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*[Continued on next page]*

- (54) Title:** APPARATUS AND METHOD FOR OBTAINING FORMATION SAMPLES

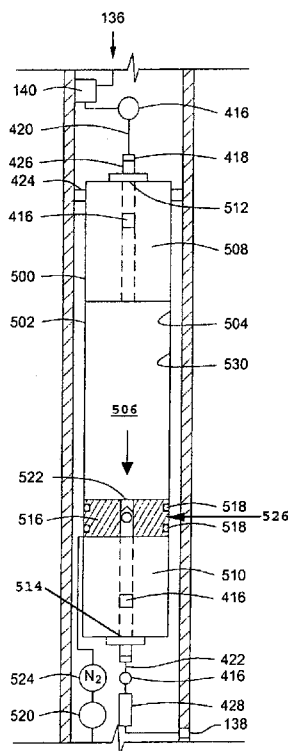


FIG. 5

**(57) Abstract:** An apparatus and method for collecting a fluid from a subterranean formation are disclosed. A fluid sample container has an elongated body. The elongated body includes an internal cavity, a first end having a first opening for receiving the downhole fluid into the internal cavity, a second end axially displaced from the first end, the second end having a second opening for expelling at least a portion of the downhole fluid from the internal cavity. Fluid collecting includes establishing fluid communication with a formation of interest and the fluid sample container receiving the downhole fluid into the internal cavity through the first opening and expelling at least a portion of the downhole fluid from the internal cavity through the second opening.



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**APPARATUS AND METHOD FOR OBTAINING FORMATION SAMPLES****Inventors: SIMPSON, Angus J. & SHAMMAI, Michael H.****BACKGROUND****1. Technical Field**

5 [0001] The present disclosure generally relates to apparatuses and methods for evaluating formations traversed by a well borehole and in particular to formation sampling and testing.

**2. Background Information**

10 [0002] Formation sampling and testing tools have been used in the oil and gas industry for collecting formation samples, for monitoring formation parameters such as pressure along a well borehole, and for predicting performance of reservoirs around the borehole. Such formation sampling and testing tools typically include an elastomer packer or pad that is pressed against a borehole wall portion to form an isolated zone from which formation samples are collected. Information that helps in  
15 determining the viability of the formation for producing hydrocarbons and in determining drilling operation parameters may then be acquired by evaluating the formation samples.

[0003] Information about the subterranean formations traversed by the borehole may be obtained by any number of techniques. Techniques used to obtain formation  
20 information include obtaining one or more downhole fluid samples produced from the subterranean formations. Downhole fluids, as used herein include any one or any combination of drilling fluids, return fluids, connate formation fluids, and formation fluids that may be contaminated by materials and fluids such as mud filtrates, drilling fluids and return fluids. Downhole fluid samples are often retrieved from the  
25 borehole and tested in a rig-site or remote laboratory to determine properties of the fluid samples, which properties are used to estimate formation properties. Modern fluid sampling also includes various downhole tests to estimate fluid properties while the fluid sample is downhole.

[0004] Some formations produce hazardous fluids, and local governmental  
30 regulations may greatly control and restrict the amount of formation fluids that are introduced into the well borehole to reduce the risk of exposing the surface

environment and personnel to these hazardous fluids. This is the case even when it is necessary to retrieve connate formation samples from formations that produce hazardous downhole fluids. It is difficult to retrieve connate formation samples from these hazardous fluid producing formations, because borehole fluids and filtrates  
5 often contaminate the formation samples. One obstacle is that cleanup processes used to remove borehole contaminants from a fluid sample to obtain a connate fluid sample substantially free of borehole contaminants usually results in ejecting large amounts of formation fluid into the borehole. Thus, the hazardous formation fluids are produced into the return fluid posing environmental threats and hazards to personnel  
10 at the surface.

### **SUMMARY**

[0005] The following presents a general summary of several aspects of the disclosure in order to provide a basic understanding of at least some aspects of the disclosure. This summary is not an extensive overview of the disclosure. It is not intended to  
15 identify key or critical elements of the disclosure or to delineate the scope of the claims. The following summary merely presents some concepts of the disclosure in a general form as a prelude to the more detailed description that follows.

[0006] An apparatus for collecting a fluid from a subterranean formation is disclosed that includes a fluid sample container that has an elongated body. The elongated body  
20 includes an internal cavity, a first end having a first opening for receiving the downhole fluid into the internal cavity, a second end axially displaced from the first end, the second end having a second opening for expelling at least a portion of the downhole fluid from the internal cavity.

