Nov. 23, 1965 V. GILL 3,218,868

FLUID SAMPLING

Filed Aug. 8, 1962

FIG. 1

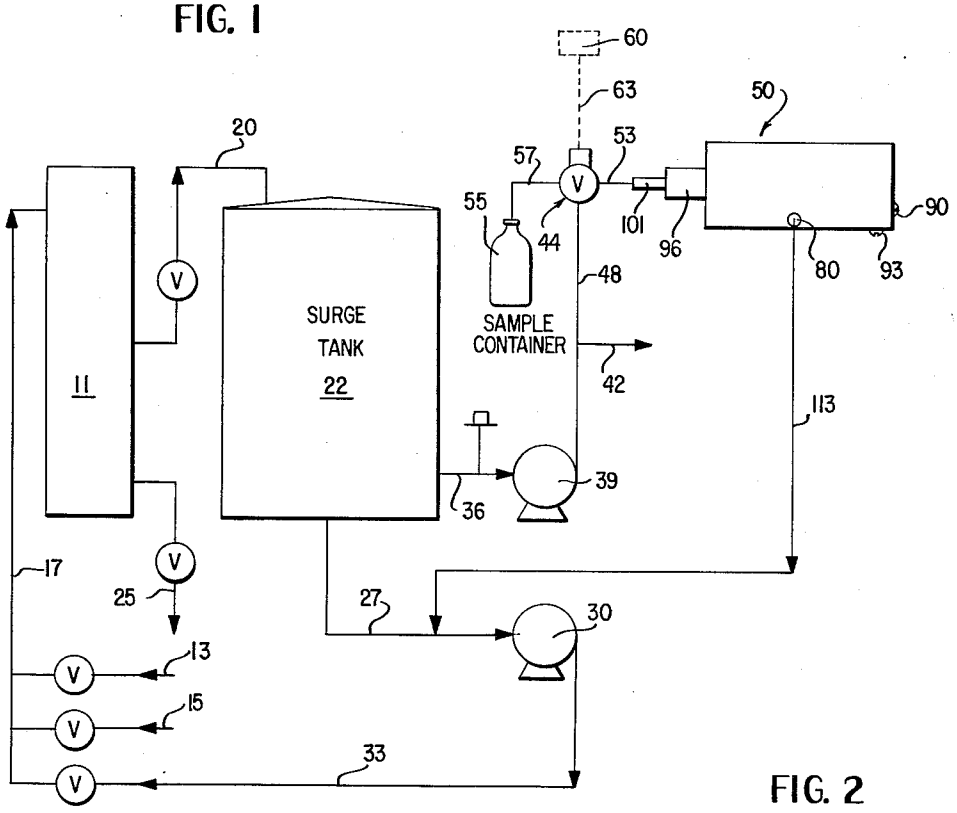
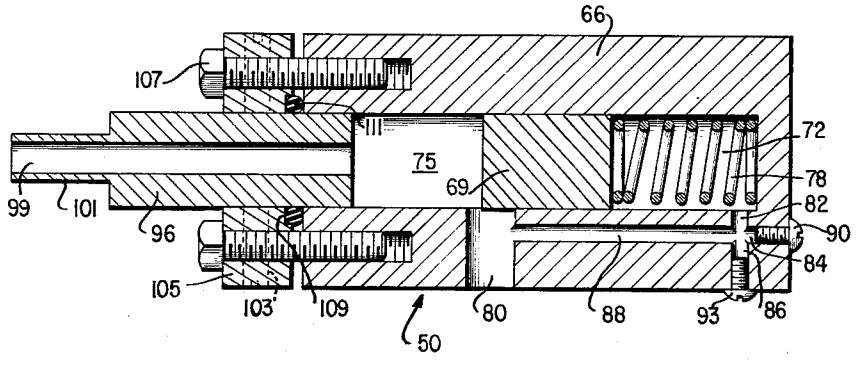


FIG. 2



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United States Patent Office 3,218,868
Patented Nov. 23, 1965

3,218,868

FLUID SAMPLING

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Filed Aug. 8, 1962, Ser. No. 215,695
4 Claims. (Cl. 73—422)

This invention is a novel apparatus for trapping a liquid sample. The device is characterized by extraordinary simplicity, the device having but two moving parts, and by the provision it contains for trapping a "live" sample of the fluid and releasing the sample to a storage vessel through the same duct used to introduce the sample into the trap. In this way the "latest" sample is obtained, rather than a sample obtained at the beginning or a previous portion of the flow period. Thus the device of this invention is designed for long and durable service and is of particular use in keeping informed of the composition, etc., of flowing liquid material which is subject to sudden variations in its characteristics.

