desired time intervals and thus, for example, a series of sample tests or analyses may be carried out within a sewage tank during any one day by a completely automated process without any need to interfere with the sampler whatsoever.

What I claim is:

1. A liquid sampler comprising:

a container submersible in a bath of liquid to be sampled;

an elongated inlet for conducting liquid from the bath into the container, said inlet including an elongated tapered tube of resilient material disposed within said container providing a passage communicating between the interior and exterior thereof;

lips on the downstream end of said tube providing an orifice relatively freely spreadable to a substantially slit-shaped configuration by and under hydrostatic pressures obtaining in said bath permitting relatively free flow of liquid therethrough into the container, said lips being strongly resistant to further spreading and enlargement of said orifice restricting passage of lumps of solids therethrough;

an air vent connectable to an air line for venting air displaced by liquid entering the container and, alter-

nately, for delivering compressed air into the container, and

an outlet through which liquid is expellable from the container by the compressed air aforesaid;

said tube being closeable by said compressed air to occlude the said orifice and the said passage.

2. A liquid sampler as claimed in claim 1 wherein said tube is sealingly secured, at its upstream end, about an aperture provided in the container and constituting part of said inlet.

3. A liquid sampler as claimed in claim 1 wherein said lips are biased to retain the substantially slit-shaped configuration of the orifice in and between its open and closed positions to prevent the entry of solids through said orifice to the interior of the container at all times.

4. A liquid sampler as claimed in claim 1 wherein said tube is predisposed to progressive collapse longitudinally thereof from said orifice towards the upstream end of the hose under increasing pressure of air within said container.

5. A liquid sampler as claimed in claim 1 wherein: said container comprises a cover detachably and hermetically sealed to a base, and

the upstream end of said tube is sealingly secured about an aperture provided in said base.

6. A liquid sampler as claimed in claim 5 wherein: said air vent is disposed at the top of said cover, and said outlet is disposed adjacent the bottom of said cover.

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S. CLEMENT SWISHER, Primary Examiner

U.S. Cl. X.R.

137—525.1