[0007] A method for collecting a downhole fluid includes establishing fluid  
25 communication with a formation of interest and a fluid sample container having an elongated body, the elongated body including an internal cavity, a first end having a first opening, a second end axially displaced from the first end, the second end having a second opening. The method further includes receiving the downhole fluid into the internal cavity through the first opening and expelling at least a portion of the  
30 downhole fluid from the internal cavity through the second opening.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0008] For detailed understanding of the present disclosure, references should be made to the following detailed description of the several embodiments, taken in conjunction with the accompanying drawings, in which like elements have been given  
5 like numerals and wherein:

**FIG. 1** schematically illustrates a non-limiting example of a well logging system in a wireline arrangement according to several non-limiting embodiments of the disclosure;

**FIG. 2** illustrates a non-limiting example of extendable probes useful in  
10 several embodiments of the disclosure;

**FIG. 3** illustrates a non-limiting example of a straddle packer arrangement useful in several embodiments of the disclosure;

**FIG. 4** illustrates a non-limiting example of a fluid sample container suitable for operation as a flush-through sample container; and

**FIG. 5** illustrates an exemplary fluid sample container including one or more  
15 devices for controlling pressure within the container during transport.

### **DESCRIPTION OF EXEMPLARY EMBODIMENTS**

[0009] **FIG. 1** schematically illustrates a non-limiting example of a well logging system **100** in a wireline arrangement according to several non-limiting embodiments  
20 of the disclosure. The exemplary logging system **100** includes a downhole sub **102** shown disposed in a borehole **104** and supported by a wireline cable **106**. The exemplary downhole sub **102** may include one or more centralizers **108**, **110** for centralizing the downhole sub **102** in the borehole **104**. The cable **106** may be supported by a sheave wheel **112** disposed in a drilling rig **114**. The cable **106** may be  
25 wound on a drum **116**, shown here mounted on a truck **118**, for lowering or raising the downhole sub **102** in the borehole. The cable **106** may comprise a multi-strand cable having electrical conductors for carrying electrical signals and power from the surface to the downhole sub **102** and for transmitting information to and from the downhole sub **102**. The downhole sub **102** may send information to and receive information

from the surface for processing and/or for executing commands. A surface transceiver **120** and a controller **122** may be located on the truck **118** or at any suitable surface location. The exemplary downhole sub **102** communicates with the surface controller **122** via the surface transceiver **120** and a downhole transceiver **124**.

- 5   **[0010]** The exemplary wireline **FIG. 1** operates as a carrier, but any carrier is considered within the scope of the disclosure. The term “carrier” as used herein means any device, device component, combination of devices, media and/or member that may be used to convey, house, support or otherwise facilitate the use of another device, device component, combination of devices, media and/or member.
- 10   Exemplary non-limiting carriers include drill strings of the coiled tube type, of the jointed pipe type and any combination or portion thereof. Other carrier examples include casing pipes, wirelines, wireline sondes, slickline sondes, downhole subs, BHA's, drill string inserts, modules, internal housings and substrate portions thereof.

- [0011]** In the non-limiting embodiment of **FIG. 1**, the downhole sub **102** includes a downhole evaluation tool **126**, and the downhole evaluation tool **126** may include an assembly of several tool segments that are joined end-to-end by threaded sleeves or mutual compression unions **128**. An assembly of tool segments suitable for the present disclosure may include an arrangement as shown in **FIG. 1**. The exemplary arrangement includes the transceiver **124** discussed above, and a downhole controller
- 15   **130** is shown below the transceiver **124**. The downhole controller **130** may further include a processor and memory for processing information and for executing commands used for controlling aspects of the downhole sub **102**. A power unit **132** may be coupled below the controller **130**. The power unit **132** may include one or more of a hydraulic power unit, an electrical power unit and an electro-mechanical
- 20   power unit. A formation sampling tool **134** is shown coupled to the downhole evaluation tool **126** below the power unit **132**.

- [0012]** The exemplary formation sampling tool **134** shown in **FIG. 1** includes a formation sampling member **136** and a sample expulsion member **138**. The formation sampling member **136** may be extendable as shown in this example or the formation
- 30   sampling member **136** may be a tool portion having a port for receiving a formation sample. Likewise, the sample expulsion member **138** may be extendable as shown in this example or the sample expulsion member **138** may be a tool portion having a port

for expelling a formation sample from the tool. The exemplary formation sampling tool **134** may be configured for acquiring and/or extracting a formation core sample, a formation fluid sample, formation images, nuclear information, electromagnetic information, and/or other downhole samples.