The fluid sampling device of this invention has means whereby a fluid stream flowing under pressure, passes directly through the sample chamber and whereby the release of fluid pressure causes discharge of a sample, trapped from the flowing stream, to a storage or testing apparatus. Fluid is ejected to the storage or test apparatus through the same duct which admits it to the sample trap and the ejection is preferably performed by the release of a spring which operates a piston. The movement of the piston in turn also controls the exit of the moving stream, from which the sample is taken, from the sample chamber.

The fluid sampling device of this invention is a hollow body, usually cylindrical in form and made of Teflon, which provides a passage through which a fluid stream passes and in which a fluid sample is trapped. The passage has an inlet and outlet, usually on opposite ends of the fluid receiving portion, and thereby provides for flow of the sample completely through the chamber. The size of the chamber is determined by the piston which divides the hollow space within the body into a fluid receiving chamber and a spring chamber.

Ideally, the fluid sample trap of this invention will also have means associated with the inlet for adjusting the size of the sample chamber to the quantity of fluid sample desired and for equalizing the fluid pressure on opposite sides of the piston.

The liquid sample trap may be fitted to any sort of pipeline or other system which carries fluid under pressure. The connection to such a system preferably is by means of a multi-port valve arrangement which allows periodic communication between the pipeline and the inlet of the sample chamber. The fluid pressure in the pipeline serves to flow fluid through the sample chamber and the cutting off of this pressure allows the spring to eject the trapped sample. The valve may be actuated, for example, by a timer, for continuous monitoring of the fluid in the pipeline.

The invention will be better understood by reference to the accompanying drawings in which

FIGURE 1 is a schematic view of an oil treatment and delivery system which uses the sampling device of this invention and

FIGURE 2 is a cross-sectional view of the sampling device.

In the system of the drawings, means are provided for treating and storing a fluid, for example petroleum oil, and for delivering this fluid to further use while providing for periodic sampling of the fluid in the delivery line for testing purposes. An oil composition, for example, oil containing connate water, may be delivered to the

treating chamber **11** by the valved lines **13** or **15** and **17**. Treated oil may be removed from the treater **11** by line **20** to surge tank **22** while separated water is removed by line **25**. The line **27** which leads to the circulation pump **30**, and valved line **33** leading from the pump to line **17**, may be provided to keep the fluid in the surge tank circulating. Line **36** is provided for removal of fluid from the surge tank **22** to delivery by pump **39** and line **42**.

The sampling system includes a three-port valve **44** connected to delivery line **42** by sample line **48**. The valve **44** is also connected to sampling device **50** by line **53** and to sample container **55** by line **57**. Valve **44** preferably is a solenoid-actuated valve connected to a switching device **60**, which preferably is a timer, by the electrical lead **63**. Valve **44** may be a conventional type of two-position solenoid actuated valve and it is so arranged in the system that line **53** is in communication with line **57** when the solenoid is energized and with line **48** when the solenoid is deenergized.

The sampling device comprises the generally hollow body **66** having an open end and a closed end with a longitudinal passage therein. A freely slidable piston **69** divides this passage into spring chamber **72** and sample chamber **75**. As shown, the spring chamber **72** contains the coil spring **78**. This spring and the piston **69** are the only parts of the sampling device which need move when in use. The body **66** is provided with the exhaust duct **80** at about its midsection and near the end of the spring chamber **72**, with the vent **82** which can lead to the outside of the body by holes **84** and/or **86** and to the exhaust duct **80** by by-pass duct **88**. As shown, ducts **84** and **86** may be fully or partially plugged with screws **90** and **93**.

The open end of body **66** is provided with the sizing cylinder **96** which has the central entry and exit duct **99**. As shown, this sizing cylinder may have the elongated neck portion **101** and may be fastened in position by one or more set-screws **103** in the washer **105**. Washer **105** in turn is held to the body **66** by two or more screws such as the screws **107** and the washer may be grooved as at **109** to hold a seal such as O-ring **111** which seals the space between body **66**, washer **105** and sizing cylinder **96**. While described or alluded to as "cylindrical," the central passage of body **66**, as well as the piston **69** and the sizing cylinder **96** may be only partially circular or polygonal in form, so long as piston **69** and cylinder **96** fit snugly enough in the passage to prevent excessive leakage of fluid around the piston or cylinder. Exhaust duct **80** may be joined by line **113** to circulation suction line **27**.