5    **[0013]** Referring to **FIGS. 1, 2** and **3**, several non-limiting embodiments may be configured with the formation sampling tool **134** operable as a fluid sampling tool. In these embodiments, the formation sampling member may include an extendable probe having a sealing pad **200** for isolating a portion of the well borehole. The fluid expulsion member **138** may also include an extendable probe having a sealing pad  
10    **200** as depicted in **FIG. 2**. Other exemplary arrangements may use straddle packers **300** as depicted in **FIG. 3** for isolating borehole portions for the respective formation sampling member **136** and fluid expulsion member **138**. Combinations of extendable pad seals and straddle packers are also within the scope of the disclosure. A fluid pump **140** may be placed in fluid communication with the formation sampling  
15    member **136** included with the formation sampling tool **134** for collecting fluid samples. The fluid pump **140** may be a single pump or may include one pump for line purging and a smaller displacement pump for collecting samples and for quantitatively monitoring fluid received by the downhole evaluation tool via the formation sampling tool **134**. The fluid pump **140** may be a variable rate pump or a  
20    constant rate pump.

**[0014]** One or more flush-through fluid sample containers **142** may be included below the fluid pump **140** and above the sample expulsion member **138**. In several examples, the fluid sample containers **142** are individually or collectively detachable from the downhole evaluation tool formation sampling tool **134**. Further details of  
25    several exemplary flush-through fluid sample containers will be provided below with reference to **FIGS. 4-5**.

**[0015]** **FIG. 4** illustrates a non-limiting example of a fluid sample container **400** suitable for operation as a flush-through sample container according to one or more embodiments described above and shown in **FIG. 1** at reference numeral **142**. The  
30    exemplary fluid sample container **400** may be used in a wireline arrangement, in a while-drilling drilling arrangement, a slickline arrangement or by using any suitable carrier for conveying the fluid sample container **400** in a well borehole. The

exemplary embodiment of **FIG. 4** is shown detachably mounted in a downhole sub **102**.

[0016] The exemplary fluid sample container **400** shown in **FIG. 4** includes an elongated body **402** having an internal cavity **404** for receiving fluid samples **406**.

5 The elongated body **402** portion of the exemplary fluid sample container **400** includes a first end **408** and a second end **410** axially displaced from the first end. The elongated body **402** has a first opening **412** in the first end for receiving the fluid **406** into the internal cavity **404**, and a second opening **414** in the second end **410** for expelling at least a portion of the fluid **406** from the internal cavity **404**. The fluid  
10 sample container **400** of this non-limiting embodiment includes a fluid flow control device **416** proximate the second end **410** of the body **402** and coupled to the downhole sub for controlling fluid expulsion from the internal cavity **404**. The fluid flow control device **416** shown may be a controlled valve or any suitable fluid flow control device that is controllable to control fluid expulsion from the second opening  
15 **414** during fluid sampling and may be operable to cease fluid expulsion when a predetermined parameter is met for the downhole fluid expelled from the fluid container **400**.

[0017] Additional fluid control devices **416** are shown in the exemplary embodiment of **FIG. 4** coupled to the downhole sub input flow line **420** and within the container  
20 **400** proximate the body first end **408** to control fluid flow to and within the first end. The first end fluid control devices may be substantially similar to the fluid control devices **416** proximate the second end **410**, but the fluid control devices **416** may be of different types without departing from the scope of the disclosure.

[0018] The exemplary embodiment shown in **FIG. 4** includes a flow line connector  
25 **418** connected to an input flow line **420** at the body first end **408** for allowing fluid flow into the internal cavity **404**. A similar flow line connector **418** and flow control device **416** are shown coupled to an output flow line **422** at the body second end **410** for allowing fluid expulsion from the internal cavity **404**. The input flow line **420** and the output flow line **422** in the example shown here are flow line portions of the  
30 downhole sub **102** that are in fluid communication with the internal cavity **404** of the formation sample container **400**.

[0019] The fluid sample container **400** may be detachable from the downhole sub **102** using detachable flow line connectors **418** and one or more detachable mounting members **424** that couple the fluid sample container body **402** to the downhole sub **102**. The downhole sub **102** may include a pump **140** for conveying fluid through a fluid flow control device **416**, which may be a valve controllable downhole using command signals. The fluid flow control device **416** is in communication with the internal cavity **404**.

[0020] The exemplary fluid sample container **400** may further include a check valve **426** as shown coupled to the input flow line connector **418** and a similar check valve **426** coupled to the output flow line connector **418** to help ensure fluid flows through the fluid sample container **400** in one direction during a downhole sample cleanup process.

[0021] The non-limiting embodiment of **FIG. 4** may further include a fluid evaluation module **428**. In one or more embodiments, the fluid evaluation module **428** may be in fluid communication with the output flow line **422** for estimating fluid content of fluid expelled from the internal cavity **404**. In one or more embodiments, the fluid evaluation module **428** may be in fluid communication with the input flow line **420** for estimating fluid content of fluid entering the internal cavity **404**. In one or more embodiments, a fluid evaluation module **428** may be in fluid communication with both the input flow line **420** and the output flow line **422** for estimating fluid content of fluid entering and exiting the internal cavity **404**. The fluid evaluation module may be a single module as shown or may be implemented using two or more modules.

[0022] The fluid evaluation module **428** may include any number of fluid measurement devices for estimating fluid characteristics of the fluid **406** entering or leaving the internal cavity **404**. The fluid evaluation module **428** may be arranged to estimate optical characteristics, electrical characteristics, physical characteristics and any combination of characteristics of the fluid **406**. For example, some test devices may be in fluid contact with fluid flowing in the fluid evaluation module, some devices may be in optical communication, some devices may be in acoustic communication, some devices may be in physical contact with the fluid, and still others may be in pressure and/or thermal communication with the fluid.

[0023] Optical characteristics may be estimated using a downhole fluorescence test device, a reflectometer, a spectrometer, or any combination thereof. Physical characteristics of the fluid may be estimated using a viscometer, a pressure sensor, a temperature sensor, fluid density transducer, or any combination thereof. Electrical characteristics of the fluid **406** may be estimated using resistivity measurement devices, capacitance and dielectric constant measurement devices, or combinations thereof. Other devices may be included with the fluid evaluation module **428** for estimating fluid chemical properties and compositional properties. Exemplary devices include, but are not limited to, a gas chromatograph, a pH test device, a salinity test device, a CO<sub>2</sub> test device, an H<sub>2</sub>S test device, a device for determining wax and asphaltene components, a device for determining metal content, (mercury or other metal), a device for determining acidity of the fluid, or any combination thereof.

[0024] In one or more embodiments, the internal cavity **404** is defined by a smooth curvilinear surface **430** within the body **402**. The surface **430** may be selected based on the desired cavity volume, overall size of the body and on fluid flow characteristics. In the exemplary embodiment of **FIG. 4**, the internal cavity **404** has a substantially oval cross section along a longitudinal axis. In one or more embodiments, the internal cavity **404** may be spherical with a substantially circular cross section. In one or more embodiments, the internal cavity **404** may have a cylindrical center portion with flat end portions, hemispherical end portions, conical end portions, or any other end portion shape that provides relatively free fluid flow within the internal cavity **404**. A surface treatment that reduces fluid adhesion may be used to further reduce sticking and resistance in the fluid flow within the internal cavity **404**. Exemplary surface treatments include, but are not limited to, polishing, coatings, laminates, inserts and combinations thereof.

[0025] Turning now to **FIG. 5**, an exemplary fluid sample container **500** may further include one or more devices for controlling pressure within the container **500** during transport. The non-limiting embodiment shown in **FIG. 5** is coupled to a downhole sub **102** and includes a substantially cylindrical internal cavity **504**. Many of the items in **FIG. 5** may be substantially similar to the like-numbered items describe above and shown in **FIG. 4**. For brevity, the following description will focus more on the additional features shown in **FIG. 5**.

[0026] The exemplary fluid sample container **500** includes an elongated body **502** having an internal cavity **504** for receiving fluid samples **506**. The elongated body **502** portion of the exemplary fluid sample container **500** includes a first end **508** and a second end **510** axially displaced from the first end. The elongated body **502** has a first opening **512** in the first end **508** for receiving the fluid into the internal cavity **504** from the formation sampling member **136**. A second opening **514** in the second end **510** may be used for expelling at least a portion of the fluid **506** from the internal cavity **504** through the fluid expulsion member **138**. The fluid sample container **500** of this non-limiting embodiment includes a pressure control device **516** for controlling pressure of the fluid sample **506**. The pressure control device **516** provides a flow path via a check valve **522** for fluid **506** flowing through the internal cavity **504** and allows for substantially unrestricted flow during the cleanup process and expulsion of fluid from the internal cavity **504** via the expulsion member **138**. The pressure control device **516** in one or more non-limiting embodiments includes a piston **526** that is movably disposed within the cavity **504**. One or more O-rings **518** provide a fluid and pressure seal between the piston **526** and cavity wall **530**. The check valve **522** is positioned within the piston **526** to provide a flow path through the piston **526** to the opening **514** in the second end **510**.