The position of the moving elements in FIGURE 2 is illustrative of their position when the pump **39** is operating to deliver fluid and the switch **60** is open. The solenoid being deenergized, part of the fluid being pumped by **39** is diverted to the line **48**. This line communicates through the valve **44**, with the line **53** and the duct **99**. Pressure of fluid in the duct **99** is sufficient to force the piston **69** to the right, in the drawing, against the bias of the spring **78**, creating the sample chamber **75**. This fluid pressure continues to force the piston **69** to the right until the pressure is relieved by movement of the piston beyond the entry of duct **80**. When this opening is sufficient to stabilize the pressure in chamber **75**, movement of the piston **69** ceases, but flow of the fluid continues through chamber **75**, duct **80** and line **113**.

When the switch **60** is closed, the solenoid of valve **44** is actuated, putting line **53** in communication with line **57** and ending flow of fluid in line **48**. The release of pressure from this fluid in chamber **75** allows spring **78** to push piston **69** back to the left in the drawing, covering the entry to duct **80** and forcing fluid from chamber **75** out through duct **99**, line **53**, valve **44** and

line **57** to the sample container **55**. The compression force of spring **78** is sufficient to push piston **69** into close contact with cylinder **96**, thus forcing a volume of fluid equal to the volume of chamber **75** into the sample container. Vent **82** allows oil from by-pass **88** to relieve any vacuum formed in spring chamber **72**. Also the by-pass permits the use of a relatively loose-fitting piston **69** since oil leaked around the piston will not hamper its operation. This avoids having to equip piston **69** with seal rings with their accompanying expense. If a sealed piston is provided then the spring side of the piston could be vented to the atmosphere and by-pass **88** omitted, but this is not the preferred embodiment.

The freshness of the sample dictates a minimum length for lines **48**, **53** and **57**, if the latter is not vented. The timer may be set, for example, to energize the solenoid for fifteen seconds each minute. The system preferably is provided with means for removing and replacing the sample container and instead of a sample container may be provided with continuous testing means, for example an electrolytic testing cell.

It is claimed:

1. A fluid sample trap comprising a body having a passage therein, a fluid inlet and a fluid outlet spaced apart in said body and communicating with said passage, a piston slidably mounted in the passage dividing the passage into a fluid-receiving chamber and a spring chamber, said spring chamber being provided with a spring, biasing said piston towards said inlet and into a position of shut-off of said outlet with respect to said fluid-receiving chamber, said piston being slidably moved in the passage under the pressure of fluid from said inlet to enlarge said fluid-receiving chamber and compress the spring until said fluid-receiving chamber communicates with said outlet, said piston being moved in the substantial absence of fluid pressure from said inlet and due to the compression of the spring, to eject said fluid through said inlet, said inlet being housed in a means inserted in said body and being adjustable to determine the volume of said fluid receiving chamber.

2. A fluid sample trap of adjustable size comprising a body having a passage therein containing a piston slidably mounted in the passage dividing the passage into a fluid-receiving chamber and a spring chamber, said spring chamber being provided with a spring which is compressible by said piston and which biases said piston toward said fluid-receiving chamber, a movable inlet body adjustably held within said fluid-receiving chamber and providing a fluid inlet, a fluid outlet at the opposite end of said fluid-receiving chamber from said inlet body, and a vented by-pass duct connecting said outlet and said spring chamber, said piston being of a size suitable for being contained within said spring chamber and uncovering said outlet under the influence of fluid pressure in the said fluid-receiving chamber and of being contained within said fluid-receiving chamber and covering said fluid outlet under the influence of spring pressure.

3. A fluid sampling system adapted for continuously taking samples of pumped fluid of adjustable size from a line, comprising a fluid sample trap, a sample container and a valve operable in one position to connect said line to a fluid receiving chamber in said trap and in another position to connect said chamber to said container, said fluid sample trap comprising a body having a passage therein containing a piston slidably mounted in the passage dividing the passage into said fluid-receiving chamber and a spring chamber, said spring chamber being provided with a spring which is compressible by said piston and which biases said piston toward said fluid-receiving chamber, a movable inlet body adjustably held within said fluid-receiving chamber and providing a fluid inlet, a fluid outlet at the opposite end of said fluid receiving chamber from said inlet body, and a vented by-pass duct connecting said outlet and said spring chamber, said piston being of a size suitable for being contained within said spring chamber and uncovering said outlet under the influence of fluid pressure in the said fluid-receiving chamber and of being contained within said fluid-receiving chamber to displace fluid to said container, and covering said fluid outlet under the influence of spring pressure.

4. The system of claim **3** in which the fluid outlet is in communication with a non-sampling portion of said pump fluid system.

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