[0027] The piston **526** is shown positioned toward the second end **510** with the sample **506** shown with an arrow to indicate the direction of flow through the container **500**. The check valve **522** prevents flow in the opposite direction. In this manner, the fluid flow through the internal cavity is substantially free flowing during sample cleanup.

[0028] The pressure control device **516** may be actuated using a device controller **520**. In one or more embodiments, the device controller **520** may be a pump substantially similar to the pump **140** described above and shown in **FIG. 1**. In one or more embodiments, the pump **140** may be used as the controller for the pressure control device **516**. A gas supply **524** is shown in communication with one end of the piston **526** and with the device controller **520**. In one or more embodiments, the gas supply may include a pressurized inert gas such as nitrogen. When actuated, the device controller may be used to add pressure to the gas supply and/or to urge gas toward the piston **526**. When pressurized, the piston tends to move toward the first

end **508**, thereby decreasing the volume in the cavity **504** and/or increasing the pressure within the cavity **504** when one or more of the inflow and outflow fluid control devices **416** are actuated to cease fluid flow. In this manner, the fluid **506** may be maintained at a predetermined pressure once a fluid sample is collected in the  
5 internal cavity **504**. For example, the fluid **506** may be maintained above its bubble point pressure for transport to the surface.

[0029] Several non-limiting operational embodiments for formation sampling will now be described with reference to **FIGS. 1** through **5**. In one or more embodiments a downhole sub **102** may be conveyed in a well borehole to a formation of interest. A  
10 portion of the borehole is isolated using straddle packers, a pad seal disposed on the end of an extendable probe or by using a combination of packers and extendable probe to create an isolated zone. Fluid communication is established between the formation of interest and the downhole sub by exposing a tool port to the isolated zone. In some embodiments, formation pressure may be sufficient to flow fluid from  
15 the formation into the tool. In one or more embodiments, a pump **140** or other flow controller may be used to urge fluid into the downhole sub.

[0030] Fluid flow into the downhole sub may be maintained in a substantially continuous manner to perform a cleanup process for removing borehole contaminants from the downhole fluid entering the downhole sub. The sample cleanup process may  
20 include initially expelling fluid from the downhole sub while the pump or formation pressure urges fluid through the downhole sub. In one or more embodiments, the fluid is monitored for content properties during the cleanup process to estimate a cleanliness level of the fluid flowing within the tool. In one or more embodiments, fluid expulsion is accomplished by reinjecting the expelled fluid into the formation  
25 proximate the downhole sub to limit or prevent the fluid from entering the borehole annulus. In one or more embodiments, the fluid is injected into the formation using an extendable expulsion member that is extended to establish fluid communication with the formation. The fluid expulsion may be halted when the fluid within the tool is estimated to be substantially free of contaminants.

30 [0031] In one or more embodiments, fluid samples may be contained within the tool using an internal fluid sample container **400**, **500**. In one or more embodiments, the fluid cleanup process may include urging the fluid received in the tool through a first

end of the fluid sample container and expelling the fluid from a second end of the fluid sample container. Once the estimations show that the fluid within the fluid sample container are substantially free of contaminants, the second container end flow path may be closed using a sub-carried valve **416** that is in fluid communication with the output flow line **422**.

[0032] The pump **140** may be used to increase the pressure in the container internal cavity **404**, **504** to a desired pressure. Once the pressure within the internal cavity reaches the desired pressure, then the pump may be halted and a second sub-carried valve **416** that is in fluid communication with the input flow line **420** may be actuated to close the flow path into the internal cavity **404**, **504**. In this manner, the fluid sample **406**, **506** is sealed within a volume defined between the two sub-carried valves **416**.

[0033] Pressure within the internal cavity may be controlled after sample collection and during transport using a pressure control device. Fluid may flow through the pressure control device during the cleanup process and a check valve may be used to allow fluid flow in only one direction through the pressure control device. An inert gas may be used to move a piston within the internal cavity to control pressure.

[0034] In one or more embodiments, the fluid sample container **400**, **500** may be transported to a surface location and removed from the downhole sub without losing fluid containment within the internal cavity **404**, **504**. Surface operations may include actuating the first end and second end fluid control devices **416** within the container body **402**, **502** to seal the respective first end and second end portions of the internal cavity **404**, **504**. The fluid sample container **400**, **500** may then be disconnected from the downhole sub **102** by disconnecting the detachable couplings **424** and the flow line connectors **418**.

[0035] The sample container internal cavity **404**, **504** may be flushed of contaminants and/or connate fluids without leaving substantial residue within the internal cavity. The pump **140** may generate a fluid flow through the cavity. In some embodiments, the cavity **404**, **504** includes a curvilinear wall **430**, **530** that reduces fluid sticking within the cavity. The wall **430**, **530** may further include a surface treatment that

further reduces fluid resistance and may be used to reduce sample sticking along the wall **430, 530**.

**[0036]** Fluid initially urged into the downhole sub **102** may include one or more contaminants such as borehole fluid and filtrates. Undesirable fluid sample components such as the above-noted contaminants may be cleaned from the fluid entering the downhole evaluation tool **126** by pumping the fluid into the tool and then expelling the fluid through the sample expulsion member **138** until the fluid entering the tool is substantially free of the undesirable contaminants.

**[0037]** In one or more embodiments, pumping and expulsion is performed for a period of time without separate content monitoring with the period of time selected to establish substantially contaminant-free connate fluid flow in the tool. The fluid sample expulsion may be halted on or after completion of the time-based pumping. In one or more embodiments, fluid flowing in the tool is monitored using a downhole tester to estimate fluid content in substantially real-time. The fluid sample expulsion may be halted on or after the content estimate establishes that the fluid flowing in the tool is substantially contaminant-free connate fluid.

**[0038]** One or more operational embodiments address fluid expulsion where environmental regulations, safety concerns or other factors make it desirable to reduce or avoid introducing produced formation fluid to the well borehole. Fluid communication may be established between the sample expulsion member **138** and the formation proximate the sample expulsion member. In this manner, fluid expelled from the tool may be directly injected into the formation with leakage into the well borehole being reduced to levels in compliance with the applicable regulations or to levels that mitigate the safety hazards or that otherwise meet the selected leakage standards set for the particular sampling operation. Formation fluid samples that are substantially free of contaminants may be brought to the surface for testing on-site or in a laboratory environment using the flush through sample container **142**.

**[0039]** The present disclosure is to be taken as illustrative rather than as limiting the scope or nature of the claims below. Numerous modifications and variations will become apparent to those skilled in the art after studying the disclosure, including use of equivalent functional and/or structural substitutes for elements described herein,

use of equivalent functional couplings for couplings described herein, and/or use of equivalent functional actions for actions described herein. Such insubstantial variations are to be considered within the scope of the claims below.

**CLAIMS**

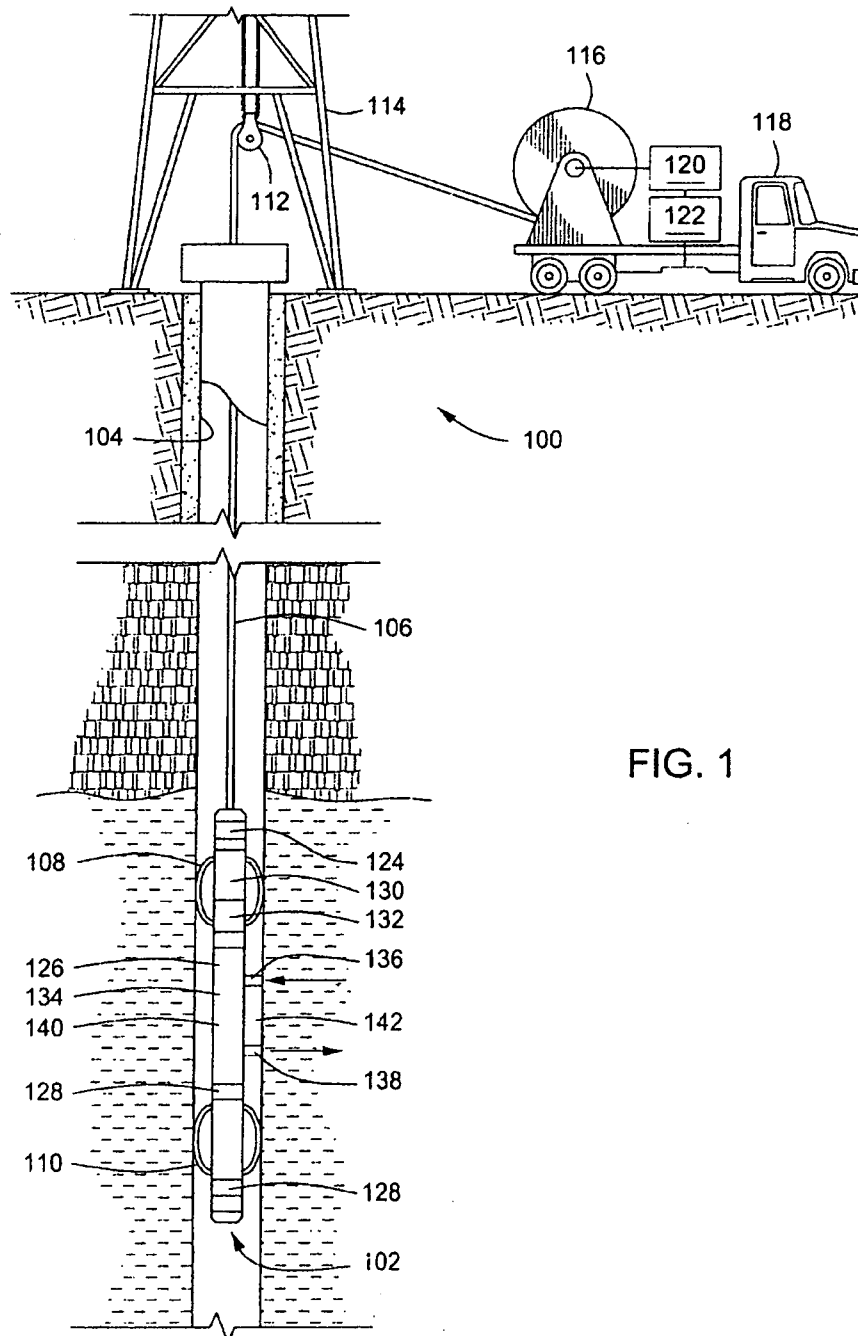
What is claimed is:

- 1    1.    An apparatus for collecting a downhole fluid, the apparatus comprising:
  - 2            (a)    a fluid sample container having an elongated body, the elongated body
  - 3                   including an internal cavity, a first end having a first opening for
  - 4                   receiving the downhole fluid into the internal cavity, a second end
  - 5                   axially displaced from the first end, the second end having a second
  - 6                   opening for expelling at least a portion of the downhole fluid from the
  - 7                   internal cavity.
- 1    2.    An apparatus according to claim 1, wherein the internal cavity is defined in
- 2           part by a wall having a curvilinear cross section profile for fluid sticking, fluid
- 3           resistance or a combination thereof within the internal cavity.
- 1    3.    An apparatus according to claim 2, wherein the wall curvilinear cross section
- 2           profile approximates at least a portion of one or more of a circle and an oval.
- 1    4.    An apparatus according to claim 1, wherein the internal cavity is defined in
- 2           part by a wall having a surface treatment that reduces fluid sticking, fluid
- 3           resistance or a combination thereof.
- 1    5.    An apparatus according to claim 4, wherein the surface treatment is selected
- 2           from one or more of a coating, a polished surface and an insert.
- 1    6.    An apparatus according to claim 1 further comprising a flow control device
- 2           that is controllable to cease downhole fluid expulsion from the second opening
- 3           when a predetermined parameter is met for the downhole fluid.
- 1    7.    An apparatus according to claim 1, further comprising a pressure control
- 2           device for controlling fluid pressure within the internal cavity.
- 1    8.    An apparatus according to claim 7, wherein the pressure control device
- 2           includes a pump for controlling pressure in the internal cavity.

- 1     9.     An apparatus according to claim 7, wherein the pressure control device  
2           includes a member disposed within the internal cavity for controlling pressure  
3           in the internal cavity.
- 1     10.    An apparatus according to claim 9, wherein the member includes a piston that  
2           moves in the internal cavity to control pressure in the internal cavity.
- 1     11.    An apparatus according to claim 9 further comprising a check valve coupled to  
2           the pressure control device to allow fluid flow through a central opening of the  
3           pressure control device.
- 1     12.    An apparatus according to claim 1 further comprising a fluid monitoring  
2           device for estimating a property of the downhole fluid.
- 1     13.    An apparatus according to claim 12, wherein the property of the downhole  
2           fluid includes a level of contamination.
- 1     14.    A method for collecting a downhole fluid, the method comprising:  
2           (a)     establishing fluid communication with a formation of interest and a  
3           fluid sample container having an elongated body, the elongated body  
4           including an internal cavity, a first end having a first opening, a second  
5           end axially displaced from the first end, the second end having a  
6           second opening;  
7           (b)     receiving the downhole fluid into the internal cavity through the first  
8           opening; and  
9           (c)     expelling at least a portion of the downhole fluid from the internal  
10          cavity through the second opening.
- 1     15.    A method according to claim 14 further comprising reducing fluid  
2           perturbations within the internal cavity using a wall having a curvilinear cross  
3           section profile defining at least in part the internal cavity.
- 1     16.    A method according to claim 15, wherein the wall curvilinear cross section  
2           profile approximates at least a portion of one or more of a circle and an oval.

- 1 17. A method according to claim 14, wherein reducing fluid perturbations  
2 includes using a wall having a surface treatment that reduces fluid sticking,  
3 fluid resistance or a combination thereof.
- 1 18. A method according to claim 17, wherein the surface treatment is selected  
2 from one or more of a coating, a polished surface and an insert.
- 1 19. A method according to claim 14 further comprising ceasing the downhole  
2 fluid expulsion when a predetermined parameter is met for the downhole fluid  
3 using a flow control device that is controllable to cease downhole fluid  
4 expulsion from the second opening.
- 1 20. A method according to claim 14 further comprising controlling fluid pressure  
2 within the internal cavity using a pressure control device.
- 1 21. A method according to claim 20, wherein controlling fluid pressure within the  
2 internal cavity includes using a pump as part of the pressure control device.
- 1 22. A method according to claim 20, wherein controlling fluid pressure within the  
2 internal cavity includes controllably changing a volume within the internal  
3 cavity using a member disposed within the internal cavity.
- 1 23. A method according to claim 22, wherein the member includes a piston and  
2 controllably changing a volume within the internal cavity includes moving the  
3 piston to control pressure within the internal cavity.
- 1 24. A method according to claim 22 further comprising, flowing the downhole  
2 fluid through a check valve in the member.
- 1 25. A method according to claim 14 further comprising estimating a property of  
2 the downhole fluid using a monitoring device.
- 1 26. A method according to claim 25, wherein the property of the downhole fluid  
2 includes a level of contamination.

1/4



2/4

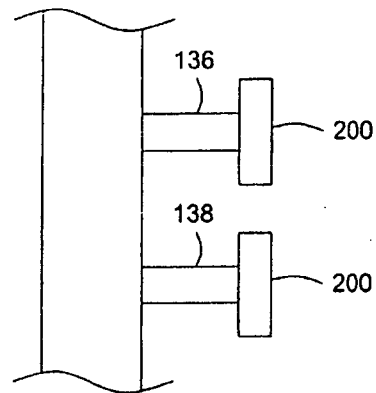


FIG. 2

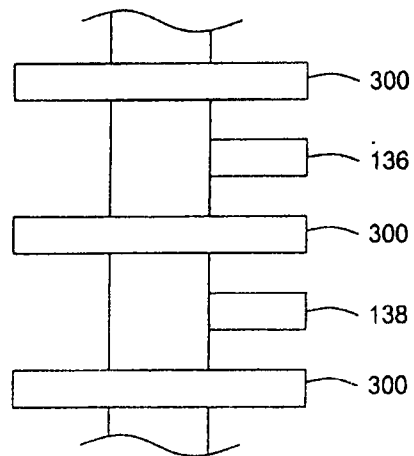


FIG. 3

3/4

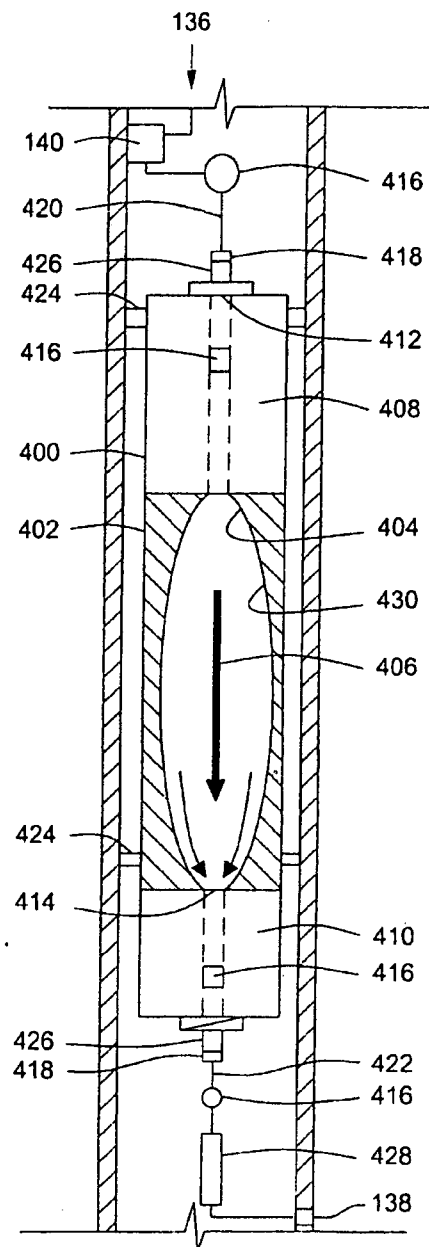


FIG. 4

4/4

FIG. 5

